Bruce Randal Angus Snaddon

LEARNING FOR FUTURE KNOWING NOW

Investigating Transformative Pedagogic Processes Within a Design Faculty in a South African University of Technology

Arkitektur- og designhøgskolen i Oslo
The Oslo School of Architecture and Design

PhD thesis

Bruce Randal Angus Snaddon

LEARNING FOR FUTURE KNOWING NOW: INVESTIGATING TRANSFORMATIVE PEDAGOGIC PROCESSES WITHIN A DESIGN FACULTY IN A SOUTH AFRICAN UNIVERSITY OF TECHNOLOGY

LEARNING FOR FUTURE KNOWING NOW

ISSN: 1502-217X

ISBN: 978-82-547-0331-1

CON-TEXT

PhD thesis 102

A doctoral thesis submitted to

The Oslo School of Architecture and Design, Norway

PUBLISHER:

Arkitektur – og designhøyskolen I Oslo

COVER PHOTO:

Troy Davies

PRINTED BY:

Bodoni

CONTENTS

ABSTRACT

Design educators working in higher education institutions face the enduring challenge of translating creative design practice into pedagogy and curricula that prepare students for entry into the world of work. This not only entails keeping up with current and given modes of designing but also requires critical attention to how the practice and discipline of designing, with its material and increasingly immaterial outcomes, are shaping and being shaped by a fast-paced, complex and connected world. This includes how design practice, education, and research have progressively moved from linear views of designing as problem-solving to include more collaborative platforms and approaches. Design courses need flexible curricula and dynamic pedagogical approaches to address and respond to such flux, the changing needs of society and, importantly, the role of sustainable design concerning the current climate crisis.

In this thesis, I take up the question of how design educators can actively explore different approaches to design pedagogy that might enable a transition for design education towards long-term sustainability. Such transition includes a critical review of how and where design learning might be carried out, so as to break with hegemonic orthodoxies in design practice, its education, and in broader society. Consequently, this thesis is a practice-based inquiry into the need to shape design curricular and pedagogical activities to meet future work and professional practice as well as the burgeoning fields of design for sustainability and social innovation in an unsustainable world.

In the case of this study in a South African university of technology (UoT) environment, student designers need to learn how to work with complex settings such as designing for developing world issues in contexts of heightened socioeconomic and political inequality, and the changing demands and needs of clients, communities and policy, to mention a few. In shaping and connecting suitable and productive relations between design practice and design pedagogy, this study investigates currently ill-defined literacies and learning that might be appropriate for these domains of design and their emergent impact. As such, this thesis brings to the fore the 're-learning' taking place in a South African UoT through experimental pedagogy at the crossroads of design, sociocultural learning theory, and critical posthuman perspectives.

The key research question that is addressed in this study is: How might current design pedagogy transition toward emerging and complex contexts through curricular experimentation that is oriented towards sustainable futures by design? The study is conducted as participatory action research and is practice-based with a focus on a participatory mode of pedagogical praxis. Consequently, the study comprises an inquiry into a range of design project-cases over five years that aimed to enhance learning practices, resources, and reflections as part of a wider pedagogical shift toward learning about sustainable design in the context of climate change.

The main contribution of this study is a pedagogical framework that comprises a set of mutually reinforcing modalities and navigational principles for design education in a transitioning reorientation towards long-term sustainable design practice. This study may resonate with and provide useful insights for designer-educator-researchers who are engaged in transitioning their pedagogy away from the dominant market-driven paradigm that continues to inflect design education and practice.

ACKNOWLEDGEMENTS

First, I would like to express my gratitude to Andrew Morrison, who's unwavering supervisory support and collegiality has been an inspirational influence throughout my PhD work. I thank you, Andrew, for your superb dedication to research excellence and how you have welcomed me into this space and encouraged me to produce the best work that I can. Thank you for creating this opportunity and taking on the challenge of working with me over a great distance, between Norway and South Africa and over an extended timeframe.

I would also like to thank Institute Leader, Rachel Troye, and the rest of the Design Institute staff at the Oslo School of Architecture and Design (AHO) for welcoming me as a PhD fellow into the highly motivated and professionally driven environment that you have all created at AHO. I have greatly enjoyed the collegial atmosphere amongst fellow PhD students, and the inspiration and challenges of the PhD school run by Tim Anstey. I will always value the discursive workspace shared with William Kempton, Etienne Gernez, Jan Fredrik Schønheyder, Manuela Aguirre, and Jonathan Romm. Thanks to Håkan Edeholdt who has been key in nurturing the partnership between AHO and my home university in Cape Town over many years.

A special thanks to my colleagues and Faculty Dean Johannes Cronjé at the Cape Peninsula University of Technology (CPUT) for their enduring support during the completion of my thesis. Notable in their collaborative work that underpins this PhD research is Andrea Grant Broom, Alettia Chisin, Johan van Niekerk and Corbin Raymond, thank you all for such a wonderful journey together as we have explored new and expansive spaces for design learning and research concerning climate change and sustainability. Mugendi M'Rithaa, I have valued working alongside you through various inter-university partnerships. Thank you for the challenges that you have thrown my way over the years, always in the effort of questioning how design can make a more meaningful difference for all people and living beings.

Finally, I am deeply thankful to my family for letting me go to Oslo to start my PhD and for the continued support over the completion years. Special thanks for your love and encouragement Michelle, Liam and Isabella.

Bruce Snaddon
Cape Town, January 2020

1

1 Introduction

1.1 Educating sustainable designers through experimental pedagogy

> From a very early age, we are taught to break apart problems, to fragment the world. This apparently makes complex tasks and subjects more manageable, but we pay a hidden, enormous price. We can no longer see the consequences of our actions; we lose our intrinsic sense of connection to a larger whole. When we try to 'see the big picture,' we try to reassemble the fragments in our minds, to list and organize all the pieces. (Senge, 2006, p. 3)

Design educators face exciting yet daunting challenges in keeping up with how the practice and discipline of designing, with its material and increasingly immaterial outcomes, are shaping and being shaped by a fast-paced world that is complex, connected and in flux. Transitions concerning shifts from linear views of designing as problem-solving, towards designing as problem identification (Marenko & Brassett, 2015), continuously place new demands on educators responsible for questioning and "translating creative practice into pedagogic activities" (Orr & Shreeve, 2018, p. 26).

Design practice, education, and research have been progressively moving to include more collaborative and multi-authorial platforms and approaches (Marenko & Brassett, 2015). This increasingly appears in areas such as social innovation, design activism, and design for sustainability. Such change is marked by a shift from user-centered design processes towards participatory experiences. Significantly for designers, this means a change in attitude, from 'designing *for* users' to one of 'designing *with* users' that will require new ways of thinking, feeling and working (Rochfort, 2002; Sanders, 2002; Poggenpohl, 2002).

Behind such a transition is the need to shape design curricular and pedagogical activities to meet future work and professional practice, while also focusing urgent attention towards the fields of design for sustainability and social innovation in a fast-changing world. In the case of this research study in a South African higher education institution (HEI) environment, designers need to work with complex settings such as designing for developing world issues in contexts of heightened socioeconomic and political inequality, and the changing demands and needs of clients, communities, and policy, to mention a few. In shaping and connecting suitable and productive relations between design practice and design pedagogy, design educators have needed to review literacies and learning that might be appropriate for these domains of design and their emergent and likely impact. Their task as educators is to devise and implement resources, processes, venues, and opportunities to facilitate and support students in learning to design. Equally important is learning how to relate that design outwards, prospectively as it were, towards likely scenarios and future settings of making.

In design education, this requires pedagogies that can be revealing of a "globalized but fragmented homogeneity" (Kossoff, 2015, p. 36) that tends to obscure the bigger picture as Senge (2006) has put it in the opening quote above. Design educators need to create the learning environments and situations for learning where new "expansive patterns of thinking are nurtured", where "collective aspiration is set free" and where students "continually learn how to learn together" (Senge, 2006, p. 3).

Such learning would need to develop the kinds of skills and dispositions students require to "cope and work with the improvisational, emergent, dynamic and highly complex environment of… co-design endeavour[s], which they will meet in professional life" (Heape, 2015, p. 1369). As Farías and Sánchez Criado (2018) point out, there is a need for more research into how the above-mentioned transitions and redefinitions of design are being translated into pedagogical practices. It is towards this gap that my research is directed. This importantly concerns how "any programmatic redefinition of design not only entails unlearning how to practice, but also a commitment to re-educate future designers" (Farías & Sánchez Criado, p. 19) in response to these transitions. As such, my thesis brings to the fore the 're-learning' taking place in our pedagogical experiments at the crossroads of design, sociocultural learning theory, and critical posthuman perspectives.

1.1.1 Issues, challenges, and potentials

The issues challenging and facing us globally in design education are increasingly evident today. The wider project of curriculum development in design schools pressurises educators to meet current needs associated with the world of work and challenging real-world issues while enabling students to be motivated questioners and active agents in working with design futures in the here and now (Fry, 2009). The latter requires universities to be spaces for a healthy critique of dominant forms of social and economic order. Davis (2011) insists that "design educators must develop flexible curricular structures that can respond quickly to changing times" (p. 74). Yet, in many developed and developing world HEI contexts, there are barriers to these imperatives. These take the form of rigid course structures with discrete subject codes, already full curricula, a focus on individual practice and skills acquisition, entrenched complicity of design professions in capitalist economic growth, and educators resistant to change.

Concerning sustainability and in the context of the global South, educators need to be critically engaged in their pedagogy as a means of ensuring that their design curricula are serving local (and global) issues of social and environmental justice. Regarding these issues, Fry and Willis (2017), in a special issue of *Design Philosophy Papers*, along with other critical design thinkers from the global South, have presented a range of perspectives relating to advancing the practices of decoloniality (e.g. Fry, 2017; Escobar, 2017). Decoloniality in their view is not another label but an imperative based in action. One such example would be the "constitution of a conceptual and practical borderland wherein the continued agency of enduring forms of colonial power meet a counterforce of not mere resistance, but generative of another kind of otherness" (Fry & Willis, 2017, p. 1).

Critical engagement thus infers a questioning approach towards hegemonic orthodoxies in design practice, its education, and in broader society. In this, I agree with Akama and Yee (2016) who suggest that such an approach entails asking "different questions that concern other world-views" (p. 2). For example, they suggest that "instead of seeking growth, progress, replication and scalability of design in 'solving problems', what if we ask questions about how design can enable inter-relatedness, respect and reciprocity?" (p. 2). A greater potential thus arises when framing design that "starts from an interrelated view of designing that cannot be disentangled

from the ecological, relational, [and] intimate contexts in which it is performed" (Akama & Yee, p. 1).

Furthermore, in the South African context, Perold-Bull (2018) articulates in the book *Educating citizen designers in South Africa,* that there is a dualistic logic at play whereby the same individualised perspective of problem-solving that bred difference in the past is being applied in working towards productive change. She points out that the ideals of social justice embodied by critical citizenship education will remain a utopian vision unless we as educators critique the restrictive forces that manifest in the existing structures within which we function. "We need a different kind of logic to think with" (p. 188) she says, one that harnesses the productive and creative energy of acting "affirmatively in the present by actively resisting the present" (p. 194).

Importantly for my thesis, I take up these perspectives on transformation in education and relate them more specifically to the challenge of transitioning design courses to include design for sustainability, which is the main focus of my study. In this view, design for sustainability is about matters concerning not only the sustainability of the designed object itself but the "design of the relations in which it is to be situated" in current and future contexts (Fry, 2009, p. 187). Design understood as having 'sustaining ability' may thus enable futuring possibilities, whereby the objects of design "can design sustaining 'relations and effects', to which form and function are subordinate" (Fry, pp. 187-188). Design for sustainability viewed in this relational way is a challenge for design education. Consequently, my study is attentive to how experimental design pedagogy might bring about dispositions of sustain-ability in students that are up to this futuring task. I elaborate and discuss design for sustainability in more detail in section 1.3.1 in this chapter.

These perspectives on different kinds of questioning and logic within design education settings outline some of the issues in this thesis work. These challenges must also be framed affirmatively within the following potentialities. These are: a national curriculum review process currently underway in South Africa, and a call across the country for curricula to be decolonised and for educators to play active roles in questioning what counts as knowledge and where it comes from. Furthermore, and to the focus of this study, there is potential for educational design projects that are context-sensitive and real-world oriented, to offer transformative learning experiences for all involved (students, educators, community and other stakeholders in a project context) through participatory processes. In this way, student designers gain the first-hand experience of being participatory role players, who are in turn mediated by multiple forms and sources of agency within contexts where design is performed. Working this way through "processes of researching, defining, and implementing solutions to problems concerning economic, social, political, and ecological" issues (Le Roux & Costandius, 2013, p. 110), students learn how to understand the "complexities of social behaviour and identity that apply not only to the audience they design for, but most importantly to the people they design with" (Le Roux & Costandius, p. 118).

1.2 Focus of the study

1.2.1 Main research questions

The title of the thesis, *Learning for Future Knowing now*, indicates the orientation of the study towards how design education can and should engage with futuring learning processes concerning knowledge that can be currently relevant for transitions towards sustainability. The subtitle, *Investigating Transformative Pedagogic Processes Within a Design Faculty in a South African University of Technology*, points to the experimental processes currently underway in a particular design faculty in South Africa. The key research question that I address in relation to this title is:

How might current design pedagogy transition toward emerging and complex contexts through curricular experimentation that is oriented towards sustainable futures by design?

A number of sub-questions forms the basis for the five peer-reviewed publications included in this thesis. These are: What roles may the speculative, performative and locative aspects of design pedagogy play in creating dynamic learning spaces? What are the qualities of an immersive pedagogy that is productive of sustainable design dispositions in students? Together these are questions that have guided and shaped my inquiry through the published work and in writing up this exegesis.

1.2.2 Questions arising through the research process

Additional questions that have surfaced through the published offerings in this research have to do with what the productive characteristics of pedagogical experiment might be, and how the use of designerly tools and making of alternative material-discursive artefacts unlock new spaces within which to learn and act for students. Together these questions relate to pedagogical experiments that challenge the given and prescribed in design education curricula, and that explore transitioning alternatives where educators play a participatory role with students and within contextual situations in seeking ways to design that might be more sustainable in the long-term.

In summary, in this thesis, I inquire into project-cases in a particular university design faculty where design pedagogy has been experimented with to develop a culture of participatory inquiry that is oriented towards sustainable design practice. With less emphasis on prescribed learning outcomes and disciplinary skillsets, such pedagogy is an exploration of situated experiential learning within and through multi-disciplinary projects located in varied and complex off campus situations and settings. These are eventful places and spaces for a pedagogy that is enabling of dispositions in design students that are oriented towards sustainable futures. Through our pedagogical praxis of exploration, these charged learning spaces have equally been of value for us as educators as we have learnt through the designerly doing of several project iterations that have been oriented towards sustainable design practice.

Our approach has been one of questioning what it is that we can do as design educators with our students, through experimentation that allows in alternative ways of 'knowing' and 'being with' them (e.g. Grimmett & Halvorson, 2010; Cross, 2001; Lawson, 2005; Schön, 1988). These alternative ways have involved seeking contexts for design that are conducive for learning that might enable appropriate literacies and dispositions to become oriented towards long-term sustainable designing (Barnett, 2012; Sheridan & Rowsell, 2010). These are literacies and dispositions that are currently ill-defined or missing in our curricula. During these explorations, our designerly ways of 'conversing with the materials of the situation' (Schön, 1992) have been pedagogically aligned with a sociocultural perspective on learning that is situated and experiential, recognising that the transformative capacity of learning identities is enacted in 'lived relations' to others (Yee, Raijmakers, & Ichikawa, 2019; Ellsworth, 2005).

As design educator researchers, we have worked these approaches together in the project-cases that make up the focus of my study, and the published outcomes that make up this thesis focus on questions of what the generative pedagogical qualities might be within these project-cases.

In using the term project-cases I am referring to case-based research that aims to inquire into and articulate conceptual underpinnings and framings concerning research inquiry (Schrank, 2006). Furthermore, such case-based research entails studying phenomena in the natural context

where they occur and provides ways to explore "the significance of *different* social and physical contexts and their impact on the social process" (Swanborn, 2010, p. 15, original emphasis). The project-cases in this thesis are drawn from a range of case-based teaching and research interventions into what may be called designs for learning and learning designs (e.g. Snaddon, Morrison, Hemmersam, Grant Broom, & Erstad, 2019).

This exegesis draws together findings and propositions from my published outcomes and lifts up an argument that is presented in Chapter 5. I conclude Chapter 5 with a pedagogical framework that is aimed at educators navigating a transitioning process towards sustainable design practice. In Chapter 6, I then present a discussion on the implications and questions relating to such a framework within my design faculty, situated as it is in a South African HEI landscape.

1.3 Matters driving this research

1.3.1 The contested concept of sustainability

In this thesis, I work with the idea of sustainability not as a "specifiable target state, but the continuous exploratory pursuit, through open-ended learning, of ways to ensure that life goes on …" (Foster, 2008, p. 145). Ehrenfeld (2008) has suggested that the concept of sustainability is a contested one unless it is defined in terms of what needs to be sustained. In his view, 'flourishing' is the definitive quality – so he offers a definition of sustainability to be "the possibility that human and other life will flourish on the planet forever" (p. 6). Explaining his use of flourishing as a concept to define sustainability, Ehrenfeld states that the possibility of flourishing is "an emergent property of a complex living system" (p. 52). Such properties are emergent in the contexts within which the stakeholders of complex systems engage, taking on the characteristics determined by the system. In his view, "flourishing is the most basic foundation of human striving and, if properly articulated, can be the strongest possible driver toward sustainability" (p. 53).

In 1987, what has come to be known as the Brundtland Report, linked sustainability with development defining it as "development that meets the needs of the present, without compromising the ability of future generations to meet their own needs" (United Nations, 1987, p. 37). The report also warned of the fragile and finely balanced nature of the earth, and that if certain thresholds are crossed, the basic integrity of the system will be endangered. The statement then that "today we are close to many of these thresholds; [and that] we must be ever mindful of the risk of endangering the survival of life on earth" (p. 29) has an even more urgent ring 32 years later, as many of these thresholds have now been crossed (i.e. climate change, ozone depletion, and species loss). What is more concerning is that the biggest source of planetary boundary stress is due to excessive consumption levels of the wealthiest 10 percent of the world population, "and the production patterns of the companies producing the goods and services that they buy" (Raworth, 2012, p. 19).

Still linking sustainability with development, Holden, Linnerud, and Banister (2016) suggest a model for sustainable development based on "three moral imperatives: satisfying human needs, ensuring social equity, and respecting environmental limits" (p. 213). This seeks to firmly acknowledge environmental limits and potential threats of ever-increasing economic growth as being key dimensions in the sustainability debate, and ironically missing from the sustainable development goals identified in The Millennium Development Goals Report (United Nations, 2015). Although pitched at a policy-making level, these imperatives proposed by Holden et al. have significant implications for design education. In this thesis, I argue that it is the

responsibility of design educators to consider seriously how their design curricula and pedagogy account for designing in terms of a balance between needs, equity and environmental limits.

The current epoch we live in has been dubbed the 'Anthropocene', a term that acknowledges the "time interval in which human activities now rival global geophysical processes" (Steffen et al., 2011, p. 739). Ehrenfeld (2008) has also warned that "relentless demands for energy and materials are upsetting and destroying the habitats and communities of human and non-human species… [and evolution can] no longer…proceed without the indelible markings of human activity" (p. 3). A critique of the 'anthropos' in the naming of this epoch is articulated and proposed in the concept of the 'Capitalocene', as a counter-narrative to identify more accurately the problems of rampant economic development and how to construct effective responses (Boehnert, 2018). In Boehnert's words, "not everyone shares responsibility for ecologically destructive modes of development. Power and responsibility are concentrated on those who have the ability to influence industrial development and system structures" (Boehnert, 2018, Kindle location 335). A pressing shift is required, a "critiquing [of] the ideas, politics and technologies that have contributed to ecological crisis" (Boehnert, 2018, Kindle location 355), and for this to happen there is no advantage in bringing the mythos of the Anthropocene into the future (Armstrong as cited in Boehnert, 2018, Kindle location 355). To this point, Armstrong (2017) has coined the term 'Ecocene'.

The Ecocene is an emergent era and one that is futures-oriented. In such a view, the challenge is for all agentive beings to be considered relationally, in terms of "matter, space, time, ecology, and each other" (Armstrong, 2017, p. 196). Most importantly, this alludes to relationality as ongoing through the experience of alternative spaces, across disciplines and concepts, and involving processes that embrace anomaly, subversion, and paradoxes. In my view, the latter concept defines for design education a deeply proactive space within which educators and students might function, a space of "bittersweet optimism and relentless creativity that invites… [all] life forms to tread strange, alternative pathways towards uncertain futures" (Armstrong, p. 192). In this exegesis it is towards this notion of the Ecocene that I gravitate, and, therefore, I qualify the term 'sustainability' by prefacing it with the words 'long-term'. This infers commitments to looking beyond short-termism and concerns deeper and longer commitments to assessing and navigating pathways to sustainability (Boehnert, 2018). In this regard, a long-term view on sustainability concerns the challenging work in design education of critiquing visions of the future as "a means of recognising and disturbing power relations, acknowledging where particular futures have been silenced and considering ways in which we can craft the future differently" (Ryan, 2016, p. 120).

Even as these models and definitions offer valuable guidance, sustainability remains a complex and contested problem comprising countless relational strands between "people, the environment and the things that people make and do" (Irwin, 2012, p. 2). Irwin further proposes that "the transition to a sustainable society is one of the biggest design challenges the human race has ever faced" and that this task will challenge "a new breed of 'transition designers' working within a new design paradigm, across disciplinary and professional divides" (p. 1). Key here is the notion of relationality. The "social reality of designing" (Buchanan, 1992, p. 16) is well described by Rittel and Webber (1973) as being a 'wicked problem', characterised by properties that are nested and multi-layered, indeterminate and having no stopping rule, meaning that "there are no ends to the causal chains that link interacting open systems" (p. 162).

Sterling (2009) points out the irony that although the world is "increasingly complex, interdependent and unsustainable… conversely, the way we perceive, think, and educate tends to be fragmentary and limited" (p. 77). This resonates with what Bateson (1972) famously said, that

we are "governed by epistemologies that we know to be wrong" (p. 493). This idea articulates a problem that permeates many worldviews. Boehnert (2013) points out that we "have inherited a highly reductive way of knowing, an intellectual tradition and a worldview characterized by atomism, mechanism, anthropocentrism, rationalism, individualism and a dualistic tradition pitting humanity versus the natural world" (p. 3). Although we may be aware of the limits of reductionist and objectivist approaches, these ways of thinking and acting "still tend to inform our perception and thinking – and much educational policy and practice" at a very deep level (Sterling, 2009, p. 78).

In light of this, the implications and challenges for design education are great. The question of how we educate designers to be able to see, think and act relationally, rather than in siloed, instrumental and mechanistic ways becomes paramount, if we are to influence any kind of transition towards long-term sustainable futures that allow for the flourishing of all living things.

1.3.2 Design education in transition

There is a certain ideological duality in design education that is either more consumer-focused or more socially oriented (Campbell & Brown, 2018). These authors point out that consumer-focused design, which is guided by the fast-paced market, sits in contradistinction to social impact design. This is due to the latter being concerned with critiquing the problem of capitalism and its inherent individualistic consumerism, which leads to inequality and various forms of cultural deterioration.

Due to the former of these ideologies having been dominant for over a century, designers have been complicit in serving a capitalist agenda for longer than the more recent few decades of design for social and environmental impact. As has already been stated in the section before, the underlying worldview that informs the status quo in design education is largely a modernist paradigm driven by the needs of capitalism and its maximising of high economic growth. Such a worldview favours what Sterling (2009) calls "a lopsided competence" that manifests as tendencies towards problem-solving, reductionism, cause-effect, atomism, narrow boundaries, positivism and determinism (p. 79). These kinds of approaches have been arguably successful in the past but are maladaptive to the current situation we find ourselves in, where "complexity, uncertainty and volatility in intermeshed economic, social and ecological systems" is increasingly the order of the day (p. 80).

In this thesis, I concur with Sterling's (2009) proposition that educators should actively be creating learning situations where learning will "ideally be reflexive, experiential, inquiring, experimental, participative, iterative, real-world and action-oriented, invoking 'learning as change' in the active pursuit of sustainability…" (p. 82). To this point, the experiential and participatory route that colleagues and I have taken in our pedagogy over the past few years has involved exploration into 'ecologies for learning' (Cope & Kalantzis, 2017; Jackson, 2013). In working with this ecological metaphor, we see learning as a living dynamic process that connects students in holistic ways to other people and the environment (Jackson, 2013).

As a core premise in our experimental design pedagogy, the concept of learning ecologies aptly describes our tactics of immersing our students in complex real-world contexts. Such a move entails consideration of distributed agency and resource potentials beyond the individual subject. It also concerns the suspension of students' disciplinary and competitive rush towards solutions and learning how to engage deeply in processes of ascertaining what matters within such contexts. I will expand on the concept of learning ecologies in my Conceptual Framings section

later in this chapter as it is central to my research questions regarding transitioning design learning spaces.

Such an approach thus opens up a wider conception of designers merely being "profit-enhancing specialists" (Wood, 2008, p. 2). Given the dominant narrative that places the economy rather than society or the environment as the "sovereign category in defining what it means to be collectively human" (Gray, 2018, p. 106), this presents a challenge on the scale of paradigm shift. This is no small task for academia as such a transition needs to happen at multiple levels from the personally transformative experience of educators to programmatic and institutional levels. Moreover, as "educational systems are a subset of social systems… that… are shaped by prevailing social and political norms, pressures, and expectations" (Sterling, Dawson, & Warwick, 2018, p. 325), this means the challenge extends far beyond academia alone. In this, colleagues and I working in this area accept that our challenge is in "transition[ing our courses] towards a network society and a knowledge society while making the transition towards sustainability" (Manzini, 2009, p. 4).

1.4 Orientation of the study

1.4.1 What does this study do?

This PhD thesis deals largely with the question of how, through experimental pedagogy, transitional learning spaces for design students might be developed that respond to today's urgent issues of sustainability and ecological dilemmas outlined above. To be explicit, my focus is on the introduction of exploratory pedagogical approaches to enable sustainable practice capabilities in relation to design knowledge and skills.

My research interest is thus an educational one concerning the kind of teaching and learning that can be productive of dispositional capacities and emergent design literacies appropriate for meaningful transition in design practice towards long-term sustainability.

This research study engages with these challenges at a course level within the Design Faculty at the Cape Peninsula University of Technology (CPUT), Cape Town, South Africa. In this thesis, I inquire into an emerging pedagogical framework that colleagues and I are developing with bachelor's and postgraduate-level students from Industrial Design, Graphic Design, Surface Design, Fashion Design, and Engineering. Project work has taken place over five years involving different cohorts of approximately 250 students, 10 faculty staff, and a range of guest speakers, design professionals, and organisations beyond the university. The real-world engagements of such work have entailed working with people in multiple communities and informal settlement settings, constituting a part of course-based curricula known as 'service learning' (Service learning, CPUT, n.d.).

My work is situated within a wider curriculum review and development process as required by the Higher Education Qualifications Committee (HEQC) in South Africa, with all existing national qualifications being revised along with the introduction of a suite of new qualifications. Such a process affords the opportunity for a careful review of curricula and teaching with regard to the pressing socio-political, economic and environmental issues of our current times in South Africa. In this, the current move to decolonise curricula and pedagogy specifically demands that universities and academics question how their courses are oriented towards knowledge production that is open to epistemic diversity (Mbembe, 2016).

This exegesis draws on five underlying research publications (summarised at the end of this chapter) which are based on a variety of experimental design project-cases and draws selectively on student insights and comments gathered during and after these project-cases. These multi-sited cases are explored through a design-oriented action research mode of inquiry and involve 'nomadic shifts' in location between campus and a variety of other settings away from the formal studio.

1.4.2 Nomadic pedagogical praxis

In this mode, a move away from the "mediating physical institution that specifies curriculum and pedagogy" (Facer, 2011, p. 24) is achieved, as means to explore more freely what a transitioning educational approach might involve.

In this thesis, I use the term nomadic to describe pedagogical kinetics whereby students and educators move beyond the given frames for learning, such as studio briefs in design with pre-determined deliverables, into unknown terrains and territories. I qualify these learning landscapes as comprising physical, cultural, and mental domains that may be traversed individually and collectively, motivating design learning and inquiry that reaches toward sustainable professional practices, and artefacts that themselves generate discourses of change and critique.

Nomadism as a concept originates in the work of Deleuze & Guattari (1987) and has been developed further by post-structuralist and post-human philosophers like Braidotti (2006), who speak of nomadism in terms of critical and creative inquiry into "the role of the former 'centre' in redefining power relations" (p. 69). This concept is valuable for my study as I inquire into experimental pedagogy that attempts to nomadically enable learning spaces where "margins and centre shift and destabilize each other in parallel, albeit dissymmetrical, movements" (p. 69). These moves and shifts are fundamental to my argument and proposition that for a re-orientation of design education towards sustainable design, interrogation of given positions and practices are needed. From such a nomadic perspective, we have inquired into what it is about place and space that influences and impacts design pedagogy and a dynamic design interplay between people, projects, topics, materials, processes, and outcomes. Such nomadism brings an ontological fluidity to perceptions of the human environment, where we do not merely "look back on the things to be found in it or to discern their congealed shapes and layouts, but to join with them in the material flows and movements contributing to their – and our – ongoing formation" (Ingold, 2011, p. 88).

As ours is a pedagogy that aims to challenge given educational practices and positions, I use the term 'praxis' as a way to describe the nature of our pedagogy in its exploratory, collaborative, participatory engagement. Praxis refers to a creative process characterised by 'other-seeking', it is dialogic and always risky as it requires prudent judgement in the moment (Smith, 2011). I use this term much as Lather (1991) and Freire (1992/2014) have concerning perspectives on mutually educative experience containing emancipatory intent and always being about commitment to human wellbeing. Furthermore, Breunig (2005) takes up the notion of praxis to investigate classroom practices and it is in this way that I use the term to describe our pedagogy which is largely based on experiential education and critical pedagogy approaches (p. 111). In her words, praxis "is reflective, active, creative, contextual, purposeful, and socially constructed" (p. 111).

In this respect, through the exploratory project-cases colleagues and I have developed an approach that works within current institutional review and reform processes, yet also steps outside of formal curriculated coursework and pedagogy. By this, I mean that dissatisfaction with

the fixed and rigid structure of courses led a group of colleagues and myself to seek out alternative spaces for our educational project, to go to sites and situations of social and environmental need. It is worth reiterating Fry's (2012) definition of 'the environment' as not being a location, but rather "'the everywhere'–the inner and outer; the earth, the sky and the ocean; the home as the world given and the world of our own creation" (p. 3).

Through an exploration into shaping and supporting such spaces where we could experiment more freely with modes and modalities for design learning, we aimed to engage with the barriers that we perceived as limiting for transformative learning to do with sustainable design practice. Our projects would move between the Bauhaus inflected studio culture embedded in design courses, and real-world engagement in scenarios out in the field where design might be put into ethical and respectful practice (Tunstall, 2011). These nomadic moves have been in response to the previously-mentioned matters driving this research.

In attending to the eventful spaces and places in which design learning can be troubled and dislocated, this multi-sited participatory action research traces evidence of emergent dispositions in graduate design students as they traverse unfamiliar physical and learning territories. By creating such learning environments, we have aimed to engage students in more dynamic processes than those traditionally associated with studio-based work that can often be grounded in a hegemonic worldview with assumptions of given modes of disciplinary practices.

1.4.3 Developing design for sustainable learning futures

In contrast, in our projects and my research work, I focus more on cross-cutting dispositions or "horizontal design competences" (Leong & Lee, 2014, p. 477) than the so-called 'hard', disciplinarily unique skills encapsulated in specific design course curricula such as industrial design or graphic design. All of the project-case studies in my thesis have included a multi-disciplinary mix of students not only from our Design faculty but also including Engineering. My focus on so-called horizontal design competencies and dispositions is not to diminish the 'vertical stack' (McCullagh, 2010) of expertise, theory, and critique required for any particular design discipline. Rather, it has been to create design project spaces where students might exercise their design knowledge through interdisciplinary and participatory ways. Such a pedagogical move was to transition beyond the potential contradictions between the kinds of learning required in conventional design disciplines versus design for sustainability scenarios.

In our project-case work, the varied settings and situations were what defined and demanded a particular range of design competencies in the student group. In this way, project outcomes were less prescriptive and targeted toward designed outcomes such as products or services. This allowed space for students to exercise alternative, more open and broader modes of learning that yielded dispositions that, in time, oriented students' emergent ecological literacies.

This all forms part of experimental ways to engage learning for design students such that they are enabled as curiously confident learners to unlearn, to some extent, what they have come to understand in their earlier disciplinary design coursework. This is not a perverse undoing of knowledge; instead, it is a critical process of expansion and movement to make space for a wider view on what designing can do if it is positioned as a participatory activity with long-term sustainability in mind. Hence, with an emphasis on the ontological, my inquiry concerns pedagogical praxis that is oriented towards long-term sustainable futures. Such pedagogy aspires to enable agentive learners in an expansive process of 'becoming aware' of their emergent designing identities as relational; socially, materially, culturally and environmentally.

1.4.4 Knowing, doing and being

These ways of 'becoming aware' lift up the need for a careful pedagogy and responsive curricula that introduce and activate a dynamic and moving relationship between what Barnett and Coate (2005) refer to as the three dimensions of knowing, doing and being. The last more contested dimension of 'being' is what this thesis aims to explore, or more specifically, what ontologies of being in relation to designing for sustainability might bring to learning experience for design students. In the words of Barnett and Coate (2005):

> A world of uncertainty poses challenges not just of knowing and of right action but also, and more fundamentally, on us as beings in the world. How do I understand myself? How do I orient myself? How do I stand in relation to the world? … [H]ow might human being as such be developed so that it is adequate to a changing and uncertain world? (p. 108)

And as Orr (2004) articulates on the wicked problem of sustainability education; loading students with facts about the decline of society and environment is not enough, the truth he suggests "cannot be told, it must be felt" (p. 212).

I briefly summarise a sense of this through comments made by students when reflecting on their learning experience during some of the off campus projects that make up the cases in this study. Many commented on how they 'lived into' newly found skills through self-organising group work, while others noted how the experience allowed them to see their peers of four to five years differently. Tashma, an industrial design student, reflected that "as a team, as a class, as a group, we went to the next level of trust, appreciation, of love… at the end of the day it made our team so much stronger, and the bond thicker" (2016). Hafizah, a graphic design student, when reflecting on her learning experience with others in real-world settings said:

> Don't be closed-minded, be open-minded, everyone is going through something different, so you need to be able to not just look but take in what you are seeing. For me, design is about being more alert… we need to be constantly evolving designers especially if we want to visually tell stories to people. (2016)

Perhaps most tellingly, Stehan, an industrial design student, described "a sea change when we met with people from different communities and we started engaging with them and hearing their stories and getting to know their context…" (2016). Reflecting on how decisions made on the fly yielded participatory activities during community engagement that they hadn't predicted, prompted him to add; "I was almost moved to tears at one point seeing how much the kids enjoyed it and really did feel part of it" (2016).

I present these quotes as a means of connecting some of the contextual project-case data with the core learning theories informing this study, and as a means of aligning this exegesis with my research questions.

1.5 Background context

1.5.1 The South African HEI landscape

Although this research deals with common issues for teaching and learning within the domain of design in many higher education institutions globally, this study is firmly situated within the context of the global South. In this section, I briefly outline the South African university context

within which colleagues and I are working and researching. In Chapter 2 (Context) I will then elaborate further on how this research study is situated within the current higher education landscape in South Africa and globally.

South Africa is ranked amongst those countries with medium human development by the United Nations Development Programme (UNDP), yet has the highest Gini co-efficient in this group, which is the measure of the distance between the richest and the poorest in a country (UNDP, 2018b). Until recently, the HEI sector in South Africa has reflected the country's colonial and apartheid past in its student profile. Students were either advantaged or disadvantaged along race and class lines. The #feesmustfall movement demanding free decolonised education across HEIs countrywide has culminated in free tertiary education for those who cannot afford it (Badat, 2016). However, transformation has been achieved more in terms of access rather than student success, requiring redress in the form of balancing skewed participation (Leibowitz, 2012). That is, currently, HEIs are at maximum capacity with students being granted free access, but crucial academic and welfare support is still underdeveloped to ensure productive participation and success for these students.

Available resources and the extent to which each university functions within a pro-social-justice ethos varies widely – a legacy of the apartheid era that is still evident today and perpetuated by varied leadership styles, lecturer skills base, management and institutional cultures (Leibowitz, 2012). These factors are important in light of this study being about finding ways to transform design education within constrained conditions. Social, economic, political and environmental issues of redress are bound up in the question of how universities can be spaces for healthy critique of dominant forms of social and economic order. In the case of universities of technology and their much-vaunted close relationship with industry, this overly embedded relationship in the way the commercial world works may have led to uncritical views on whether the economic and societal status quo should be blindly maintained. This is especially problematic in a developing country with unemployment at over 27%, and where, in the last decade (and still today) the public and corporate sectors have openly plundered state coffers for gain that has been limited to an exclusive few rather than for the needy masses (Shai, 2017). The disjuncture between economic and social transformation imperatives is, however, a vibrant topic for academic debate (e.g. Leibowitz, 2012; Bozalek & Boughey, 2012; Leibowitz & Bozalek, 2016).

1.5.2 Design education in South Africa

Tertiary-level design education in South Africa is being challenged by these shifting pressures within institutional contexts and a design industry that is adjusting slowly to socio-political change and an economy in recession. Transitional change must also be framed within systemic problems in design programmes, such as formal course structures with discrete subject codes, already full curricula, a focus on individual practice and skills acquisition, entrenched complicity of design professions in capitalist economic growth, and educators resistant to change. These challenges are complex and multi-layered and are compounded in a developing world context with underprepared students entering higher education from a weak schooling system.

Ignoring the critical role that design education can play in addressing imperatives relating to designing for social justice and sustainability is too great a risk. Doing so would not only undermine the potential for design to be a vital change-making process but would also miss opportunities to meaningfully develop critical cross-field learning opportunities that exist in curriculum documentation that aim to build capacity for life-long learning. These developmental outcomes are described by the South African Qualifications Authority (SAQA) to include, amongst others; creative and critical thinking, responsibility towards the environment and health

of others, team and community-working skills along with the ability to recognise the world as a set of interrelated systems where problem-solving contexts cannot exist in isolation (SAQA, 2000). In my experience as an educator, these outcomes are often ignored when design project briefs are set, resulting in student work being carried out in isolation from the broader consequences of design actions, and the future making opportunities that lie therein.

These are conditions ripe for positioning design as capable of disrupting the status quo and "changing existing situations into preferred ones" as one definition of design holds (Simon, 1996, p. 111). However, careful attention should be paid as to how, with whom and what these preferred situations might be. As educators and students alike, we are often "unaware of the perpetual propping of the dominant ideologies or *preferred situation*s toward which [we] are subtly yet forcibly propelled by design" (Kaiser & Nash, 2015, p. 1618). Designing, and by extension, its education is a political act (Costandius & Bitzer, 2015) that imbues design with "immense responsibility and power that… designers, academics and educators are only beginning to comprehend" (Fenn & Hobbs, 2018, p. 141). In order to step into this contested space, design students require an expanded set of literacies and capacities that are currently still ill-defined or missing in curricula.

As educators, we need to find meaningful ways to engage students in critical design approaches that include the satisfaction of human needs, ensuring social equity, and respecting environmental limits. To deal with such paradox I argue for pedagogy that is productive of lived and deeply transformative learning experience for students, involving shifts in knowledge, behaviours, and emotion. In turn, such a pedagogical approach can dynamically reinvigorate design curricula to become critically and creatively responsive to pressing and emergent issues within a complex developing world context.

1.5.3 A turn towards social transformation imperatives in design education

A small number of South African educators are experimenting with curriculum and pedagogy that engenders critical literacy and social justice dispositions, and this work is gradually being researched and reported on (e.g. Costandius & Bitzer, 2018; Botes, 2018). In addition, design programmes in universities oriented towards sustainability are involved in global networks that aim to build momentum around this agenda, for example, the DESIS network (DESIS Network, 2016) and LeNSin (LeNS International, n.d.). Importantly, the research work and knowledge production that is gathered and reported in these distributed networks connect up the so-called BRICS countries (Brazil, Russia, India, China, and South Africa) and encourage shared practices and successes unique to these developing world contexts.

Currently, in South Africa, the call for sustainable design practice is underdeveloped in the creative industries and consequently, there is a limited push in academia to prepare students to question how designing may transition away from practice that is potentially harmful to people, the planet and to living things generally. Other than NGOs with sustainability and social justice agendas, there is very little culture of practice in our mainstream design industry that openly requires and can actively champion young designers pursuing more responsible design careers. This remains a relatively unexploited gap for educational institutions competing with and complementing one another in the South African HEI landscape.

It therefore falls on higher education institutions to urgently support practice-based and exploratory research into design education that capacitates design students with sustainability literacies to negotiate the risk-averse and ambivalent terrains of business and society at large. Moreover, it is important for practice-based research projects to be viewed as collaborative and

participatory for students and educators alike, as many educators lack the requisite experience and confidence that supports innovative pedagogy. It is equally important for this work to be well communicated within and beyond academia in order for the complexity and value of these approaches to be understood and further developed. I argue that although this is framed as a transitional process, a highly experimental and activist stance is required to break with entrenched habits in the profession and academic discipline of design.

1.6 Key terms

In the unfolding of this exegesis I will be elaborating on and putting certain terms and composite phrases to use, but to aid as an introductory phase of defining these terms I briefly unpack key terms in this section as a pedagogical framing of concepts.

1.6.1 Dispositions

In the study, I use the term 'dispositions' to describe behaviours in design students that can assist a process of their becoming confident and motivated 'agentive' learners as they explore the use of their existing design literacy skills more broadly. My particular interest lies in how dispositions, often described as the soft skills treading silently alongside the so-called hard skills, are shaping perceptions and worldview (see Gibson & Owens, 2015). This has a bearing on the question of how pedagogy can address a dispositional shift in students towards sustainable design behaviours, in a world governed by a dominant high-growth and market-driven paradigm. In using the term 'agentive' above I refer to conceptions of identity as multiple and dialogical, where development of agentive selves involves "using [a] unique repertoire of tools, resources, relationships, and cultural artifacts" available in any particular context (Hull & Katz, 2006, p. 47).

I focus on the use of the term 'disposition' as it is fundamental to my argument and proposition, where I maintain that transitioning design courses towards sustainable design practice involves behavioural change facilitated through pedagogy that enables sustainable design values to emerge through performative expression and agentive, embodied engagement within ecologies for learning.

Next, I define three further composite phrases that are embedded and linked in the above proposition. These are 'performative expression', 'embodied engagement' and 'ecologies of learning'.

1.6.2 Performative expression

'Performative expression', not to be confused with instrumental performance, links imaginative meaning making with the "production of a subject through… performance" (Dong, 2007, p. 5), and can open up dialogue in ways that are imaginary, playful, and disruptive of hierarchy (Lock, 2013). Within the experimental spaces and social learning situations in the project-cases under review, the element of the performative has been a signature element of our pedagogical approach allowing individual and shared agency to evolve and materialise.

1.6.3 Embodied engagement

'Embodied engagement' refers to "our embodied presence in the world as physical beings rather than as disembodied and deconstructed minds" (Reason, 1998, p. 11). Furthermore, it concerns experiential ways of knowing and being, and is about a deeper experience requiring a "change in knowledge, behaviours and emotion" (Shreeve, 2015, p. 83). This resonates with Ehrenfeld's

(2008) concept of 'presencing', which he defines as "an experience in which awareness of the worldly context of the action shows itself to the actor" (p. 153). For designers learning about how to practice sustainably, this is significant. It involves engagement with careful questions around the intended as well as the unintended consequences of designing actions and offers through such engagement, an ethical "sense of Being that is normally absent" (p. 156).

1.6.4 Ecologies for learning

'Ecologies for learning' (further elaborated in the Conceptual Framings section below) is a concept developed by Cope & Kalantzis (2017) and Jackson (2013) and is centred in a developmental and socioculturally framed perspective on the transformative character of learning as activity (e.g. Wertsch, 1994). The relationally framed concept of learning ecologies helps explore an ecosystem view on learning that considers distributed agency and resource potentials beyond the individual subject, and beyond the often-siloed territories of academia, business, government, and community.

The above conceptual perspectives and positions have been lifted up as key orientations towards how sustainable design dispositions might be engendered in students. Such orientations aim to develop traits such as "carefulness, thoughtfulness, humility, criticality, receptiveness, resilience, courage and stillness", which can, in turn, cultivate the commonly valued dispositions in graduates of 'adaptability', 'flexibility' and 'self-reliance' (Barnett, 2012, p. 75).

1.7 Conceptual framings

1.7.1 Negotiating a broader range of knowledge processes

Within the state of transitional play so described, this study explores how sustainable design attitudes might be meaningfully engendered in design students within an educational setting that is largely "maladaptive to contemporary global [and local] conditions" (Sterling et al., 2018, p. 325) and resistant to change. In taking up this challenge I am responding to the call for "those designing literacy curriculum and pedagogy to cultivate the design literacies dispositions so that students are able to understand a greater range of choices and therefore are better able to become competent problem solvers for the 21st century" (Sheridan & Rowsell, 2010, p. 112).

As educators, we need to explore meaningful ways to engage students in "negotiating discourse differences" (Cope & Kalantzis, 2009, p. 166) and widening design approaches that include the satisfaction of human needs, ensuring social equity, and respecting environmental limits. Such a move is to be understood as not only addressing the degradation of the biophysical environment but the social and cultural environments too, something akin to "a balanced humankind in a balanced world" (Findeli, 2001, p. 14). Negotiating such difference requires critical literacies concerning analysis, critique, and transformation of norms and practices governing designing in social and cultural fields of everyday life (Luke, 2012). Cope and Kalantzis (2009) describe the micro dynamics of a pedagogy of multiliteracies as using a broader range of knowledge processes where "more powerful learning arises from weaving between different knowledge processes in an explicit and purposeful way" (p. 187).

Further to this broad introduction, I now detail six conceptual framings that inform and orient my research stance in this thesis. These are perspectives on sociocultural learning theory, transition design vision, decentering the human, the futuring potential of design, transformative learning, and learning ecologies.

1.7.2 Sociocultural learning theory

Sociocultural learning theory tells us that learning is a socially participative process and a fundamental part of daily life as learners are transformed in a constant state of becoming (Vygotsky, 1978; Lave & Wenger, 1991; Gee, 2008). Identity so framed is understood as being fluid and emergent resulting from learners' engagement in different settings across a landscape of communities of practice (Lave & Wenger, 1991. Knowledgeability can be developed through negotiating a productive and adaptable identity, or agentive self, in relation to the experience of travelling through such landscapes (Wenger-Trayner & Wenger-Trayner, 2015).

Robust as these concepts are, for design education they skirt issues of concern such as embedded contextual power structures, a need for a wider framing of design learning landscapes beyond the anthropocentric, design thinking and making as a material-discursive process, and ethical designing intent as part of an "axiological landscape" (Findeli, 2001, p.13). This last valuative dimension is especially important for my research in its focus on developmental pedagogy that positions students within learning situations where they can experience first-hand how their design intent, activity and outputs need to be viewed within a "complex field of relations" (Heape, 2015, p. 1362).

The framing concepts of knowledgeability and intellection mentioned above are largely viewed from the perspective of human capacity. As this study concerns the need to orient design education towards sustainable futures where human agency and being is considered as part of the many subsystems making up the vast earthly ecological system (Buchanan, 1985; Manzini & Cullars, 1992; Margolin, 2007), a wider framing of knowledgeability is needed. In addressing this I turn to conceptions of learning and designing sustainably that draw on holism rather than separation, distributed rather than individual agency, and trans-disciplinary interplay rather than siloed specialisation.

1.7.3 Transition design vision

Firstly, I align this research work with the transition design visions of key design research scholars (e.g. Papanek, 1985; Buchanan, 1985; Manzini & Cullars, 1992, 2009; Margolin, 2007; Frascara, 2002; Poggenpohl, 2009; Davis, 2016; Irwin, Kossoff, & Tonkinwise, 2015). In one such educational instance, Irwin et al., (2015) at the Carnegie Mellon University have proposed transition design as an educational framework or counterpoint to complement existing design approaches such as the developing sub-disciplines of design for service and design for social innovation. Described as a "proposition for a new area of design practice, study, and research that advocates design-led societal transition toward more sustainable futures" (Irwin, 2015, p. 229), the natural world is always acknowledged as the greater context within which all design solutions exist.

In heeding the call for design education to proactively engage in pedagogy "oriented toward the future with forecasting, foresight and planning" (Friedman, 2012, p. 140), I take up the challenge of looking for "knowledge in new places that, in turn, leads to shifts in [students] mindset and posture" (Irwin, 2015, p. 238). Working with a transition design vision has an approach that entails a certain pragmatism, whereby points of leverage within the existing system are sought out that can be influenced and activated for change. This goes to the heart of my thesis which investigates experimental pedagogy that seeks to locate and activate such leverage points, to develop student's capacity for design-led societal transition toward more sustainable futures.

1.7.4 Decentering the human

Secondly, in an expansive move toward a wider conception of design agency, I turn to the philosophical work of Deleuze and Guattari (1987) and its interpretation for design by Marenko and Brassett (2015), feminist new materialism and critical posthumanism (e.g. Braidotti, 2006, 2013; Barad, 2003, 2011) as a way of arguing for sustainable design pedagogy within a "multi-layered posthuman predicament" (Braidotti, 2018, p. 2). Braidotti coined the term 'cartographies of power' to describe the politics of location that structure the subject position "in terms of both space (geo-political or ecological dimension) and time (historical and genealogical dimension)" (2013, p. 164). A locative conception of learning, therefore, has to do with locally relevant knowledge brought about through learning mobilities concerning "de-territorialisations, transgressions and disruptions that characterize the learning process" (Fendler 2013, p. 786).

As touched on earlier, these concepts provide a rich designerly, philosophical and theoretical space from which to illuminate and explicate the cases of experimental design pedagogy that this study draws on for data. These are cases that explore design knowledgeability potential in and across agentive landscapes beyond traditionally disciplinary-bound educational settings.

In particular, what is useful to my study is Barad's development of an 'agential realist' framework that counters the assumption that "the world consists of autonomous, intentional and rational human actors against the backdrop of the natural environment" (Murris & Bozalek, 2019, p. 5). Barad's (2007) agential realism goes beyond the humanist accounts of the knowing subject and proposes that "intelligibility is an ontological performance of the world in its ongoing articulation… [that] is not a human-dependent characteristic but a feature of the world in its differential becoming" (p. 149). To articulate this performative process Barad coined the neologism 'intra-action' to signify what she describes as:

> …the mutual constitution of entangled agencies. That is, in contrast to the usual 'interaction,' which assumes that there are separate individual agencies that precede their interaction, the notion of intra-action recognizes that distinct agencies do not precede, but rather emerge through, their intra-action. (Barad, 2007, p. 33)

Knowing, in her view, is not a bounded or closed practice, but rather it entails dynamic intra-action of multiple agentive others in an ongoing network of performances. The ongoing articulation of intra-action is what promotes relational ontologies and constitutes the world. This resonates strongly with learning theory to do with identity development through multimodal and mediating networks of meaning making. The notion of a designer's agentive 'becoming' being understood as world-making is a highly complex one, and draws attention to how all acts of designing possess immense potential for good – and also for damage, if ill-considered.

The posthumanist perspective thus offers my study a philosophical and conceptual framing as well as a methodological approach of explicating and understanding the microdynamics of our experimental design pedagogy. Such an approach has highlighted fresh perspectives on the entangled nature of the "changing and contingent ontology of the world, including the ontology of knowing" (Barad, 2007, p. 73). This is relevant in the light of my study and its inquiry into how pedagogy might be enacted in order to bring about meaningful student learning through wider ontologies of knowing. To clarify, knowledge generation concerning sustainable design practice is enacted through dynamic relations between knowing, doing and being for multiple agentive actors. These perspectives will be articulated in Chapter 5, where I present arguments supporting a working and navigational pedagogical framework to support a transition towards sustainable design in design courses.

1.7.5 Futuring potential of design

How do we as designer educators step more knowingly and with more consideration into this spatial and temporal interplay with our students, so that we may activate this potential for good? A designer's futuring potential is evoked in Margolin's (2007) words, "As creators of models, prototypes, and propositions, designers occupy a dialectical space between the world that is and the world that could be. Informed by the past and the present, their activity is oriented towards the future" (p. 4).

But do we have open enough educational approaches and can current curricula and pedagogy enable such a dialectical space? If how we interact with the world and how we design in it depends not only on what we think but how we think, educators need to consider carefully how the experience of design learning might be infused with life affirming thinking and doing. "The way we think about the future is a significant factor in shaping our possibility space", as Facer (2019, p. 1) puts it in her keynote presentation at the Beyond Oil Conference in Bergen. She states that how we think about the future "frames what we can and can't see in the present, it creates the conditions for our capacity to imagine", and most importantly how our imagination will shape the future and how reciprocally "our imagination of it will shape the present" (p. 1). This entails developing capacity in design students to "imagine and assess the potential of decisions made now to create a future by putting values into practice" (Miller, 2007, p. 360).

Furthermore, design fiction is put forward by Celi and Formia (2015) as a means of "exploring and sharing the possible and preferable", through "generating compelling, participative, shared visions of possible futures" (p. 12). In this, an emphasis is placed on shared visions that are co-generated as cooperative speculations with wider communities who are not design specialists.

As a means of further framing this research, I draw on Findeli (2001) who emphasised the importance of a designer's understanding of complex systems, and that the designer's ethical responsibility involves acting within and not upon a system (p. 13). Others have also lifted ethics and caring as being pivotal and political capacities (Tronto, 1993, 2013) in need of development for 21st century designers (e.g. Tunstall, 2013; Irwin et al., 2015; Ingold, 2018). For design education, this is an important turn as it prompts educators to consider and explore alternatives to the reductionist and objectivist epistemology we know to be wrong. Such an alternative view could entail learning situations where nascent designers might be considered as ontologically emergent within relational fields that are systemic, contingent and fluid.

1.7.6 Transformative learning

To better understand the types and ranges of learning mentioned above, I draw on transformative learning theory originally developed by Mezirow (1990) and further evolved by others (e.g. Dirkx & Dang, 2009). In particular, I build on transformative learning research in the field of design education developed by Yee et al. (2019) who propose that transformative learning is a form of social value, in that the perspective changes that occur for participants engaging with social impact design work are outcomes of value. These authors who research the field of social innovation practice, raise the point that this "reveal[s] more meaningful indicators of social impact, such as learning from failure" (Yee et al., p. 2).

This concept is useful in how it provides a more nuanced understanding of learning beyond pedagogical and curricular dimensions of formal learning settings, opening up the idea of learners moving through liminal phases as they grapple with new learning settings, new concepts and learner identities in flux. Importantly for my study, transformative learning is noted in the

dynamic "role that the cohort group plays in fostering… self-transformative processes" (Dirkx & Dang, 2009, p. 91).

Meyer, Land, and Baillie (2010) describe a transformative learning process as a developmental trajectory consisting of liminal phases through which a learner moves in a recursively enactive manner. Here 'enactive' implies the embodied and active process of bringing forth meaning through performative engagement with the world (Dong, 2007). These liminal phases consist of three relational modes with the following features:

> Preliminal – A threshold concept is described as being initiated by an encounter with unfamiliar territory, a wicked problem that unsettles prior understanding, rendering it fluid (Rittel & Webber, 1973; Meyer, et al., 2010; Fendler, 2013).
> Liminal – A state of liminality is provoked that brings about an ontological and epistemic shift through reconfiguration of a learning subject's conceptual schema.
> Postliminal – The learner crosses a conceptual boundary and enters a postliminal state where the subject is irreversibly transformed, such that a changed way of knowing and use of discourse becomes evident. (Mezirow, 1990; Meyer et al., 2010)

Learning framed this way provides educators with a way to chart the path of transformation in students by being aware of the pedagogically fertile ground where confusions and discomfort abound at the edges of understanding (Berger, 2004; Osmond & Turner, 2010). Berger (2004) recommends that key responsibilities for a transformative educator are to: help students recognise liminal edges, be good company for students as they work through these phases, and support students to build firm ground in new places of understanding.

Finally, in this section, I connect these conceptions of transformative learning with the idea of 'transitional spaces' in the work of Ellsworth (2005). Ellsworth speaks of transitional spaces as 'pedagogical pivot points' that move "inner realities into a special relation to outer realties" (Winnicott as cited in Ellsworth, 2005, p. 60). These are spaces likened to a "good-enough holding environment… [where] the space and time of an attentive, responsive holding of demands and invitations that carry the potential for transitional experience" might be enabled (p. 60). Transitional and transformative experience for a student thus contributes towards potential evolution of learner identity. This resonates strongly with the earlier concept of nomadism and is well articulated by Ellsworth:

> We think only in relation. We think only in process and in the constant movement across the boundaries between our inner and outer realities, and that movement, in its very crossing, reconfigures those boundaries and what they make… of ourselves and of others. (2005, p. 61)

1.7.7 Learning ecologies

I draw on the notion of learning ecologies (Jackson, 2013; Morrison, Erstad, Liestøl, Pinfold, Snaddon, Hemmersam, Grant-Broom, 2019) as a key concept from which to consider learning in terms of a space within which learning occurs, a habitat within which a student can think, do, learn and become. This suggests a framing of an individual's learning ecology as a living relational interplay between head, hands, and heart, through which a person can think, do, learn, and become. Furthermore, and towards a posthuman perspective, an individual's learning ecology is then contextualised as a developmental process within a wider ecology of learning in "dynamic relations of proximity" with ecologies of multiple others (Braidotti, 2013, p. 29).

An ecosystem view therefore concerns distributed agency and resource potentials beyond the individual, and wider than the often-siloed territories of academia, business, government, and community. Hence the notion of 'symbiotic learning' has to do with mutually beneficial learning partners "across old institutional and organizational borders" that may enliven and enact tacit processes that show up new possibilities for design action (Eikeland, 2012, p. 114).

For the concept of learning ecologies to be used meaningfully in this thesis I will briefly provide more detail of its conceptual basis according to Jackson's (2013, 2016) definition of it. Jackson (2013) states that "an individual's learning ecology comprises their process and set of contexts, relationships and interactions that provides opportunities and resources for learning, development and achievement" (p. 1). Significantly for my study, this implies that learning ecologies connect our moment-to-moment thinking and doing, organising such moments into meaningful experiences that can inform new patterns of understanding. These are the "patterns that influence our beliefs, give us confidence in our own capability to act in the world and shape our future actions" (2013, p. 7). For students encountering new and unfamiliar learning landscapes concerning the complex issue of sustainability, this becomes a metaphorically evocative and useful concept to guide a pedagogical framework.

I use the concept of learning ecologies as a framing that draws on a nested set of concepts that include Lemke's 'ecosocial systems' and spatiotemporal dimensions of learning (1997, 2013), Lave & Wenger's 'communities of practice' (Lave & Wenger, 1991; Wenger, 1998), and posthuman perspectives articulated by Braidotti (2013) and Barad (2007). These perspectives will be further detailed in Chapter 3 where I review the literature pertaining to this study.

1.8 Methodology

As a practice-based-research study located in a design faculty in a South African HEI, my research interest has to do with a transitioning orientation for design courses towards sustainable futures. The knowledge claim from which my research proceeds is one that suggests that design educators engaging with exploratory design pedagogy beyond the bounds of traditional design learning situations and that is enabling of transformative learning experience are having some success in engendering student dispositions that are oriented towards sustainable design practice.

1.8.1 Practice-based participatory action research

The framing of my inquiry has evolved over the timeframe of this study, from a traditionally qualitative and constructivist approach oriented toward advocacy and participatory methods to embrace what St. Pierre (2014) has termed a post-qualitative approach. As my study has involved inquiry into a number of project-cases where we as design educators explored, through our embodied practice with students, alternative and varied pedagogical modes and settings over several years, our efforts have been in the domain of bringing about change within given structures. In experimenting with our pedagogy so as to counter the inadequacies of current design curricula that serve the dominant capitalist economic system, we as educator-researchers have, from the outset, embraced a flattened ontological perspective in our teaching.

This has meant that from the outset of this study I (along with colleagues) have adopted the role of practitioner-researcher and design educator with an action agenda for transitioning curricular and pedagogical reform that has been strongly collaborative (see Creswell, 2014). My research embraces a sociocultural perspective on learning in the context of design education, where my ontological stance acknowledges the situated, experiential and intra-active nature of learning and knowledge building as it is collaboratively co-created by design educators with students.

Educator-researcher and student voice is therefore interwoven as an important relational ingredient throughout this thesis (Holliday, 2007). Furthermore, a posthumanist perspective significantly inflects my research stance in a way that acknowledges our embedded and relational roles as design-educator-researchers not only in relation to other humans within context-sensitive design projects but in relation to non-human natural world others (Barad, 2007; Dawney, 2018).

Consequently, my methodological approach has been one that has evolved as I have read and engaged with my study data and findings through recent literature to do with "scholarship organized under the 'ontological turn'" (St Pierre, 2014, p. 12). This evolution has been most marked during the writing up of this exegesis, where I have sharpened my understanding of how my research process, while being qualitative in nature has been more than "a blunt version of inquiry", going beyond framing, using and reflecting on design-based knowledge (Morrison, Mainsah, & Rygh, 2019, p. 1). For example, Perold-Bull and Costandius (2019) similarly explore an approach to "research as teaching and teaching as research" in their article using a post-qualitative design research stance in the context of transformation in a South African HEI (p. 60). Put simply, a post-qualitative approach is a critical response to the logic of traditional qualitative research methods that "foregrounds extractivist practices of knowing and coming to know" (Kuntz, 2015, p. 21). A post-qualitative approach in St. Pierre's view is not about "rejecting conventional humanist qualitative methodology", but is one that critiques the assumptions inherent in the nature of qualitative inquiry that are "grounded in Enlightenment humanism's description of human being, of language, of the material, the empirical, the real, of knowledge, power, [and] freedom…" (p. 5).

The topic of this research involves inquiry into project-cases in a university design faculty where design pedagogy has been experimented with to develop a participatory culture, for students and educators, that is oriented towards sustainable design practice. In order to address this topic, I have developed a mixed methods study that joins up design practice making and research in design and design pedagogy methods, with methods from educational and social science research.

1.8.2 Methods, techniques, and technology of design in research

Post-qualitative methods used in this exegesis resonate with what Lury (2018) emphasise as the "do-*ing"* of a method or methods and the "following out of the with", the "among" and "between" of interdisciplinary research as "ways to intervene in and make the present active" (p. 21). This highlights the importance of interpretation, collaboration and performative meaning making through "intervening, participating in, and collaborating" within the pedagogical situations that make up the cases in this study (Denzin, 2017, p. 15). Overall, this aligns with a "socio-material view argued by many researchers where the designer and the method they enact cannot be separated" (Akama & Yee, 2016, p. 8). That is to say, in putting the "methods, techniques and technology of design" (Akama & Yee, p. 9) to use in this thesis, a designerly making-as-research process is followed that opens up new relations between design and formal research processes.

A designerly making-as-research process in the context of this study involves designing, developing, implementing, documenting, observing, and investigating relations in a nomadic pedagogy between students and educators, and especially between students in varied collaborative learning environments. Techniques and tools of design including sketching, process mapping, visualising, modelling, and prototyping are an integral part of a making-as-research process. Participant observation during pedagogical situations, interviewing students and

collaborative workshopping during and post projects, writing singly and collaboratively have all been part of a nomadic journey of inquiry. Arranging these activities of generating, gathering, filtering, sorting, and juxtaposing have led to a "tangled method of discovery" (Richardson & St. Pierre, 2005, p. 967) involving a "crafting [of] relationships among pieces of information to determine which arrangement might offer a new perspective or prompt a new question" (Bench, 2018, p. 45).

In pursuing a mesh of methods in this way my research exposition evidences a "back-and-forth between cases and concepts that is central to qualitative inquiry" (Ragin, 2018, p. 105). Such an approach elicits thick descriptions, rich contextualisation, participative representations (such as documentary film and photography) and nuanced reflections on events and processes (interviews and workshops) during and after the case studies. What unites these methods, is that they become the "means by which the social world is not only investigated, but may also be engaged" (Lury & Wakeford, 2012, p. 6).

The post-qualitative nature of this study is therefore an unfolding story bound up in our design educator roles enacted during these cases and in the method and writing of this research whereby I engage in a sense-making journey through inquiry into these cases and the total experience of which they are a part. The accounts of, and accounting for project-cases in this study indicate active responsiveness on the part of educators and students as events unfolded, in key moments during and between the projects, and afterwards as research explication in this exegesis. Overall, as a research methodology that is design inflected, the above approaches are designed to appropriately aid this inquiry into pedagogical and curricular experimentation that is oriented towards sustainable futures.

1.8.3 Design project-cases as participatory pedagogy and research

This study draws on trans-disciplinary projects involving bachelors level Design students from Industrial, Graphic, Surface Design and in some cases, Engineering students at CPUT. In one of the cases, students from other universities in the Western Cape were included. A signature approach for us has been to relocate and shift design projects off campus, away from normative settings circumscribed by certain power dynamics, towards varied real-world contexts rich in anomaly and unexpected surprises. These multi-sited projects, carried out over a five-year period, constitute the case study analysis. A participatory-research inquiry into design learning in varied sites and situations over a period of time with changing cohorts of design students in what amounts to a multivocal and dialoguing approach (Tracy, 2010), is what provides a qualitatively robust methodology in this study.

1.8.4 Unfolding the research story

Having now outlined the research methodology and mixed methods in this study, I present summaries of the five published outcomes of this research in the following section. In these contributions, the research story unfolds over a period of five years during which our experimental pedagogy has evolved through multiple design projects conducted in and around Cape Town, and further afield. In each of the published outcomes, I deal with a particular project-case or selection of cases, and inquire into the pedagogy and learning that arises through various conceptual perspectives and guided by my research questions. In Chapter 5 of this exegesis, I synthesise my argument by drawing on the findings and discussions in the published outcomes, and further understandings that have emerged from the writing and research process of this exegesis.

1.9 Research Publications

The thesis follows the PhD by compilation model, comprising an exegesis and five peer reviewed international publications. These publications form part of the body of the main thesis, and are not an appendix. The published outcomes are summarised next as a means of providing the reader with an overview of the varying project-case contexts and the main findings emerging from these design-based research inquiries. In the majority of these publications I have co-authored with colleagues involved in the collaborative project-case work that provides the focus of this thesis. These are colleagues based in both hemispheres, who are academics and researchers in and outside of several universities, all of whom are involved in activities of shared design pedagogy praxis and composition of research inquiry into such practices in both the Western Cape in South Africa and the far North of Norway. In four of the five publications, I have been the lead author. This has enabled me to build a set of research outputs based on a range of conceptual perspectives and framed by my research design, while pursuing a participatory action research mode of discursive inquiry with co-authors.

1.9.1 Publication 1

Learning Spaces for Sustainable Futures: Encounters between design and rhetoric in shaping nomadic pedagogy.

The first publication (Snaddon, Morrison, & Grant-Broom, 2017) is a webtext published in *Kairos–A Journal of Rhetoric, Technology, and Pedagogy*. Through a spatial and journey-based interface, this webtext embodies a multimodal, qualitative inquiry into ways to support dynamic learning for undergraduate design students as they explore their emergent roles as critically engaged and resilient designers transitioning toward sustainable design practice.

The inquiry presents an exploratory pedagogical framework devised for and through a multidisciplinary design project based in the Design Faculty at CPUT, Cape Town, South Africa. The framework was developed to enhance learning practices, resources, and reflections as part of a wider pedagogical shift toward learning about sustainable design in the context of climate change. This learning took place in a move from the local and related practices of the design studio out into a shared journey between two regional cities. It crossed national borders and climate zones, and engaged with front-line communities affected by climate change, all by way of situated and experiential knowledge creation. It involved a group of 36 students working across design disciplines on a physical and learning journey which included their design teachers in their roles as educators and researchers. The journey became pedagogical and pedagogy became the journey, together creating a space that transformed agentive selves in lived relations to others (see Ellsworth, 2005). Overall, the exploration drew together conceptual, productive, and experiential design learning and design multiliteracies, along with approaches to situated and emergent reflection and knowledge building. The webtext is centred around stages and key events in the journey across a landscape. Methodologically, it takes up a diversity of modes of making, documenting, and reflecting on this shared learning journey, including photography, interviews, participant observation, and a documentary film. This is conveyed through a spatial rhetoric that is designed to evince and allow access to different thematics and elements in the interface so that readers—students, educators, researchers—may differentially traverse the multimodal account of the learning journey. Pivotal moments are pointed to during the learning process which were found to have effectively altered students' dispositions and cultivated attributes of thoughtfulness, self-awareness, resilience, adaptability, and self-reliance. These are moments that effectively connect design students more confidently to the process of building their learning identities consistent with the skills and agency desired for knowing and acting in a

transitioning world. A discussion is offered around the possibilities of enacting a renewal of design curriculum through pedagogy that is responsive to the speculative, locative, and performative elements found in the experimental project under analysis.

1.9.2 Publication 2

Futures-oriented design pedagogy: performing a space of powerful possibility.

The second publication (Snaddon & Chisin, 2017) is a full paper presented at the NORDES Design + Power conference. This publication is an inquiry into a second part of the experimental project-case that the first publication is based upon.

Where is the futuring power in performative design pedagogy? How do we, as educators and researchers, engage with pedagogical approaches in design learning that are flexible and responsive to changing times? These are the questions asked relating to an experimental 'pedagogical interruption' (Ellsworth, 2005) that took students into a space for learning possibilities within the context of Afrikaburn (2019), a creative festival in the semi-desert. The pedagogical impulse had been to firstly relocate design students and educators into a space where the environmental extremes would be experientially immersive, so as to bring their social ecology in step with the environmental ecology. Secondly, it had been to situate the design learning activity within a sociocultural microcosm over a week, where embodied, performative engagement with all participants would provide feedback and give momentum to the groups' praxis. Performance in design pedagogy is referred to as imaginative meaning-making, performatively produced. Findings suggest that pedagogy that is enabling of performative event spaces in radically relational settings, can expose and quicken a relational ontology for design students and their ongoing articulation of a co-created world.

1.9.3 Publication 3

Investigating agentive urban learning: An assembly of situated experiences for sustainable futures.

This third publication (Morrison, Erstad, et al., 2019) is published in the *Oxford Review of Education*, and is an exploration into the dynamic between conceptions of education and contextual issues within cities, paying particular attention to 'agentive urban learning'.

Agentive urban learning is proposed as those processes by which young people build agency in the urban context, using the resources of the city to firstly develop personal agency, which consequently allows them to act within the city. The focus is on how young people develop such agentive urban learning themselves and how it might be enhanced pedagogically at school and university. Three case studies explore different facets – the first on how young people themselves develop this agency in situated settings and the tools that they use to reflect upon the future; the second how digital tools might be used to enhance students' understanding of the city as a site of change, in this instance, climate change; the third how such agency might be developed collectively in partnership with other city dwellers. Findings reveal that the 'agentive' in learning has to do with learners finding their own contextual articulations. These are complex interpersonal, cultural, and communicative changes in how students enact, perform, and engage in the dynamics and venues in their urban meaning making. In conclusion, the publication shows how a diversity of students' engagement in urban contexts of learning offers ways from which to further investigate how identity, setting and stakeholder relationships matter as part of potentially sustainable agentive learning futures.

1.9.4 Publication 4

Investigating design-based learning ecologies.

The fourth publication (Snaddon et al., 2019), published in *Artifact: Journal of Design Practice*, is a case-based inquiry into agile pedagogy that enables students to co-create as citizens in public spaces, through agentive multimodal construction of their identities and modes of transformative representation.

For educators in design and urbanism, the responsibility of translating emergent design practice and changing societal needs into pedagogical activities demands that attention be given to agentive learning that explores the interplay between what is and what can be. As such, this futuring imperative brings into play a mix of modes of situated experience, communication and tools from design and learning to query the planned and built environment as a given, while offering alternate future visions and critiques. The core research problematic is how to develop, enact and critique design-based pedagogies that may allow designer-educator-researchers and students alike to co-create learning ecologies as dynamic engagement in re-making the city. This is taken up within the wider context of climate change and pressing societal and environmental needs within which design and urbanism education increasingly needs to be oriented. This inquiry is located within a shared practice of design pedagogy across two continents, and climatic and disciplinary domains between the Western Cape in South Africa and the far North of Norway. The main finding of this research is that pedagogies that are enabling of, and attentive to the interplay of an assemblage of relational context-sensitive modalities, can be conducive to sustainable and futuring design-based urban engagements.

1.9.5 Publication 5

Design pedagogy for sustainability: developing qualities of transformative agentive learning.

The fifth publication (Snaddon, 2019) is a paper presented at the *Design Sustainability for All, Learning Networks on Sustainability (LeNS) World Distributed Conference*. This publication is an inquiry into design pedagogy that seeks to enable authentic ontological shifts in a student's sense of self and emergent designing agency in relation to wider human and non-human ecologies.

For design educators developing students' readiness as sustainably aware design practitioners, it remains a challenge to bring about transformative and meaningful learning experiences for students as they engage with the complex issue of sustainability. The contention in this publication is that, in tackling this challenge, it is key for educators to develop compelling pedagogy that activates ecologies for learning and ecological literacies, where students can experience their evolving agentive selves in relation to wider systemic relationships. In exploring this contention, this paper examines a project-case where Biomimicry was introduced to complement pilot coursework as part of the Learning Network for Sustainable Energy Systems (LeNSes) to promote a Sustainable Product Service System (S.PSS) view and tools. In framing this practice-based research paper the following question is posed: What are the qualities of an ecologically immersive pedagogy that is productive of sustainable design dispositions in students? The project-case reveals how students negotiate learning as agentive subjects moving across disciplinary, social, environmental and personal learning thresholds. In connecting social learning theory, design for sustainability and systems thinking, the concepts of learning ecologies and agentive learning are drawn together. Conducted as participatory action research, the

qualitative inquiry process reveals how pivotal learning moments were found to have cultivated attributes of resilience, performative adaptability, and relational awareness.

1.10 Outline of the thesis

This exegesis, comprising five peer reviewed publications, presents a synopsis of the research study as a whole and is structured as follows.

Chapter 1 is an overall introduction to the study, the conceptual framings and includes short summaries of the five publications. Chapter 2 places the study in the context of a university in the global South with all its attendant challenges and opportunities. This chapter also situates the study in relation to my own academic and professional pathway. Chapter 3 presents a review of the literature that has informed this study. It is presented as a genealogy that traces the themes, turns and cross-over points in scholarly literature to do with learning theory, design pedagogy and futures-oriented design for sustainability. Chapter 4 details the methodology, methods, design techniques and tools that have been used throughout this study in both the experimental design pedagogy and as a research-through-design process. Chapter 5 presents an overview of the argument that has been arrived at through this study, and expands through discussion, a framework for the orientation of sustainable design pedagogy. Chapter 6 concludes the exegesis with implications of the study for transitioning sustainable design education within CPUT, in South Africa and globally.

1.11 Conclusion

The process of conceptualising and arriving at a framework for sustainable design pedagogy has been complex. In researching such a layered topic, contextualised within an emerging economy in a fledgling democratic state, it has been necessary to draw on research in multiple fields including design studies, design education, social learning theory, sustainability and transition studies, and post-colonial studies. Such a trans-disciplinary research process has led me towards a critical posthumanist perspective as an overarching philosophy that connects up the above fields.

The pedagogical framework that my thesis offers is therefore guided by a posthumanist stance, elaborated through the work of Deleuze and Guattari (1987), Haraway (2016), Braidotti (2013) Fendler (2013) and Barad (2003). As an analytical and navigational approach, posthumanism problematises anthropocentrism by offering a perspective that frees up the becoming human subject to navigate new spaces for critical thinking and creativity that reveal hidden, dynamic, and relational potential. It maps and critiques boundaries thrown up by humanist and anthropocentric notions of the world and offers affirmative gambits for emergent agentive subjects as they orient their nascent design identities in relation to multiple others.

In the above sections I have outlined the contexts and conceptual framings that orient my overall research stance and relate to the title of this thesis, namely *Learning for Future Knowing now: Investigating Transformative Pedagogic Processes Within a Design Faculty in a South African University of Technology*. These conceptual framings are presented as a selection of perspectives that together, present ways to conceptually and analytically approach my main research question; How might current design pedagogy transition toward emerging and complex contexts through designerly curricular experimentation that is oriented towards sustainable futures?

A key outcome of this research study is a pedagogical framework that is guided and informed by the line of questioning and conceptual framings above. The framework comprises a set of mutually reinforcing modalities and navigational principles for design education in a transitioning

reorientation towards long-term sustainable design practice. This framework and its associated implications will be presented in Chapters 5 and 6 of this exegesis.

2

2 Context of this study

This chapter aims to situate the study and inform the reader of the context of my research in narrative form, and in so doing provides a rationale for the research, its beginnings, current status and ongoing application within my academic practice and institutional duties.

2.1 Global themes for design, design research and design pedagogy

2.1.1 Intersections of design research, practice and education

The 2018 Design Research Society (DRS) conference in Ireland had as its theme, design as a catalyst for change, along with the converse view of change as a catalyst for design (DRS, 2018). This theme highlights for design researchers, academics, students and design practitioners, the attention being given to the changing territorial contexts and intersections of design research, practice, education and policy. To the point of my research study, I cite this as an example of the global design, design research and design education context within which my work is situated. Furthermore, the track themes for this conference lift up key concerns for design research such as, Ethics and Values, Multiple Voices, Sustainable Design, Design for Transitions, and Design Pedagogy. Questions arising from the keynote presentations were indicative of global concerns and interests of design researchers and academics, for example, is design research a tool for industry or an agent for social and cultural change, or can it be both?

2.1.2 Design pedagogy as nexus

These themes and questions broadly frame my research globally and locally as my research focuses on the question of how design pedagogy, as a key and dynamic aspect of design education, might address the above-mentioned concerns. This places my work at a nexus between design research, the developmental and critical educational environment, and the world of work, where educators are faced with choices in how their pedagogies model the curriculum and its delivery. Such choices relate to the role of educators in how they balance their modelling of a global identity of professional design practice with a questioning approach that interrogates whether such an identity is relevant and appropriate in the light of sustainable design futures.

Having said this, I take what I have outlined above as a suitable indicator that my research and academic work in this thesis is dealing with highly topical and relevant issues of the day. I now proceed with the more local and personal contexts within which my research and collaborative design pedagogy practice is located.

2.2 South African HEIs in transition

2.2.1 The South African HEI landscape

As this study is set in the context of exploratory design teaching and learning and research at a higher education institution in South Africa, it is important to describe the wider landscape within which such approaches have evolved. Public Universities of Technology (UoT's) of which the Cape Peninsula University of Technology (CPUT) is one, resulted from mergers between technikons (higher education institutions offering technical and vocational education) and some universities in the mid-2000s (History - CPUT, n.d.). This process created 22 new institutions from the previous 36 with new ones recently added to bring the total to 26. These institutions vary widely "between historically advantaged and historically disadvantaged universities; between those that are research-led or teaching-oriented; merged and unmerged; urban and rural" (Leibowitz & Bozalek, 2018, p. 985).

Public and private institutions offering a variety of higher education qualifications similar to what might be found anywhere in the world can be found in all the main city centers across the country. However, as a system, higher education is influenced by the unequal conditions in South African society with its large disparity between rich and poor (Bhorat, 2015). After the country's first democratic elections in 1994, President Nelson Mandela initiated a process of transformation when he established the National Commission on Higher Education (National Commission on Higher Education, 1996). With various reports emanating from the NCHE report in 1996, top-down policy-driven transformation became the pattern with little meaningful grassroots change on campuses.

This has been acknowledged in reports such as the Soudien report (Soudien et al., 2008) and the Higher Education South Africa sector position paper (HESA, 2010) leading to key recommendations. These urge institutions and educators to build a culture and practice of transformation ranging from governance levels through to programme curriculum renewal that can deal with questions such as, "Does the curriculum prepare young people for their role in South Africa and the world in the context of the challenges posed by the 21st century?" (Soudien et al., p. 31). Leibowitz (2012) notes that the Soudien report (Soudien et al., 2008) went to the heart of deep divisions in the country and posed challenging questions to do with positionality and biography of educators and their ability to teach for the public good.

However, political, socioeconomic and HEI change has been slow to manifest and has led to frustrations for students and many academics. Notably, in the last three years UoT's and universities have been affected by violent student protests around the #feesmustfall movement and the demand for access to free education for all. This has culminated in national government making billions of rands available in support of financially disadvantaged students seeking higher education, and has significantly changed the student demographic making it more representative of the general population. Jansen (2018) sites two principle challenges inherent in this shift, student poverty and the pressures within universities to address the social (and not only academic) needs of this new profile, and remedial actions for what was lacking in schools preparing students for higher education.

2.2.2 Opportunity in curriculum review in design

UoT's across the country are currently in the process of curriculum review as required by the Higher Education Qualifications Committee (HEQC), with all existing qualifications being revised along with the introduction of a suite of new qualifications. CPUT's Curriculum 2020

plan proposes that the "re-curriculation process, if regarded as a strategic initiative presents CPUT with an opportunity to bring about renewal in terms of curricula as well as pedagogic practice" (Bester, 2012, p. 5). This marks a move toward faculty staff becoming more engaged with the enactment of curriculum, where curriculum making happens through active adaptation to student and societal needs, and pedagogic techniques are consequently improvised and co-developed.

The challenge here is that the curriculum review process understood merely as redesigning the delivery of programmes is not the same as rethinking the philosophy and content of programmes, and the former is sometimes the assumption that UoT's believe will be their transformation from a technikon into a university. Importantly, this process offers opportunities for design programmes in UoT's to question how they orientate towards issues such as a decolonised curriculum, sustainability and social justice. Additionally, there is increased urgency in finding a fit within an HEI ecosystem that has become increasingly competitive. This is a result of private institutions being able to adapt quickly with new course offerings to emergent educational opportunity, whereas public sector HEIs are encumbered with bureaucratic administrative processes and resistance to change.

CPUT has established within its Fundani Centre for Higher Education Development the formal support structures necessary to ensure the process of curriculum renewal is academically sound and operationally achievable. As part of this support structure, a curriculum development unit was set up to engage with program review teams through the Curriculum Officers (CO) Forum which aims to build capacity at departmental and faculty levels. The unit facilitates customised workshops and subject review sessions for departments in relation to the South African HEQC and South African Qualifications Framework (SAQA) requirements to develop a culture of reflective practice and scholarship in teaching and learning (Fundani, Cape Peninsula University of Technology, n.d.).

Since 2012 I have served in the capacity of Curriculum Officer and had a hand in the conceptualisation and development of revised and new design qualifications in the Visual Communication Design department where I am a senior lecturer. Our work in the CO Forum involves meeting once a month to engage in discussion on various aspects pertaining to curriculum, teaching, learning and assessment. This has been, and continues to be a vibrant forum for discussion and sharing of exploratory pedagogical practice. The forum space has become both inspirational in an inter-disciplinary sense as well as being a means of ensuring that we are in touch with the burgeoning needs and realities of our current South African HEI context.

2.3 CPUT's institutional vision and position

CPUT's Vision 2020 strategy is supported by a "Research, Technology and Innovation 10-year Blueprint" that states in its vision the need to "unlock the potential of staff, students and partners to excel in research, technology and innovation that offer solutions to the needs of society" (2012, p. 10). Significantly for this research study, the niche research area of design for sustainability has been identified in this policy.

These institutional policies are driven by national strategic imperatives e.g. Department of Science and Technology's Innovation Ten-Year Plan for South Africa (The Ten-Year Plan for Science and Technology, n.d.), the New Growth Plan that supports potential new green economies, and the National Development Plan 2030 (South African Government, 2020) that emphasises alignment of innovative problem-solving approaches linking the world of work with

academia. These also link through to the African Union objectives and more widely to the global imperatives of the UN Millennium Development Goals (United Nations, 2015), and specifically the UN Sustainable Development Goals (United Nations Department for Economic and Social Affairs, 2019). Overall these imperatives have common ground in terms of the following areas, which are potentially impacted by this; strengthening the bio-economy, enabling safe drinking water and sanitation, providing energy security and supporting environmental sustainability and climate change.

The Faculty of Informatics and Design, in which I teach, at the Cape Peninsula University of Technology (CPUT) consists of a rich mix of fifteen different programmes, eight of them being design-focused. We are situated in one of five campuses, in the historical District Six site where a community of sixty thousand people were forcibly removed by government during the social engineering of the apartheid era (Cape Town History and Heritage, 2008).

The shift away from purely disciplinary vocational offerings is described as "scenarios concerning a move from more work-oriented diplomas to more academic degrees" and the setting up of "third spaces between the two worlds of academia and work" (Garraway, 2013, p. 5). A third space is framed by the concept of a 'quadruple helix model' that recognises government, academia, industry, and civil society as "key actors promoting a democratic approach to innovation through which strategy development and decision-making are exposed to feedback from key stakeholders, resulting in socially accountable policies and practices" (Carayannis & Campbell, 2012, p. 1).

My research is set against this backdrop and aims to aid in the process of developing reflexive research discourse around the design pedagogy and curricula that are evolving in the faculty to bring about responsive and engaged design education that builds on and explores more widely the notion of third spaces described above.

Moves towards teaching and learning being more multi-disciplinary and inclusive of critical understandings of the world has been slow to evolve, but has gathered significant momentum in recent years and manifests in a growing research culture. Applied research outputs by faculty staff and postgraduate students are on the increase and the institution has developed strategies to ensure steady growth in the field of research and innovation.

2.4 Design education landscape in South Africa

In the field of Design Education, South African public and private institutions offer a range of qualifications that serve what is a fairly robust design industry. These encompass the typical disciplines of graphic/visual communication design (inclusive of online design), product and industrial design, fashion design, jewellery, and surface (previously textile) design. Within the UoT's, courses in these design disciplines are offered at all undergraduate levels and some postgraduate levels through to doctoral studies. Seven public universities and UoT's offer design programmes that retain much of the traditional master-apprentice modes of pedagogical delivery emanating from the Bauhaus model developed in Europe and the USA.

Innovative transition towards new design knowledge domains and pedagogy in the UOT's is often limited for a want of more courageous and visionary academic leadership, administrative and budget support, and a culture of encouragement for educators to engage in curriculum renewal and adaptation. Approximately ten private design schools offer niched programmes (with very high fees) that are pitched specifically towards industry requirements in many of the traditional and emergent fields of design. Although these are well funded and able to adapt

competitively within the HEI landscape, the focus remains (as in the public HEIs) on designing for human consumption.

Within such a state of play, Fenn & Hobbs (2018) point out the existing status quo of design as a traditionally taught academic discipline is ill equipped to deliver on the potential for design to provide humankind with "a more just, equitable and sustainable future" (p. 141). A number of educators however are involved in innovative practice using networked support in the form of national conferences like the Design Education Forum of South Africa (DEFSA), internationally networked platforms (e.g. LeNSin, n.d.; DESIS Network, 2016), and through collaborative projects involving multi-disciplinary design challenges.

There is also a steady increase in scholarly design research being produced by educators starting to bridge between teaching and research while improving their qualifications. In this way, the scholarship of teaching and learning (SOTL) is becoming well established in South Africa and is evolving a vital multi-disciplinary space for experimental and reflective work that engages with the many challenges of higher education in a vastly unequal society (e.g. Leibowitz & Bozalek, 2018).

2.5 Design education in and as change

With the broadening scope of design in recent decades design schools around the world have added to already full programmes in a curriculum-by-accrual approach (Davis, 2011). This has often led to tension amongst faculty staff around the issue of adapting existing curricula to the new demands emerging from post-industrial technological advances in digital media, the social media revolution and the changing roles required of designers.

Davis, in the Icograda Design Education Manifesto (2011) talks about the structural barriers to interdisciplinary work in design education and advocates that "design educators must develop flexible curricular structures that can respond quickly to changing times" (p. 74). This goes to the wider project of curriculum development in design schools where the pressure is on meeting real-world challenges, yet at the same time propelling our students to be motivated questioners and active agents in working with design futures in the here and now.

How then are we to engage students actively in these wicked problems, in emergent dynamics of learning, in seeing the wider scope of needs relating to change connected to climate, community, and consumption? In the context of design education in contemporary and post-apartheid South Africa, such matters need to be an identified part of a wider national and institutional programme of transformation in higher education. In so doing, such transformation can have political and structural consequences for South African society. As Botes (2018) argues, this would entail design educators working towards capacitating students with critical and structural analysis skills to investigate deeper causalities within society, and nurture the academic project of politicising "notions of culture, knowledge and power" (p. 39).

2.5.1 An ethics of care in design education

Design education in South Africa today is in transition. Similar to other global contexts, we "already face the challenges of future design education" and are in a slow process of developing the requisite skills and capacities to meet such challenges (Friedman, 2012, p. 150). On this, Friedman argues for capacity to be fostered in young designers to "master an art of human engagement based on ethics and care" (Friedman, p. 150). From pedagogy and curriculum approaches grounded in the logic of the industrial and modernist era, we now see shifts towards

inclusive processes concerning participatory and co-design methods. A shifting design focus from tangible products to intangible services has influenced design education leading to wider engagement with new knowledge domains to achieve broader literacies suitable for an emergent and complex world.

This study is a response to such shifts and involves qualitative design research that engages educators and "students in public interest visions of society" (Denzin, 2017, pp. 8-9) with "equitable forms of teaching and learning" (Gutiérrez, Engeström, & Sannino, 2016, p. 275). An ethical turn has opened up design practice (and design education) to be reimagined and repositioned as more considerate of life affirming decisions beneficial to all inhabitants of earth. In turning 'care-fully' with this paradigm shift, we find ourselves as design researcher educators in the role of activists within a transitioning space needing to courageously experiment with ways of ushering in new pedagogies that question, critique, re-connect and re-balance. In (re)cognising that the preparation of students for design practices of making products, systems, and services is an integral part of the making of the world, we are then ethically bound to question how we orient to that world (Dawney, 2018).

This comes late in the day "at a moment of environmental instability and human hardship spawned by climate instability, water scarcity, collapsing fisheries, and stark economic inequality" (Maniates, 2017, p. 218). To this point, the UNDP 2018 Statistical Update notes that the global Sustainable Development Goals need "new indicators for assessing the many faces of inequality, the impact of the global environmental crisis on people now and tomorrow, the importance of voice, and the ways in which communities rather than individuals are progressing" (UNDP, 2018a, p. iv).

2.5.2 Education for the public good

Within the state of transitional play so described, this study focuses on how sustainable design attitudes might be meaningfully engendered in design students as preparation for entry into an increasingly trans-disciplinary profession, a dynamic nexus where design thinking and doing needs to be acutely responsive to political, social, economic and cultural hegemony. In this vein, Sheridan and Rowsell (2010) challenge "those designing literacy curriculum and pedagogy to cultivate the design literacies dispositions so that students are able to understand a greater range of choices and therefore are better able to become competent problem solvers for the 21st century" (p. 112).

Educators in South African public and private universities offering a range of design programmes have made pioneering moves to preparing designers as social change makers. A recent book, *Educating citizen designers in South Africa* (Costandius & Botes, 2018) the first of its kind in post-apartheid South Africa, gathers cases of critical citizenship design teaching and learning pedagogies across a range of HEIs. Together, these cases provide a view on pockets of design education in South Africa where engagement with promoting social justice, shared values and critical thinking is occurring in a scholarly mode.

Additionally, a robust group of scholars researching in the social sciences and education have been producing research on the topic of higher education for the public good. These works explore the particular intensity of struggles around injustice, equality and human flourishing in the global South and how this relates to education in the developed world (e.g. Leibowitz, 2012; Zembylas, Bozalek, & Shefer, 2014; Bozalek et al., 2014). Of note is the work of Gray van Heerden and her critical questioning around subjectivity in higher education from a socially just perspective.

In CPUT examples of projects that are part of work integrated learning and service learning have taken students and staff into under-resourced schools and rural communities, such as the Design Build concept in the Architecture & Technology course (Perold & Delport, 2018), and the Service Learning project in the Department of Town and Regional Planning (Morrison, Erstad, et al., 2019). In the design department, we have worked with productive relationships that have emerged out of design education and research being recognised as value generators for initiatives and organisations beyond academia. These relationships have evolved over a period of eight years and have included collaborative work between design educators, local government, design industry, NGOs and other design-led social enterprises.

Important work has been done specifically in the realm of challenging student designers to broaden their conceptual and ethical scope in domains of design for social justice and sustainability. This has led to ways of positioning their practice holistically that is not demeaning or threatening to both socioeconomic and ecological ecosystems. These are significant developments in the light of many higher education institutions remaining trapped in a liminal space due to their being "creatures of the high-growth world from which we must exit" (Maniates, 2017, p. 215). Maniates warns of a bumpy ride towards a post-growth future and that now, more than ever, is the time to leverage off momentum in a globally distributed network of higher education institutions that share an agenda for designing sustainably (Maniates, 2017).

In building relationships between academic institutions and beyond, with communities, the city and region, we see an important pattern of engagement and application of research and practice emerging that is in touch with contextual realities and strengthens the relevance of university design programmes. The next section highlights such 'third space' activity with its pro's and con's.

2.6 Broadening design discourse beyond academia into the public domain

Cape Town's bidding process, run-up to, and delivery of its World Design Capital (WDC) designation and programme in 2014 placed a spotlight on socially responsive design, with the concept, 'Live Design, Transform Life'. Three sub themes were developed within this concept; Rebuild Cape Town through community cohesion, Reconnect Cape Town through infrastructural enhancement, and Reposition Cape Town for the knowledge economy.

In response to this, I was asked by colleagues Mugendi M'Rithaa and Dean of Faculty, Johannes Cronje to co-ordinate an inter-university partnership between Finland's Aalto University and CPUT in the build-up to Helsinki handing over the designation of World Design Capital to Cape Town in 2014. This involved 18 months' sharing of expertise and planning for joint academic events to happen as part of CPUT's project activities in 2014. My task was to explore the partnership for likely inter-university projects that would build on shared visions around design, with a strong focus on design for social innovation and public good. This led to seminars, workshops, a conference, staff and student exchange and a joint exhibition of student work, 'Shaping a Shared World'. During this time, I was fortunate enough to work with design scholars such as Alastair Fuad-Luke and Ezio Manzini in their various capacities as conference speakers and visiting professor in residence.

In further committing to working in a third space between academia and the public sphere I served as chairman of the Cape Town Design Network between 2012 and 2015, and as a board member on Cape Town's WDC implementation company from 2013 to 2015. I had the privilege of working on many successful initiatives such as the ongoing Open Design Afrika festival (Open Design Afrika, n.d.). This annual event aims at opening up and improving access to

design for schools and wider society through a variety of workshops, talks, exhibitions, and maker events, and is one of the lasting legacies of the WDC.

During this time, it was my responsibility to coordinate and provide platforms (both online and physically) for sharing all CPUT design projects, events and research that related to our status as a World Design Capital. Local government implemented 70 collaborative workshops during this year-long event that utilised design thinking methodology and tools to facilitate processes of community involvement in urban upgrade projects. In the aftermath of WDC 2014, some legacy projects endure such as the Craft and Design Institute's 'Better Living Challenge' that aimed to "surface local innovative solutions to pressing or persistent socioeconomic challenges, through stimulating innovative products, services, and systems that can catalyse change and bring about better living" (Better Living Challenge, 2019, para. 2).

However, as an event driven by local government (vulnerable to short-term political expediency) and bound by constraints imposed by the then organising body, the International Council of Societies of Industrial Design (ICSID), the event has been critiqued for not building a sustainable ecosystem for design to address social innovation (see Minty, 2017). Coupled with severe budget cuts due to the country finding itself in a recession after the Zuma years of corruption, the state of local government support for the much hoped for Western Cape's design ecosystem has diminished with impacts especially felt by the downsizing of the parastatal, the Craft and Design Institute.

Valuable lessons have been learnt, not least that large-scale publicly funded events such as Cape Town's WDC status reveal how design innovation at any level is an emergent phenomenon that is immensely challenging to bring about and sustain within such a short-term programmed event. In the longer term, it is the projects that have been connected with academia's slower cycles that have continued with some success. For example, two of these projects are featured in two of the published articles in this thesis (Morrison, Erstad, et al., 2019; Snaddon et al., 2019).

2.7 North and South design research collaboration

This research is nested within international research collaboration that has linked CPUT with the Oslo School of Architecture and Design (AHO) in Norway. Two of the case studies that this study draws upon were developed under the SANCOOP C–CLIMA–Futures project, which is jointly funded by the Research Council of Norway and the South African National Research Foundation. Staff from both institutions conceptualised and carried out project work that would contribute to seeding a longer-term process under the project title, *Designerly Strategies for Scaling Up Climate Change Approaches in South Africa and Norway.*

In reaching out and collaborating between the global North and South, this research draws on shared and co-created approaches to design pedagogy, design practice and research that explores how relationships between varied regions and cultures might be leveraged. Such collaboration explores broad conceptions of the role of HEIs in making contributions to the wider knowledge society via "multiple partnerships to facilitate knowledge distribution" (Taylor & Fransman (2004, p. 6). More pertinently, as Leibowitz (2012) puts it "contributions from the South have a particular value – conditions are different and the particular experience of struggle against injustice and for equality and human flourishing takes on forms which may differ in terms of both content and intensity, from forms in the developed world" (p. xviii).

My research primarily emanates from pedagogy jointly created by colleagues located in a UoT in the South, with four of the publications making up this study containing completed project-case

studies drawn from both the Western Cape in South Africa and the far North of Norway. Ongoing and shared composition of research between such diverse socioeconomic and political contexts aids a process of understanding and critiquing the interplay of concepts that frame and give this research momentum. Our collaboration facilitates a shared practice of design pedagogy between two of the "many poly-located centres that weave together the global economy" via nomadism, where nomadism is not used as "a universal metaphor, but rather a generic term of indexation for qualitatively different degrees of access and entitlement to power" (Braidotti, 2006, p. 79).

2.8 Sociopolitical pressure points

A significant factor in the context of this research has been an institutional environment of disruption and change due to various unfolding events for UoT's across the country. In particular, mergers between institutions forced different university cultures together with very little facilitated negotiation and reconciliation between previously advantaged and disadvantaged institutions. My university, the Cape Peninsula University of Technology is one such example. In addition, many duplicated programmes (e.g. Graphic Design) were combined into single offerings. The case-work in this study is in part a resistance to top-down merger imperatives that aimed at reducing any duplicated offerings to a parity product, a process that ironed out different design education approaches that had been pioneered over time. It is the continuation of such work through exploratory, collaborative pedagogy to recover and continue momentum built over the years that forms the basis and motivation for this research. Such an approach also manifests as methodology, which I will elucidate in Chapter 4.

Between 2014 and 2017 the #feesmustfall movement and decolonising of curriculum have taken centre stage with challenging yet valuable possibilities emerging from these turbulent times. A politically charged atmosphere in a country shaped by its colonial and apartheid past along with a decade of corruption has increased the socioeconomic gap. During this time the looting of state coffers by the governing party and private sector collusion has infused a culture of impunity that continues to be pervasive in South African society. Against this backdrop, it is increasingly urgent for academics to transcend the euphoria induced by the promises of post-1994 transformation, and challenge the lack of significant change in South African society and its educational institutions.

If we are to evolve our educational offerings to encourage and prepare our youth to be active agentive role players in a vital renewal of society, culture and economy, it is incumbent on educators in higher education to open up spaces for critique including the inherited neoliberal status quo. Cope & Kalantzis (2009) point to the growing case against neoliberalism with warnings of dangerous fragmentation into a not-so-civil society. They propose a pedagogy of multiliteracies to promote active citizenship "centred on learners as agents in their own knowledge processes, capable of contributing their own as well as negotiating the differences between one community and the next" (p. 172).

In Gray's words we need to raise student's awareness of "their role as agents operating within a class system in a capitalist economy" and in so doing "provide apertures and develop critical tools to rethink their work" (2018, p. 118). Again, this remains difficult in academic culture that is largely uncritical of its aspirations and complicity in a high-growth world model that is unsuited to a developing world context. A shift is required from pedagogies of sameness to pedagogies of recognition that engage deeply with and leverage off diversity in students and the very particular socioeconomic, environmental and political context we find ourselves in. The

project-cases and this thesis research have all taken place during this unsettled period, and recognise the pedagogical value inherent in such a context.

This study, therefore, attempts to follow activist pedagogy that unsettles a status quo to enable nuanced understandings of the creatively ethical designing roles students might enact that are not only governed by the bounds of the market. The topic of young design creatives' positionality within a capitalist world exceeds the scope of this study, yet provides the ground out of which the questioning pedagogies I write about have emerged.

2.9 A personal learning journey

In becoming a design educator, I have always been intrigued by how learning happens for students. This is partly a result of a conscious pedagogical approach but, more interestingly, as un-anticipated outcomes that emerge through learning spaces that are held lightly. After 23 years of working alongside equally interested colleagues in creating enabling spaces for design learning, I am still curious. As a design educator one has freedom to explore new pedagogical strategies that translate and respond to the shifting nature of the profession, and I have found much professional satisfaction and pleasure in this exploration.

Central to the success of this has been solid collegiality, a community of enquiry and practice amongst educators, that has always involved students in collaborative projects that explore what design can do in response to real-world local contexts. 'What if' has been our mantra rather than 'can we' and this has spurred us on to do some exciting, quirky, demanding and sometimes uncomfortable things with our students that, in their process, have always been highly educational. Similar to many other design educators, a '"maveric' side to our personalities" has always been an instigating force in our educational approaches to bringing critical and reflexive strategies into action within our pedagogy (Gornick & Grout, 2008, p. 93). This study takes a close look at exploratory projects that form part of a much longer, and ongoing process of design educators seeking meaningful ways and conducive spaces where sustainable design learning may flourish.

2.9.1 Remembering early learning experience

My own schooling experience is perhaps partly the reason for my pedagogical approach. During these early years, my family relocated eight times moving through varied urban and rural settings, including a country school run by my parents in the Eastern Cape province of South Africa. The latter allowed us, as children, the freedom to learn experientially, to explore our environment and follow our obsessions in ways that starkly contrasted with what I had experienced in mainstream schooling. Boundaries were blurred between learning in and out of school as we voraciously consumed books and pursued outdoor challenges way beyond what would have been contained in graded curricula in schools at the time. Project-based learning formed the core pedagogy and would more often than not start with something we were reading. For example, Mark Twain's *The Adventures of Huckleberry Finn* sparked a project that would entail raft building and a journey down a local river. Planning beforehand involved research into local geography and history, and of course, our mathematics skills were exercised in budgeting and purchasing supplies for the trip. Post-adventure reflection brought our language and writing skills into play, but the real value lay in our ability to jointly resolve problems and crises as they emerged during the experience.

2.9.2 Hope in a new democracy

At the 4th Design Education Forum South Africa (DEFSA, 2000) in Cape Town, an address by Dr Kader Asmal (South Africa's then Minister of Education) and a keynote presented by Professor Richard Buchanan were seminal moments for me. Asmal, citing South Africa's newly crafted Constitution argued that "design finds its purpose and true beginnings in the values and constitutional life of a country and its peoples" (Buchanan, 2000, p. 3). Buchanan picked up and ran further with this in his response to what he called a dangerous and provocative conference theme, 'Reshaping South Africa by Design'. In his words, this challenge should come to mean, "supporting the value of human beings interacting with other human beings and discovering new kinds of interactions among people and their cultural and natural environment, with a goal of enhancing human dignity and supporting human rights" (Buchanan, 2000, p. 8)

In those heady times inflected with immense hope for our new democracy, I could see my role as a design educator being about enabling learning in young designers that could contribute towards such emergent value generation.

2.9.3 A research journey begins

In due course, this work became the focus of my MPhil Education thesis where I researched my teaching practice in communication design through a social awareness student project collaboration with local NGOs called 'Ideas that Matter' (e.g. SANGONeT, 2011). My aim was to better understand the learning that my teaching was enabling, through an autoethnographic methodology that drew on 'enactivism theory' (Varela, Thompson, & Rosch, 1993) and hermeneutic enquiry (Heidegger, 1996). Student's reflective journaling provided entry points for the research via several 'perturbations', or triggers. This approach drew on the philosophical hermeneutics of Gadamer (1975) that proposed that understanding in the interpretive sense begins in the face of something happening to us such that things no longer go without saying, things are no longer simply obvious. Enactivism as a discourse has its origins in philosophical hermeneutics, and proposes that through our living in the world we are in fact creating our world, where inner and outer specify one another through embodied action (Varela et al., 1993, p. 172). This early work of reflection on my own personal learning journey through research has deeply informed my teaching practice and my interest in attending carefully to and creating spaces for design learning. This PhD research picks up on some of the questions arising out of my master's thesis, notably how to address ontological issues of identity, and agency within design and learning.

2.9.4 Re-orienting pedagogy towards design for sustainability

Over the last eight years, colleagues and I have made further pedagogical explorations that invites students into participatory roles as collaborative curriculum-builders in projects within challenging problem contexts. A hallmark of these projects has been our aim to bring about learning that is co-created and enacted as part of a community of practice in multiple spaces within and beyond the bounds of the design studio as typically located within the physical confines of our Cape Town city centre campus. This resonates with the proactive approach taken by those (e.g. Leibowitz et al., 2010) who see paradoxical potential in the uncertainty of contemporary times, where teachers and learners are able to work collaboratively towards equipping themselves with skills and coping mechanisms appropriate to their particular context.

It is in this mode that our exploratory work has focused on how to bring about designing that is oriented to social justice and sustainability. For myself and others, this was influenced by a talk

that Bruce Mau gave at the 2010 Design Indaba, which is an international design conference hosted annually in Cape Town (Bruce Mau, n.d.). As a design activist, he challenged those of us in education to bring about the change needed to prepare students for a different sort of design practice, one that could affect a powerful influence on social, political and ecological change. He quoted Hannah Arendt who emphasised the critical role of education in preparing the younger generation "for the task of renewing a common world", to enable them to undertake something new, something unforeseen by us (Arendt, 2006, p. 193). In the same year, Bruce Nussbaum put the question to the design community, "Is humanitarian design the new imperialism?" (Nussbaum, 2010, para. 1). In this and within the subsequent debate issues were raised around what the underlying values might be, who generates design innovation and who benefits from it and what hegemonies are unintentionally perpetuated. The portent of this has stayed with me and others and been a cautionary principle in the pedagogy and project work that we have explored.

2.9.5 Seeking new perspectives

Engaging with these challenging provocations as design educators, colleagues and I have sought to bring about the conditions that might be conducive for engendering an expanded curiosity in, and respect for the world in which designing takes place in. This broader framing of designing takes on issues of identity, agency, emotion, imagination, care, and ethics within project-based learning settings. For several colleagues and I, a pivotal moment that challenged our notion of designing in a truly trans-disciplinary space was when we participated in a week-long immersive Biomimicry course. As a framework and methodology, this has expanded our experience of how traditional design process can be challenged to include natural processes and strategies. It has widened critique of the design brief that is traditionally viewed in limited terms of human needs and outcomes, to include ecological others, asking us to "recast the location of solutions in nature's terms as well—habitat, climate, nutrients, and so on" (Shedroff, 2009, p. 118). Perhaps more importantly, this trans-disciplinary work has given us insight into how "education can become environmental in a deep sense… [a] place where we might slow the attention and broaden our relations to the Earth" (Jardine, 2006, p. 51).

The experience of working together in a trans-disciplinary mode engaged and launched a network of passionate designers, engineers, architects, biologists and educators that have since worked together on a number of boundary-crossing sustainability projects involving academia, NGOs, business, and local/national government (see BiomimicrySA, n.d). Some of the project initiatives stemming from an introduction of what we call bio-thinking into our coursework in the design programme at CPUT are included within the research outputs that make up this thesis by compilation (e.g. Morrison, Erstad, et al., 2019; Snaddon et al., 2019).

2.9.6 Practicing resilience

These ongoing experimental ways of exploring our pedagogies to recognise and attend to the wider contexts and impacts of designing have been all but derailed in recent years by the above-mentioned upheavals within our university and the country at large. The inclusion of sustainability in design curricula has been perceived as a luxury when things are burning and protesters are disrupting and threatening students and staff who are trying to pursue their academic work. These have been trying times where valuable time in the academic year was lost and we have had to go underground and continue the academic project in secret meeting places off campus. In these cases, we worked with and through our established relationships beyond academia. The trauma caused by physical violence along with constant anxiousness about safety on campus brought the university to its knees in ways that saw a culture of mistrust between

staff and executive management, and between staff and students. Jansen (2018) articulates this well:

> More than any specific act of disruption or violence, what was beginning to manifest at universities was a creeping intolerance, intemperateness and incivility that has the potential of fundamentally altering campus cultures and, in the process, undermining the academic project. (p. 1)

However, within such a climate of intolerance, and as a result of these disruptions, our pedagogies have been tested for robustness in times of change and contestation of hegemonic power structures. In light of this research study, this has been a proving ground for some of the approaches taken in our design department to embrace pedagogies of discomfort that lead to resilient learning behaviours.

2.10 Conclusion

In this chapter, I have contextualised my research within a broader global setting that has highlighted the current issues pertaining to design research, design education, and more specifically design pedagogy oriented towards sustainable design practice. Then in bringing my research into the very local and personal contexts relating to the experimental design project-cases, I have indicated in narrative form how our design pedagogy, as philosophy and experimental practice, has emerged through various constraints and opportunities inherent in these contexts over a period of time. In the sections of this chapter, I have presented an overview of how colleagues and I have evolved our practice as educators in ways that rise to Buchannan's (2000) challenge to explore the value of "discovering new kinds of interactions among people and their cultural and natural environment, with a goal of enhancing human dignity and supporting human rights" (p. 8).

The exploratory nomadic forays into ways of drawing design student learning towards discovering new kinds of interactions among people and their cultural and natural environment have taken us beyond the bounds of academia and has initiated my research process of which this PhD work is a part. Engaging in research to do with such a process has meant for me wide reading of literature pertaining to the three interconnected fields of designing, learning, and sustainability. In my research into these fields, I have been drawn towards scholarly writing emanating from trans-disciplinary cross overs that seek a wider understanding of what the constraints and potentialities might be for sustainable design pedagogy. Hence, a fourth emergent field of post-humanist literature is presented to open up my research exposition, and as means to thread discourse in the fields of designing, learning and sustainability together meaningfully.

3

3 Conceptions of design, learning, and sustainability

As this study has to do with transitioning states of design education it would seem appropriate to structure this chapter more as a genealogy. In reviewing the literature pertaining to this study I have laid out the material so as to trace how movement in scholarly opinion has and continues to give rise to emergent conceptions of design, learning, and sustainability. By considering how these domains 'talk' to one another across turns, themes, and resonance, I present how my research has been informed by literature that addresses hybridised and boundary-crossing approaches to do with design learning that is oriented towards sustainable futures. Through this, I have set up the gaps, difficulties, and potentialities that will then be discussed and argued for as a point of view in Chapter 5.

In so doing, I draw attention to the 'immaterial turn' in design practice that concerns 'communities of systems', the connections between them, and new disciplines such as social innovation design, and trans-disciplinary design (Dubberly, 2017), and what impact this is having on design education. I read this emergence 'diffractively' (Barad, 2003, 2007, 2014) through the lens of critical post-humanism as a methodological and pedagogical move to consider the question of agentive designing that is oriented towards sustainability, and learning intra-actions between human and non-human actors (Braidotti, 2013; Barad, 2003). Such a view resonates with learning understood as socioculturally networked (Lave & Wenger, 1991; Gee, 2008) and nomadic (Braidotti, 2006; Fendler, 2013) and is re-affirmed through theory that investigates the transformative capacity of learning identities enacted in lived relations to others (Yee et al., 2019; Ellsworth, 2005).

Consequently, and in order to present the literature in a structured manner that speaks to the research questions, and to display it as an analytical tool in the research process, I present it here as five interrelated levels moving from:

1) the general state and challenges for design education,
2) to approaches to learning in design,
3) explaining the key orientations of this research within a context of sustainable design futures, towards learning spaces as ecologies, literacies, and agency,
4) engaging with diverse forms of knowledge and pluralism,
5) with the broad conceptual frames of the speculative, the performative, the locative, and finally,
6) converging on design education research in the South African and specific CPUT context.

3.1 Design, as practice, education and research

3.1.1 Overview of design education orientations

It is hardly possible to talk about design education without some reference to the Bauhaus and its influence on design pedagogy. Many current design programmes still bear some resemblance to the Bauhaus approach that "attempted to organize and codify the revolutionary ideas of the early twentieth-century 'isms' and protomodern experiments into an educational method for the new industrial era" (Heller, 2005, p. 5). However, as Lerner (2005) points out, what was a complex and multifaceted phenomenon was reduced to a formula after the Bauhaus educators moved to America when the Nazis closed down the German Bauhaus foundation course in 1933. Ehn (1998), a prominent member of the participatory design research community, has noted how despite these complex aesthetic principles, there was "no real feeling, insight or vivid realisation of ordinary people's everyday life and conditions", and suggests that "the 'soft' ideas of participation and democracy never were a cornerstone of the Bauhaus" (p. 208).

Cross (2001) offers in his article, "Designerly ways of knowing: design discipline versus design science", a succinct review of the historical concerns that have emerged in respect to the often-turbulent relationship between design and science. He arrives at the conclusion that "Design as a Discipline… can mean design studied on its own terms, within its own rigorous culture… and based on the reflective practice of design" and "'designerly' ways of knowing, thinking and acting" (pp. 4-5). In terms of design practice as well as educational practice, designerly ways of knowing refers to the underlying knowledge-making processes peculiar to designers as they engage and reflect on the activity of designing, in the artefacts created and their potential manufacturing processes (Cross, 2001; Lawson, 2005; Schön, 1988).

In the context of my study, it is important to consider how these designerly forms of knowing, thinking and acting have been encouraged and expanded in learning settings and situations, and how these discipline-focused practices have contributed towards an isolated mode of designing by designers alone. In my view, the important aspect of 'being' is absent in this definition of designerly ways of knowing, specifically as it relates to transformative learning and development of learner identities in educational settings. The ontology of knowing is a core element in my thesis as has been noted already, and will become more apparent in this chapter and those following. Notably, an ontology of "being-for-uncertainty" is inquired into and how we are to understand "being in such a way that it can help orient pedagogies in higher education" (Barnett, 2012, p. 75). The equally important 'acting' and 'doing' of design refers to praxis that is so central to design education with its mode of learning by doing. However, in aligning with the concern of my study, ontologies of knowing, doing and being become pivotal when engaging in living inquiry (Fendler, 2013), where ideas are applied in "thoughtful, reflective practice to achieve social change" (Mott, Zupan, & Debbane, 2015, p. 1263) in relation to sustainability imperatives.

To be clear on what I mean when using the term ontology, I refer to a definition of the term as meaning "of or belonging to the understanding of being" (Willis, 2006, p. 70). Willis further defines ontological as referring "to the condition or behaviour of what is", and that 'being' invokes the "conditions of the possibility of presence" (p. 70). This is key to my study and its inquiry into how design pedagogy might improve and enable suitable learning conditions for the possibility of designerly presence that is oriented towards sustainable design practice. Ontological designing then becomes a foundational concept in this thesis and is well articulated by Willis in two key points. Ontological designing means:

> (i) a hermeneutics of design concerned with the nature and of the agency of design, which understands design as a subject-decentred practice, acknowledging that things as well as people design, and following on from this, (ii) an argument for particular ways of going about design activity, especially in the contemporary context of ecological unsustainability. (Willis, 2006, p. 70)

Having established in this brief overview of design and education some of the main themes that relate to my study, I move now to some of the key theorists and concepts that have influenced design education over the last two decades.

3.1.2 Reflection-in and on-action

Lawson (2005), in his book *How Designers Think* developed a model for understanding design and its process. He states that the groups of activities and skills found in successful design "are 'formulating'…, 'representing', 'evaluating' and 'reflecting'" (p. 291). He points out, however, that the difficulty of knowing when to reflect on actions and that this may be one of the most important skills a designer might possess. This presents a challenge for design educators to develop pedagogy that enables the development of such skills. To this point, Schön's (1988) concept of the university studio as a reflective practicum aimed to help "students learn to become proficient in various kinds of reflection-in-action" (p. 5). The studio so understood would "depend for their effectiveness on coach and student entering into a kind of communication that is, at its best, a dialog of reciprocal reflection-in-action" (p. 5). Furthermore, he describes designing as "a reflective conversation with the materials of a situation" (p. 4). The notion of what might constitute the materials of a situation is key to my research work.

Jones (2015) opened his paper at the DRS 2015 conference with the observation that "Donald Schön's model of reflective professional practice has influenced a generation of designers and design educators" (p. 1600). The model was easily "adopted by design educators and has become a fixture for design pedagogy" due to its perceived value in the design process (p. 1613). Jones illustrates in his paper a reframing of "reflection as a 'potentially valuable cognitive process', not a process of discovering truth or even reality", and highlights "an alternative view of reflection as a process of utility in design education – one that seeks to leverage the personal value individual design students may derive from the practice" (p. 1612). This raises issues of the ontology of reflection and the potential difficulty for design-educator-researchers when assessing what in reflection is useful and how it might be measured. He also advocates for 'reflection-on-reflection' through "intra-disciplinary exchange of reflective practice findings" (p. 1613) as a critical part of further developing and exploring the philosophical underpinnings of Schön's model.

Schön (1988) uses the term 'coach' to reframe the notion of a 'teacher' as someone who "demonstrates, advises, questions, and criticizes" (p. 5). In his view, a good coach needs to be able to both demonstrate designing and describe it, "particularizing what he or she does or says to fit the student's momentary confusions, questions, difficulties, or potentials" (p. 5). In so doing the coach improvises, drawing on repertoire and reflecting on his or her own spontaneous performance. Schön describes this process as "conducting on-the-spot experiments in design and communication" where the coach "moves up or down the ladder of reflection, shifting from designing to description of designing, or from description to reflection on description, and back again to designing" (p. 5).

With regard to developing the space within a design faculty for a reflective practicum to come about and flourish, Schön (1988) suggests that it "must become a world with its own culture,

including its own language, norms, and rituals" if it is to resist being overwhelmed by "the academic or professional cultures that surround it" (p. 6). He warns against the danger of too strong a culture becoming disconnected from the larger worlds of university and practice. The case studies examined in my research are a response to the question of how to balance the culture of studio with that of being relevant out in the world of practice, society, and the natural environment.

These views frame the design education context of my study and are relevant in two ways. First, these views have shaped our experimental searching for alternative modes of engaging design students in practices of reflection on performative processes that are ontologically agentive. That is, reflection as process can reveal value – not only to the individual student, but for the co-design group as choices are enacted and performed. Second, my research process is resonant of reflection-on-reflection in its processual mode of inquiry into reflective practice findings.

However, the metaphor and mode of reflection is challenged later when I introduce literature and perspectives that unsettle this formulation to some degree. I reference this early work by Schön here, as even though his concepts were framed within a constructivist paradigm, the language and positionality of educators and students within a more dynamic conception of the world still remains framed by formal and disciplinary hierarchies in design education.

3.1.3 Signature design pedagogies and a 'sticky' curriculum

The progressive educational philosophy of Dewey (2007) remains central in much of the literature on design education reviewed here. Notions of learning by doing and the value of co-created experience for teachers and learners focusing on the needs and interests of the student have become pivotal in contemporary views on education. In *Experience and Education* (1997), he expresses confidence in the "potential of education if it is treated as intelligently directed development of possibilities inherent in ordinary experience" (p. 89), which has a pragmatism akin to Schön's contributions above.

This grounding in the ordinary is echoed by Shreeve (2015) in *Signature Pedagogies in Design,* where she talks about a shift away from a focus on curriculum to include a whole-person approach to learning that is about embodied, experiential ways of knowing and being. She makes the point that learning to become a design practitioner is not only limited to knowing facts but is more about a deeper experience requiring a "change in knowledge, behaviours and emotion" (p. 83). The notion of signature pedagogies as "learning activities that help students to think and act like design professionals" (p. 84) are examined in multi-disciplinary settings so as to identify both generic and signature pedagogies across different design disciplines.

In later work, Orr and Shreeve (2018) describe the "challenges, conflicts, dilemmas and ambiguity in the creative curriculum" (p. 23) as 'sticky', a term they use to evoke the teetering, tentative nature of sticky situations that might be difficult to negotiate and have uncertain outcomes that might go one way or another. Following through on their evocative metaphor they assert that art and design curriculum should be sticky for the following reasons: "it is messy and uncertain; values stick to it in ways that are difficult to see; it has an elasticity, being both sticky and stretchy; it is embodied and enacted – it sticks to the person; and it is troublesome and challenging" (pp. 25-26). This work is relevant to my study as these perspectives inform and situate my inquiry into our mode of experimental pedagogy and its engagement with troublesome and challenging issues concerning design education for long-term sustainability.

3.1.4 Responsiveness of design education to change

The *Changing the Change* conference in 2008 brought many designers, designer-researchers and design educators together to debate and discuss with some urgency, the role and potential of design research and education in the transition towards sustainability (Manzini, 2008). Gornick and Grout (2008) discuss the paradox that although "designers appear to have reached an important stage of public and corporate recognition" there is still an inability to take action in expectation of "an impending massive change in world conditions" (p. 93). These authors, both design-educator-researchers, argue that a major reason for this paradox is that design education continues to react cautiously towards "current global issues that form the context for all design activity" (p. 93). As society is in transition and new markets are emerging "we can and must be in the vanguard as proactive contributors, as this transition has much to offer designers" (p. 104).

Davis (2011) in the Icograda Design Education Manifesto also voices her concern for the future of design education and the increasing gap between what is taught in university programmes and the global context in which it is practiced. She comments that many "undergraduate programmes focus on the design of de-contextualised objects and a process with the goal of fixed, 'almost perfect' results" (p. 73). Barnett (2012) concurs by recommending that, if educators are to prepare students for the commonly valued dispositions in graduates demanded by the corporate sector; 'adaptability', 'flexibility' and 'self-reliance', then less emphasis on skills is required and more focus placed on dispositions "such as carefulness, thoughtfulness, humility, criticality, receptiveness, resilience, courage and stillness" (p. 75). To this point, Capeto (2011) expresses the opinion that most importantly, "the act of designing should continue to be understood as an act of thought. As the design field, facing new conditions reassesses itself, and its boundaries shift once more, it is our role, as design educators, to ensure that ethics, quality and thoughtfulness remain significant factors in the mindset of new designers" (p. 57).

This remains a challenge in design education and is central to this research in its study of learning spaces and situations that may bring about a shift in dispositions.

3.1.5 Proliferation of design practice and the immaterial turn

For decades design scholars have spoken of design in terms of transition and change. In the words of Buchanan (1992), "designers are exploring a progressively wider range of connections in everyday experience and how different types of connections affect the structure of action" (p. 10). Bonsiepe (2011), describes the proliferation of design practice to now encompass many new fields including "navigation design, event design, generative design, scenario design, invention design, experience design, user experience design, genetic design, humanitarian design, interaction design, interface design, emotional design, service design and social design to name a few" (p. 51). Dubberly (2017) argues that designing systems platforms, and product-service ecologies in an age of entanglement requires us "to 'connect things' – to think and act in terms of whole systems" (p. 7). In building this argument he cites Ito's (2016) summary of the changing paradigm of design thus:

> Design has… evolved from the design of objects both physical and immaterial, to the design of systems, to the design of complex adaptive systems. This evolution is shifting the role of designers; they are no longer the central planner, but rather participants within the systems they exist in. This is a fundamental shift—one that requires a new set of values. (p. 6)

Furthermore, the point that I take from these views is that for student designers learning how to play such connecting roles, their education should embrace how "design discourse increasingly recognizes that things are connected to ideas; that artifacts are tied to use, meaning, and context; and that design practice is bound up in language and conversation" (Dubberly, 2017, p. 1). Similarly, Boehnert (2018) describes design as a practice that mediates social relations, facilitating new ways of seeing and consequently a way that "new ideas are made tangible" (Kindle location 172).

Further to this, Marenko and Brassett (2015), editors and authors in *Deleuze and Design*, state clearly that no matter in which form it is materialised, design is considered as process and not as a thing. They describe design as a "process of change, invention and speculation always possessing tangible implications that cannot but affect behaviours and lives" (p. 4). Notably, for my study focus being on experiential and experimental modes of design learning, these authors offer an optimistic positioning of design "to delineate, reflect and question the ways in which the relationships between human and nonhuman agencies elicit affects, tell stories and ultimately make us think by doing" (p. 6). Following the thrust of Deleuze's emphasis on experience and experimentation, Marenko and Brassett offer a definition of designing as being the "momentary coalescence of future possibilities materialized today" (p. 6). To this, they add that no matter whether this "might take the form of things, images, experiences, services or strategies – [designing] operates as a profoundly disruptive force in contexts increasingly marked by complexity and contingency" (p. 6).

3.1.6 Inventive modes of design and research

Farías and Sánchez Criado (2018) suggest that in the last decades, design as a discipline, as research and in education has opened up to more transdisciplinary ways, "encountering the social sciences and humanities in inventive modes", (p. 16). In these authors' view, the "study of infrastructures and experimental systems as carefully arranged socio-material assemblages has indeed rendered design into a key trope or heuristic to analyze and intervene the social" (p. 16). These authors indicate that through a "mutual redefinition of both the social and design… design is revealed as radically-distributed practices requiring us to pay attention to the design capacities of both non-designer and non-human actors" (pp. 16-17). Moving beyond the problem-solving mode of user-centered design they describe an emergent practice in design involving "forms of 'problem-making': reimagining design as 'speculative', 'forensic', 'infrastructuring', 'agonistic' or 'critical making' practices" (p. 18).

Gornick and Grout (2008) in their experience of running master's and bachelor's courses in Design, state that opening up new relationships between design and the social sciences and humanities allows for a shift from 'how to design' with a focus on problem-solving, towards 'what to design' involving "a deeper understanding of the issues of living into the future in a changing world" (p. 96). Overall, these are views that support experiment in design education and especially pedagogy that places students in transdisciplinary situations of collaboration with specific groups where they can "partake[e] in their aims or, rather, their inquiries and puzzlements" (p. 18).

Concerning design research, Tovey (2015) in a book resulting from design research undertaken by the design Research Society's Special Interest Group in Design Pedagogy, comments on the role of design research serving to "enable us to understand design better, and thus to enable design education to be improved" (p. 238). The overall aim in his view is to equip "graduates for entry into the community of professional practice" (p. 239). This highlights the contextual dilemma that my research engages with, which is a questioning approach towards the

relationship between academia where design research largely occurs, and the current community of professional practice. My research and the pedagogical experimentation evident in the project-cases making up this study is concerned with a certain critique, in South African HEIs, of current understandings of design in both educational settings as well as within communities of professional practice. In my view, this highlights the need for design educators offering design education and doing research not to merely act in the role of facilitating graduate entry into what is still dominantly a professional community of practice governed by a high-growth market-driven paradigm. Just as educators should engage with their curricula through dynamic pedagogy, so should educators, through their research work, critically engage with and question the professional community of practice for which they are preparing their students.

Tovey (2015) does, however, allude to the above-mentioned dilemma when he observes that, applying designerly ways of knowing in the context of wicked problems in a world of uncertainty can overwhelm and demotivate. To this, he suggests that students need support for agile navigation through design process and that "learning experiences should develop students' natural motivations and professionalise this motivation to create resilient, informed and sustainable capacity" (p. 239). This, he points out, is the essence of transformative learning.

In the next sections, I briefly highlight two aspects of transformative learning that define how exploratory design pedagogy and research are evolving, and how this is informing collaborative processes of knowledge creation and exchange between academia, society, and communities and the world of design practice.

3.1.7 Participatory and co-design

Prior to the 1990s the core disciplines of industrial design, graphic design, textile, and fashion design existed separately in the world of work, and also in the design education institutions where they were taught. In many HEIs offering design programmes this separation remains the case, as with the institution where this study is located. In such institutions, young designers are "still educated as amenable specialists, rather than enterprising generalists" (Wood, 2008, p. 1701). The project-cases making up this study have to some extent been a response to this siloed state of affairs, and have been a fertile ground for interdisciplinarity in our experimental pedagogy.

In using the term interdisciplinarity, I refer to design for sustainability project work that has involved "collaborative research and problem-solving that cross both disciplinary boundaries and sectors of society" (Bruun, Hukkinen, Huutoniemi, & Klein, 2005, p. 31). These are situations where designing has been a collaborative process that has eroded the design "expert/lay dichotomy" to build socially and contextually robust knowledge (p. 31). This approach has meant engaging closely with people and environmental contexts "involving 'ordinary' actors traditionally perceived as static and passive" (p. 31). These are key aspects of participatory design process.

Participatory design as a research stance is notable in terms of its ethics since it engages 'with' people rather than doing research 'on' people (Reason, 1998, p. 3). In design practice, this has entailed designing 'with' users instead of designing 'for' them (Fuad-Luke, 2009). Acknowledging that this approach brings with it an alternative worldview, Reason suggests that participatory processes count both as a political and an ecological imperative. This is stated in the light of how, in his view, a positivist worldview has caused untold damage to the planet's ecosystems due to people and society being considered separate from the "planet's life processes" (p. 3). Björgvinsson, Ehn, and Hillgren (2012) describe the participatory design ethos well when

describing their experience at the Malmo University's Living Labs, as an "open innovation milieu where new constellations, issues and ideas evolve from bottom–up long-term collaborations among diverse stakeholders" (p. 127).

Co-design according to Fuad-Luke in his book *Design Activism,* is a "catch-all term to embrace participatory design, metadesign, social design and other design approaches that encourage participation" (2009, p. 147). Co-design is described as a more porous and democratic design process that can "potentially generate new affordances and new values[,] but demands a new skill set and underlying philosophical approach from designers" (Fuad-Luke, p. 148). Herein lies the challenge for design educators as they grapple with how to create learning spaces that are themselves porous and democratic, and enabling of new skill sets and literacies.

Participatory processes are therefore a core theoretical thread in this research. In terms of research, design, and learning, it is highly relevant because designers are often not familiar with the issues that they are working with on behalf of a client, and so it is with educators. We are equally ill-informed about; our student diversity, and how to align our pedagogic activities with and in a changing and uncertain world.

3.1.8 Metadesign

Lastly, and to the challenge inherent in creating the above learning environments, I include the concept of metadesign as a collaborative process that "works towards attuning political, ecological, economical, socio-cultural, sensual and emotional patterns of living, to create less fragmented and more sustainable cities, services, organisations…" (Tham & Jones, 2008, p. 1498). This is a highly complex and ambitious concept as it relates to processes of ideation and planning of the design process itself, of identifying contextual constraints and synthesising emergent opportunities (Staszowski & Leirner, 2008). Consequently, the idea of metadesign "acknowledges that future uses and problems cannot be fully anticipated at the creative moment of design" (Wood, 2008, p. 1701).

This last concept connects well with the experimental project-cases in my study, as a designed environment where metadesign can take place is "under-designed to create spaces for others to add their creativity and design, and to permit the system to evolve" (Fuad-Luke, 2009, p. 151). Similarly, in creating our pedagogical scenarios and use of diverse mediating design artefacts, we set out to enable spaces for learning that were less prescriptive and more porous, where knowledge sharing and co-creation would permit the evolving community of practice to yield appropriate responses to the needs and potentials inherent in the project situations.

Having discussed key literature relating to the general and transitioning state of design education above, I now move to literature in the field of learning theory.

3.2 Approaches to learning in design

3.2.1 Sociocultural

In their article titled *The Changing Social Spaces of Learning: Mapping New Mobilities,* Leander, Phillips, & Taylor, (2010) describe a sociocultural perspective as taking "processes of thinking and learning to be not contained within individual minds, but rather distributed across persons, tools, and learning environments" (p. 330). The authors present this perspective as being mainly inspired by the work of Vygotsky (1978) and other Vygotskian scholars in the learning sciences from the mid-1970's as they develop "'mediational' perspectives on learning" (p. 331) that are

dependent on tools of mediation such as language, material tools, and other people. This concept is extended to include the "interplay of materials, tools, technologies, … events and activities" that "characterize much of design thinking and practice based knowledge production" (Killi & Morrison, 2015, p. 749). Vygotsky (1978) placed emphasis on the "interaction between changing social conditions and the biological substrata of behavior", what he called the "interlacement" or "dialectical unity" of these two different components. Learning in this sense is highly contextual and relational as individual and society interact in a dialectical process, using tools such as speech to "organize, unify, and integrate many disparate aspects… such as perception, memory, and problem solving" (p. 126).

Cognitive anthropologists, Lave and Wenger (1991), describe 'situated learning' as an activity taking place in a social world, dialectically constituted in social practices that are constantly changing through a process of reproduction and transformation. They develop the concept of 'legitimate peripheral participation' as an analytical viewpoint on learning that describes how "learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practices of a community" (p. 29). In their view, the source of learning is primarily driven by the structure of social practice, rather than the structuring of pedagogy. Their concept that "learning must be understood with respect to a practice as a whole, with its multiplicity of relations - both within the community and with the world at large" (p. 114) is significant for my research and the project-cases as the objects of my research. Furthermore, in his book *Communities of Practice*, Wenger (1998) proposes a social theory of learning and describes it as an "encompassing process of being active participants in the practices of social communities and constructing identities in relation to these communities" (p. 4).

The concept of active participation is furthered by Scardamalia and Bereiter (2006) who point out that we are a knowledge-creating civilisation and that "from this standpoint the fundamental task of education is to enculturate youth into this knowledge-creating civilization and to help them find a place in it" (pp. 97-98). The following six points that underlie the shift toward treating students as members of a knowledge building society are worth mentioning here as they have some overlap with many of the concepts discussed earlier in this literature review. They are:

- Knowledge advancement as a community rather than individual achievement
- Knowledge advancement as idea improvement rather than as progress toward true or warranted belief
- Knowledge of in contrast to knowledge about
- Discourse as collaborative problem solving rather than as argumentation
- Constructive use of authoritative information
- Understanding as emergent. (p. 99)

3.2.2 Co-creation

Continuing with the notion of knowledge co-creation, Nespor's core argument in his book, *Knowledge in Motion: Space, Time and Curriculum* (1994/2013), is that knowledge is not an internal psychological process, and nor is it merely the product of face-to-face interaction. Rather knowledge is constructed through participation in networks of social relations that extend far beyond the immediate bounds of a programme or context. What this means is that in any interaction with people and things we are simultaneously interacting with the immediate environment as well as with people and things temporally removed from us, but still present in the situation in some way. In another ethnographic study in a school Nespor (1997) presents a lens that affords a view of an educational setting that is "extensive in space and time, fluid in

form and content; as intersections of multiple networks shaping cities, communities, schools, pedagogies, and teacher and student practices" (p. xiii). In his view education should not only be understood as what happens in the classroom or studio, but rather in the "relations that bind them to networks of practice extending beyond" (p. xiii).

From these descriptions of learning framed as knowledge that is co-created in networked and relational ways, the following literature turns more specifically toward sociocultural conceptions of learning and its facilitation through curriculum and pedagogy.

3.2.3 Curriculum makers

The notion of educators becoming curriculum makers in the classroom rather than merely transmitters of course materials is best described as a process of enactment, where curriculum and pedagogy are brought into a closer relationship with one another (Den Heyer & Abbott, 2011; Shawer, Gilmore, & Banks-Joseph, 2008). Problem-posing for discussion with students "illustrates how collaboration among teachers, and a dialogic approach to working with learners, can result in ongoing curriculum renewal" (Schleppegrell & Bowman, 1995, p. 305). In the context of their article, the idea of ongoing curriculum renewal is directed toward general education in resource-stressed conditions. However, I find it useful to consider in the light of the problem-posing approach that is central to the design process, and as a mode of student engagement in the enactment of curricula.

Grimmett and Halvorsen (2010) describe that in "life-world terms, curriculum is the horizon within which human being, knowing, and acting occurs" and that metaphorically speaking, "curriculum is a life fabric and a weaving of lives within socio-cultural worlds" (p. 248). Paolo Freire, in his book *The Pedagogy of Hope* (1992/2014), stated that a democratised education allows for a "dialogical relationship between both the educators and the educands…" ensuring "that the content is situated within the people's 'reading of the world'" (p. 280). This reference lies at the heart of what I believe is a pedagogy of empowerment and emancipation, where the setting is negotiated for a suitable fit based on those involved being welcomed generously into a space for collaboration and knowledge creation. This approach advocates for learning contexts to be considered carefully for the potential that they have for critical design literacies to be collaboratively developed in ways that align pedagogy with an enacted curriculum. Freire's methodological approach to the classroom "emphasized praxis, where ideas are put into thoughtful, reflective practice to achieve social change" (Mott et al., 2015, p. 1263). He encourages educators to join in explorations of how theory can inform practice while experiential and practical knowledge can be employed as a means to understand and interpret theory (Breunig, 2005).

3.2.4 Towards designerly learning

To this point of curriculum content being situated within a reading of the world, Den Heyer and Abbott (2011) pose the question, "How might we open up a learning space in schools for multiple ways of storying the past related to the nation-state or any community" (p. 611) when we "re-read in a writerly manner what and how we have been taught?" (p. 610). Although this relates to a general education setting the point is well made for design education settings if 'writerly' is replaced with 'designerly'. These views are useful in placing this research study within the debate around multiple literacies, which I will unpack in the following section dealing with the key orientations pertaining to my work.

3.2.5 Ecosocial learning ecologies

In *Steps to an Ecology of Mind*, Bateson states that "there is an ecology of bad ideas, just as there is an ecology of weeds, and it is characteristic of the system that basic error propagates itself" (1972, p. 489). He warns of the damage done when separating mind from the structures of which it is a part, i.e. human relationships, human society or the ecosystem.

The notion of learning ecologies (Jackson, 2013; Morrison, Erstad, et al., 2019) is a key concept from which to consider learning in terms of a space within which learning occurs, a habitat within which a student can think, do, learn and become. This suggests a framing of an individual's learning ecology as a living relational interplay between head, hands, and heart, through which a person can think, do, learn and become. Furthermore, and towards a posthuman perspective, an individual's learning ecology is then contextualised as a developmental process within a wider ecology of learning in "dynamic relations of proximity" with ecologies of multiple others (Braidotti, 2013, p. 29).

This poses an ecosystem view concerning distributed agency and resource potentials beyond the individual, and wider than the often-siloed territories of academia, business, government, and community. Hence the notion of 'symbiotic learning' has to do with mutually beneficial learning partners "across old institutional and organizational borders" that may enliven and enact tacit processes that show up new possibilities for design action (Eikeland, 2012, p. 114).

Jackson's (2013, 2016) definition of an individual's learning ecology is one that "comprises their process and set of contexts, relationships and interactions that provides opportunities and resources for learning, development and achievement" (p. 1). Significantly for my study, this implies that learning ecologies connect our moment-to-moment thinking and doing, organising such moments into meaningful experiences that can inform new patterns of understanding. These are the "patterns that influence our beliefs, give us confidence in our own capability to act in the world and shape our future actions" (2013, p. 7). For students encountering new and unfamiliar learning landscapes concerning the complex issue of sustainability, this becomes a metaphorically evocative and useful concept to guide a pedagogical framework.

It must be said at this point that I use the concept of learning ecologies as a framing that draws on a nested set of concepts that include Lemke's 'ecosocial systems' and spatiotemporal dimensions of learning (1997, 2000, 2013), and Lave & Wenger's (1991) and Wenger's (1998) 'communities of practice', and posthuman perspectives articulated by Braidotti (2013) and Barad (2007).

In summary, a sociocultural and ecosocial framing approach to design learning would, therefore, in light of the literature in this section, be about developing spaces for learning that are collaborative, dialogic, dynamic and co-created with students and other stakeholders in any design context, in an ecological manner that welcomes diverse social, cultural and ecosystems agency.

3.3 Key orientations

The following key orientations help to further locate this study with regard to questions around sustainability in design education, towards design learning spaces, literacies and agency, and lastly a (re)orientation from a posthumanist perspective.

3.3.1 Sustainable design futures and the role of design education

As discussed in Chapter 1, the very concept of sustainability is inherently problematic. Boehnert (2013) has described how, for those who are aware of the "larger context and dynamics of escalating ecological crises", the term sustainability is "often associated with greenwash" (p. 11). To the point of the rampant misuse of the term, she emphasises that sustainability remains an elusive goal due to the lack of rigorous assessment standards, and a "failure to adjust boundaries of concern wide enough to include the full impact of products, industrial systems and ways of living" (p. 11). As business continues as usual, brands take on green images and lull consumers into believing all is well, and that "unsustainable consumption is morally acceptable" (p. 11). The unpalatable idea that the dominant economic model based on infinite economic growth might be problematic is compounded by resistance to bring about changes to the way we live.

The *Changing the Change* conference in 2008 offered the following working definition of design for sustainability as being, "everything design can do to facilitate the social learning process towards a sustainable society. That is, a design for sustainability imperative needs to sustain promising social and technological innovations and to re-orient existing drivers of change towards sustainability" (DRAS, 2008, p. 42). Even though this definition is over a decade old it still holds in my view. It highlights the ongoing challenge in re-orienting design education to be one of the drivers of change processes towards long-term sustainability.

Ceschin & Gaziulusoy (2016) provide an overview of the design for sustainability field and show how it has "progressively expanded from a technical and product-centric focus towards large scale system level changes in which sustainability is understood as a sociotechnical challenge" (p. 118). Facer (2011), in the book *Learning Futures* argues that "we need to rewrite the relationship between education, socio-technical change and the future" (p. 14) if we are to challenge socio-technical changes that continue to bring about futures of social inequality and environmental degradation. She goes on to emphasise that if we as educators are to challenge the orthodox future in education:

> …we need to recognize that its purpose is less to do with producing a set of predictions, and more to do with challenging assumptions and supporting action in the present; less to do with 'divining the future' and more to do with making visible the materials – ideas, aspirations, emerging developments and historical conditions – from which better futures might be built. (p. 5)

This resonates with the notion of diffractively illuminating in pedagogy as means of making visible any and all emergent phenomena that might be useful in design futuring. Such a view augments and expands on reflexive pedagogy approaches that enable dispositions of attentiveness on the part of educators and students to be able to generate, assess, and augment 'essential orientations' and 'capacity sets' that may act as tipping points or 'macroshifts' (Laszlo, 2001, as cited in Narayanan, 2010).

Sterling (2010), in an article titled, *Learning for resilience, or the resilient learner?* concludes that 'learning and education' and 'sustainability' would appear to be far more closely related than is commonly thought. He explains in his own words:

> The former often emphasise critical reflection and autonomy, capacity building, and participation, whilst the latter emphasises self-organisation and self-renewal, community, and resilience. Both are essentially about process, emergence and

> diversity, rather than about product, control and homogeneity. Hence, it is meaningful to talk about 'learning as sustainability' wherein the two are manifested as inner and outer dimensions of the same dynamic. (p. 525)

3.3.2 Ethics and design education

Manzini and Cullars (1992) have stated that the debate on ethics in relation to large choices is hard to articulate on a smaller scale with the design and manufacture of daily objects and that we continue to lack "an ethics of design adequate to the new problematic framework" (p. 5). Manzini (2008) has long suggested that in a world that calls itself networked and knowledge-based yet is highly unsustainable, designers need to play a positive role in the necessary re-orientation through building design knowledge. He makes the point that design research cannot take a value-neutral stance any longer and that sustainability should be the meta-objective of every design research activity, not peripheral to sectors, as has been the case.

This challenge finds its origins in the 1970s in the writing of Papanek (1985) who warns that design, being such a powerful tool for shaping the human environment, and by extension society and ourselves, demands a high social and moral responsibility of the designer. Papanek points out that this requires a greater understanding of people by designers, and I would add that this also requires a reminder of people's place within the natural ecosystem. Even earlier work in the 1970s by the design theorist Maldonado (1972) proposes that the human environment should be considered as one of many subsystems making up the vast ecological system of nature. Key scholars such as Buchanan (1985), Manzini and Cullars (1992), and Margolin (2007) cite this stance in relation to the designer's role in facilitating social change.

3.3.3 Telling different stories

In relation to design education in transition towards sustainability, Ehrenfeld (2008) makes the interesting point that when developing sustainable design dispositions, we need to "hold onto two opposing models of reality and beliefs about ourselves while we use our intelligence to design the new tools and institutions that sustainability requires" (p. 215). He posits that sustainability belongs to a class of distinctions called essentially contested concepts like fairness, liberty and freedom, and the difficulty that all are commonsensical in our understanding of what they are, but applying them daily is less so. On the needed cultural shift required for humanity to avoid the climate disaster forecast, he proposes that if stories are the generator of the rules by which we live then we can start to tell ourselves different stories that may become 'true' in time. This is further explored in a later section of this literature review on the 'speculative' within design and its educational potential.

3.3.4 Design education and biomimicry

This view of design as socially, culturally and ecologically situated has led to various approaches taken by design educators to include methods such as biomimicry in design education programmes. For example, a study by Malcolm and Sanchez Ruano (2015) on the learning experience during a design project uses a partnership of biomimicry and biophilia to "provide the designer with an understanding and knowledge of nature, enhancing their awareness of the conscious and unconscious response to the natural environment" (p. 937). Thinking beyond the human world and remembering its place within the natural world can provide valuable strategies for design students when tackling design challenges with an ethical and sustainable mindset. In a South African context, Futerman, Grant-Broom, & Snaddon, (2012) write about a pilot student project within the design education faculty at CPUT that introduces biomimicry as a lens and

methodology that finds its application through imitating or taking inspiration from natural strategies as a tool for attaining sustainable products, processes, and systems.

In her critique of biomimicry and its relatively recent arrival in the design field, Mathews (2011) argues that if it is to play its promised revolutionary role of moving us closer to "planetary ecological integrity" (p. 4), it needs to be strengthened in terms of various critical ambiguities that could merely allow for its cooption into the prevalent anthropocentric mentality. Her point below is well made and speaks to how the inclusion of biomimicry as an orientation in developing critical and eco literacies in learning environments may be apt. She argues that:

> If humanity is to be re-situated inside nature… it must be achieved in a way which opens up the terms of the natural so that they can become inclusive of the artefactual. Artefact must be seen as a potential expression of the natural. Nature will then no longer be understood as that which is untouched by us but rather as something deeper, something which can be expressed in our handiwork. (p. 8)

Ceschin and Gaziulusoy (2019) highlight Mathews's point that biomimicry will not "create sustainability unless we act not only in imitation *of* nature but also *from within* nature, allowing nature to redesign not only our commodities but also our psycho-social patterns" (p. 70). Irwin and Baxter (2008) also warn of the possible subversion of biomimicry when applied in a fragmented way typical of a mechanistic worldview and "design paradigm that views forms as separate, static and unrelated objects" (p. 8).

3.3.5 Inspiring new mindsets and narratives

Perhaps, and most importantly for this research study where I include projects where biomimicry was used as a methodology and lens for sustainable practice, it is worth noting that the value of this approach has not so much been about the design of sustainable products and more to do with the ontological design experience gained by students in the process. That is, students' learning experience highlighted matters of personal dispositional shifts brought about by close observation of natural systems at work, and the question of how their design practice might become more aligned with sustainable systems.

This is echoed by Mead and Jeanrenaud (2017) who critique biomimicry practitioners' poor assessment of sustainability impacts, yet lift up the "potential of biomimetics to inspire new mindsets, values and narratives concerning the relationship between people and nature and alternative visions of development" (p. 6). These approaches and their criticisms are useful from a design education perspective and discussion on what might count as the wider critical literacies that may be required for young designers today.

3.3.6 Design as a conduit for change

The concept of design being a powerful conduit for change, and more specifically social change, is well argued by Lawson and Poggio (2015). They assert that design academia has already gone beyond the question of whether students should be engaged with wicked problems on a global scale, to the current state where many programmes carry out design education work through community engagement in many different settings. Her point is that this happens at the risk of not measuring the impacts of the work on the community, and the students involved – a kind of "social washing" (p. 521). She goes on to pose three key modes of learning appropriate for when students are working with social engagement projects out in the world; they are problem-based learning, collaborative learning, and discovery-based learning. She defines these strategies to

describe processes of students becoming "autonomous learners who are motivated… and responsible for being, in control of their own learning processes", and as enabling a genuine engagement, socially and justly (p. 530).

Problem-based learning prepares students to think critically and to "find and use appropriate learning resources… based on their own research of the subject at hand" (Lawson & Poggio, p. 530). Collaborative learning lies especially close to the heart of this research, as the role of the educators in the experimental project-cases became "one of facilitator and guide – and sometimes co-learner and co-developer" (p. 530). Peer-to-peer collaboration also manifested as students worked across levels of seniority as they shared and exchanged skills and ideas.

3.3.7 Thinking relationally

As globalised networks and technologies become more sophisticated and communication media change, humankind is developing new communicative capacities and consciousness that is evolving an ability to think relationally (Fry, 2009). These emergent relational capacities are helping us to understand "connections, networks, and complex levels of causality" (Boehnert, 2014, p. 123), which can in time enhance our potential collective capacities to attend to sustainability challenges. The literature on living systems principles and their relevance to design education is increasingly emerging within design research circles (e.g. Sterling, 2009, 2010; Ceschin & Gaziulusoy, 2016)

3.3.8 On transition design

Irwin et al. (2015) at Carnegie Mellon University have proposed transition design as an educational framework or counterpoint to complement existing design approaches such as the developing sub-disciplines of service design and design for social innovation. The framework, introduced across all levels of design in the university, is described as having four mutually reinforcing and co-evolving areas of knowledge, action, and self-reflection: "1) Vision; 2) Theories of Change; 3) Mindset & Posture; 4) New Ways of Designing" (p. 19). Kossoff's main argument is that transition design should be everyone's concern in matters of everyday life. His point is that humans should strive to satisfy their needs in place-based ways that have "emergent, self-organizing, participatory, networked, nested and semi-autonomous forms, characteristics… [that are shared] with living, whole systems" (Kossoff, 2015, p. 25).

In a special edition of *Design Philosophy Papers* (2015) a selection of papers on transition design provide a thorough review and critique of the framework. These papers, written by a range of design academics, such as Anne-Marie Willis, Ezio Manzini, Damian White, and Carl DiSalvo acknowledge the "depth, difficulty, and necessity of transitioning to a different kind of economy; … [and] vary in their estimation of the extent to which design is able to contribute to this" (Kossoff, Irwin, & Willis, 2015, p. 2). In sum, Tonkinwise (2015) emphasises that transition design is aimed at systems level change and bringing "design's human-scale artifact-interaction focus to the transformation of everyday practices needed to enable structural transitions to more sustainable economies" (p. 87).

Irwin's (2012) earlier work informs the transition design framework where she draws attention to wicked problems having the same intrinsic principles as living systems, pointing out that they are comprised of countless relational strands between "people, the environment and the things that people make and do—a relationship triad" (p. 2). Particular to design learning is her point that "a new mindset is needed; one that enables people to see wicked problems and conceive fundamentally different solutions which incorporate ethics and a deep concern for both the

social and environmental spheres" (p. 2). Along with the tangled nature of wicked problems she suggests that learning to see the interdependent relationships that comprise a wicked problem, is a wicked problem in its own right. It could be argued that accordingly, the design of learning spaces in design education fits the description of a wicked problem due to the many hidden interdependent relationships that need to be considered, especially concerning design for sustainability.

3.3.9 Spaces for design learning

The concept of spaces for learning is well illustrated in the term 'learning lives' by Erstad, Gilje, Sefton-Green, & Vasbø, (2009) who stress that the term, within a range of social educational contexts looks at "learning within and across different learning sites exploring the positioning and repositioning of learner identity across these different 'locations'" (p. 100). In an article that raises some key issues about how spatial relationships between learning contexts can inform us of the implications of using information and communication technologies in classroom settings, Erstad (2014) reviews literature and key concepts relevant to studying expanded notions of learning. Although his study involves learning in offline and online settings his research has informed my study in terms of conceptualising design learning spatially, temporally, and socioculturally. He mentions that the "time-space relationship as a unit of analysis within educational research is still quite rare" (p. 10) This has pointed to a gap that my research investigates, in how this can be usefully developed to explore different conceptions of designerly ways of learning that are not bound within regular programme offerings or the bounds of the campus studio.

Erstad (2014) goes on to cite the "reason for a new interest in these issues is partly because of the complexity of the social phenomena studied, which implies a need to include time-space relationships, an understanding of the importance of context, and how literacies and learning are framed within space and time relationships" (p. 10). He elaborates on studies of learning as either "learning in context" within specific places like school, home etc., or secondly, "studies of 'context in learning', where knowledge gained from one context is studied as part of another context" (p. 12).

This is relevant for my analysis of the experimental design project-cases that my study explores, due to the design process being facilitated as part of an educational process in multiple locations and across very different contexts.

3.3.10 Developing temporal and spatial cartographies

With regard to the time-space relationship, the concept of non-linearity comes strongly to the fore in Braidotti's (2013) work where she proposes "multi-directional relationality" as a means to "develop cartographies of power that account for the paradoxes of the posthuman era" (p. 165). This goes to power locations that structure the subject position in terms of both space and time. This way of thinking about learning as multi-directional relationality in space and time, that "enlists the creative resources of the imagination to the task of reconnecting to the past" (p. 165) and to the future, is highly relevant for my study. Learning viewed in this way is about transformative becoming, where "memory works in terms of nomadic transpositions, that is to say as creative and highly generative inter-connections which mix and match, mingle and multiply the possibilities of expansion and relations among different units or entities" (p. 167). A posthuman perspective will be further unpacked later in this chapter.

Similarly, Leander et al. (2010) propose an "expanded series of questions concerning learning, space, and time" (p. 331). These authors ask, how people on the move "build qualitatively distinct relations with different learning 'environments'", and what it means to "recast the notion of 'learning environment' to 'learning-in-place'" (p. 331). The question of how individuals chart their trajectories through multiple learning spaces is posed, and how these trajectories may be planned for and created as opportunities for learning.

3.3.11 Networked learning and knowledge

Gee (2008), a sociolinguist, introduces the term opportunity to learn (OTL) in the context of an "ethical prerequisite for fair assessment and a solid basis on which to think about educational reforms" (p. 76). He argues that OTL for learners will vary based on what their prior knowledge might be, and how new knowledge is integrated with existing knowledge if it is to make any sense and constitute learning at all. The point is well made that people learn well in smart environments that "contain, integrate, and network a variety of tools, technologies, and other people, all of which store usable knowledge" (p. 89).

To the theme of this section on learning spaces, response to the question of "where knowledge resides in such smart environments" is that it is "distributed across the insides of individuals' heads, their bodies, their tools and technologies; other people; and the ways in which all of these are integrated and linked together in a network" (p. 89). This links with Wenger's (1998) concept of communities of practice in the previous section stating that people learn new practices through participatory and networked action with others, allowing more to be accomplished than working individually.

Importantly, "knowledge is stored as much in the network and the practices of the group" (Gee, 2008, p. 92) as it is in the individual. This links with De Corte (2011) who references the practices of the group when describing 'adaptive competencies', meaning the "ability to apply meaningfully learned knowledge and skills flexibly and creatively in a variety of contexts" (p. 33). He describes the four major characteristics of adaptive competencies as being: "constructive, self-regulated, situated, and collaborative learning" (p. 33). These adaptive capacities show up in the iterative heuristics utilised by design students in our project-cases, as they apply their skills in the challenging project contexts.

3.3.12 Affectively charged spaces

Spaces, whether they are virtual or physical can create a strong sense of the pedagogy practiced in any particular setting, within a design institution or without. They will set the tone for any student and provide clear signals if a space is open for exploration, dialogue, and sharing, or carry the unspoken message of knowledge as transfer and of disconnectedness (Oblinger, 2006). Leander et al. (2010) also talk of the "affectively charged places" (p. 336) of learning and question what the characteristics of these spaces might be that recruit or draw learners to them.

On community spaces, Bickford & Wright (2006) speak of the diminishing community in higher education as a threat to a rich learning experience. This threat can, to some extent, be understood in terms of an unspoken pact between faculty who do not expect much of students in order to concentrate on the growing demands of research, and students' reduced demand for rigorous instruction in order to concentrate on their social lives. The authors suggest that the importance of community to learning is not often stated as a significant context in higher education and proposes a "community paradigm that emphasizes the role social interactions play in facilitating learning and improving student engagement" (p. 43).

3.3.13 Literacies and agency

In order to address my research question on what new literacies are becoming relevant to design education, and how they may be incorporated into the curriculum, I review in this section literature that deals with the issues of wider educational literacies and conceptions of agency.

Debates around 'new literacies' have emerged around the critique of traditional literacy curriculum being taught to a singular standard and its redundancy in a world of everyday experience where meaning making is "increasingly one of negotiating discourse differences" (Cope & Kalantzis, 2009, p. 166). The authors point out that the term 'multiliteracies' emerged from the work of the New London Group in 1996 to address the ever-broadening skills repertoire and, in pedagogic terms, an "active citizenship, centered on learners as agents in their own knowledge processes, capable of contributing their own as well as negotiating the differences between one community and the next" (p. 179). The role of design education in preparing students for the world of work as active citizens comes to particular focus here when considering a) the pervasiveness of designed systems, artefacts and services, and b) the stance of designers as they create a design and the wider consequences that their endeavours may have.

The ever-broadening skills repertoire mentioned above is taken further by Sheridan and Rowsell (2010) who challenge "those designing literacy curriculum and pedagogy to cultivate the *design literacies dispositions* so that students are able to understand a greater range of choices and therefore are better able to be competent problem solvers for the 21st century" (p. 112, emphasis added). Within the view of designs' core definition as a problem-solving discipline (Cross, 2006) the notion of disposition in design literacy highlights the importance of stance and mindset, and what prefigures a student designers as they work.

Critical literacy according to Luke (2012) refers to the analysis, critique, and transformation of norms and practices governing the social fields of everyday life through the use of technologies of print and other communication media. The point is made that issues of whose version of culture, history and everyday life count as official knowledge are ultimately questions of curriculum and pedagogy. These are questions concerning which "modes of information and cognitive scripts, which designs and genres, shall be deemed worth learning… [and] taught for what social and cultural purposes and interests" (p. 5).

3.3.14 A pedagogy of multiliteracies

Similarly, critical pedagogy is proposed by Kellner (1998) to accommodate multiple literacies summoning "educators, students, and citizens to rethink established curricula and teaching strategies to meet the challenge of empowering individuals to participate democratically in our increasingly multicultural and technological society" (p. 104). Central to the notion of a pedagogy of multiliteracies is the creation of conducive conditions for learning and meaning making, so that learners are able to negotiate their own agency and that of others who may be different from themselves. Cope and Kalantzis (2009) describe the micro dynamics of a pedagogy of multiliteracies as using a broader range of knowledge processes where "more powerful learning arises from weaving between different knowledge processes in an explicit and purposeful way" (p. 187). Their framing of knowledge processes is paraphrased thus:

- Experiencing – human cognition is situated and grounded in the real world of experience
- Conceptualising – learners become active conceptualisers as they explicate the tacit and generalise from the particular

- Analysing – learners have the critical capacity to be functionally analytic and evaluative
- Applying – learners apply understandings to a complex diversity of real-world settings.

A pedagogy of multiliteracies concerning design can, therefore, lead to a widening of design approaches that include satisfaction of human needs, ensuring social equity, and respecting environmental limits. Such a move should be understood as not only addressing degradation of the biophysical environment but the social and cultural environments too, something akin to "a balanced humankind in a balanced world" (Findeli, 2001, p. 14). Negotiating such difference requires critical literacies concerning analysis, critique, and transformation of norms and practices governing designing in social and cultural fields of everyday life (Luke, 2012).

3.3.15 Expanding notions of literacies

Mainsah (2014) argues for design education needing to develop in students the "capacity to understand, critique, and transform the social and cultural conditions in which they live" if they are to become "transformative subjects and not just objects of domination and manipulation" (p. 296). His challenge is well articulated when he speculates on "how design educators shape and deploy the tools, attitudes, and values of critical design literacy will… vary from context to context", and that this will be contingent on "curriculum designers' professional ingenuity in navigating the local contexts of design pedagogy" (p. 296). Mainsah also warns that "in relation to the future of design education the 'reflective conversation' suggested by Schön (1988) needs to move beyond 'the materials of the situation' to grasp the wider symbolic processes that frame design practice" (p. 296).

An expanded notion of literacies to include feeling is articulated by Lemke (2013). He speaks of three ways of studying an extended spectrum of literacies; 1) 'ethnographically', as we need to study the contexts of use of literacy practices, 2) 'discursively' and 'semiotically' as every literate practice involves cultural resources, and 3) 'phenomenologically' and 'experientially', as we need to understand what the use of our media feels like for creators and interpreters, participants and analysts. He argues that no meaning is ever made without feeling and that the "experience of our feelings makes sense to us in terms of available meanings" (p. 58), which in turn effects our following action and the next meaning. He also points out the historical difficulty in scholarly traditions of the disconnect between reason and emotion, cognition and affect, or the terms he prefers to use, 'meaning' and 'feeling'.

Two moves to overcome this difficulty are proposed by Lemke (2013); one being to reconceptualise feelings for us to see them in the same terms as meaning-making processes, and secondly, that because evaluation plays such a key role in the messages we identify with (or disidentify from), that evaluative practices form an important nexus for the analysis of meaning-with-feeling.

3.3.16 Towards ecological literacy in design education

This literature review cannot exhaustively review the multiple literacies that lie in educational offerings outside of design, suffice to say that in the light of this research being framed within the context of sustainable design futures, the concept of environmental literacy is key if literacies are "tools for reading the lifeworld" (Hill, 2012, p. 43). Hill defines environmental literacy as being "predicated on the belief that quality of life is linked to the quality of the environment, and that people must take responsibility to ensure that this linkage remains unbroken" (p. 44).

To this point, Boehnert (2013, 2018), in drawing attention to the term 'ecological literacy' developed by Orr in his book *Ecological Literacy* (1992), makes a clear and urgent argument for such literacy to be included in design education to "prioritise environmental and social sustainability" (p. 13). Boehnert (2018) emphasises that "the ambitious aim of ecological literacy is to create the frame of mind that recognizes the ecological and organizes cultural, political, legal and economic priorities accordingly" (Kindle location 1761). She also acknowledges the difficulty of this as it is disruptive of educational cultures, and challenges many of the basic assumptions concerning design. She warns, however, that "institutions that ignore risks in order to cling onto ecologically destructive models of development and unsustainable design practices undermine their own legitimacy" (2013, p. 13).

The challenge for design students learning to navigate these wider literacies surfaces when Cross (2006) describes the design process being a kind of 'pattern constructing process' with its own pattern language and means of transforming individual thought along with client and wider social needs, into physical artefacts. He makes the point that while this may remain a tacit process for designers, it is the responsibility for design educators to "be as articulate as they possibly can about what it is they are trying to teach, or else they can have no basis for choosing the content and methods of their teaching" (p. 9). This goes to my earlier point that design educators could do well in going about this difficult process of developing 'design literacies dispositions' (Sheridan & Rowsell, 2010) in more dynamic ways within communities of inquiry. Welcoming the attendant moments of epistemological doubt, discomfort and shared discovery can be a part of a process of "constructing and sharing expertise along the way… through experiencing or becoming what it is we want our students to become" (Leibowitz et al., 2010, p. 131)

3.3.17 Feedback, diversity and futures literacies

Carless and Boud (2018) develop an argument "that through the development of feedback literacy, students are better positioned to use information to judge their own work and enhance their learning" (p. 1323). They advance four features of student feedback literacy: "appreciating feedback processes; developing capacities in making judgments; managing affect; and taking action to use feedback" (p. 1323). Feedback literacy is thus positioned as a core competency for the workplace and lifelong learning. This notion manifests as a key aspect in the project-cases in my study as students placed in these dynamic learning environments learnt how to respond quickly in a context-sensitive manner; to real-world feedback from their peers, other non-designer stakeholders, and the immediate environment.

A crucial point made by Cope and Kalantzis (2009) is that diversity is pivotal in today's world. Diversity is more profoundly pervasive than "the straightforward demographic groupings that underwrote an earlier identity politics of gender, ethnicity, race and disability, which were the forms of politics that first unsettled the hoped-for homogeneity of mass society and the nation-state" (p. 173). When a widened scope for agency is allowed, however, space is opened up for the discovery of "existing agency in the massively plural… in workplaces, markets, self-governing communities, amongst, between and within personalities" (p. 173). In such a move, the "fabrications and falsifications of the command society with its one people, one state nationalism, its regime of mass production and uniform mass consumption" (p. 173) can be revealed and critiqued.

I close this section on literacies and agency with Miller's (2018) notion of futures literacy. His suggestion that "the future does not exist in the present but anticipation does. The form the future takes in the present is anticipation" (p. 2) frames his argument that through the integration of the future into the present we are able to connect up theories and practices of anticipation to

'use-the-future'. This he describes as "the foundation for defining and exploring the capability to 'use-the-future', for different reasons and in a variety of ways" (p. 2), which he calls futures literacy. Designing with the future in mind requires literacy that is enabling of imaginative, speculative and inventive modes of thinking and questioning so that the design "fictions about the later-than-now and the frames…[designers] use to invent these imaginary futures" (p. 2) might be practiced more knowingly within design education settings.

In a synthesis of these views on design literacies and concerning the stance of my thesis, it is, therefore, the task of design pedagogy to create learning conditions that can enable the following literacies through "context-sensitive collective intelligence process[es]" (Miller, 2018, p. 16). These are ones that capacitate design students to navigate diversity through inventive futuring while enacting their emergent identity in relation to their lived experience and receptive to feedback within such navigation. Such a synthesis aligns with the goal of a pedagogy of multi-literacies, which is to support the growth of such a design student, "a person comfortable with themselves as well as being flexible enough to collaborate and negotiate with others who are different from themselves in order to forge a common interest" (Cope & Kalantzis, 2009, p. 174).

In the last two sections, I continue with an exploration into literature and perspectives that challenge the dominant notion of 'common interests' and of a command society with a 'one people, one world' conceptual frame.

3.4 Engaging with different forms of knowledge

3.4.1 A world in which many worlds fit

Escobar (2016) argues that the crisis we are facing regarding the planetary ecological and social condition is, ontologically speaking, "the crisis of a particular world or set of world-making practices" (p. 15). This is a world usually referred to as "the dominant form of Euro-modernity (capitalist, rationalist, liberal, secular, patriarchal, white…)" (p. 15). In response to this dominant notion of a one-world world and its "subjecting all other worlds to its own terms or, worse, to non-existence", he urges for a transition towards the idea of a 'pluriverse' to denote "a world where many worlds fit" (p. 20). In his 2015 article, evocatively titled *Thinking-feeling with the Earth*, he lifts up indigenous people's ability to "think-feel with the Earth" in ways that echo mutual co-existence between humans and the planet (p. 14).

His notion of the pluriverse and associated relational ontology offers my thesis a particularly useful and profound perspective that is grounded in what he calls the Epistemologies of the South (ES). Escobar describes ES as a "compelling and practicable framework for social transformation… [that is emerging] at the intersection of the Global North and the Global South, theory and practice, and the academy and social life…" (p. 13). In this, he encourages those who dare "to outline trajectories for thinking otherwise, precisely because it carves a space… that enables thought to re-engage with life and attentively walk along the amazing diversity of forms of knowledge" that can be explored from such an open perspective (p. 13).

These views regarding dynamic re-engagement with diversity lead well into the following perspective that further develops posthumanism as a key orienting stance for my thesis. As to the question of why this stance is useful for my study? I believe that it speaks directly and unashamedly for pluralism that is needed in design education that is comfortable with boundary-crossing and notions of multiple subjectivities, aspects of which many of the

scholars already mentioned have argued for as being critical for young designers to be able to do and understand.

3.4.2 A posthuman perspective

Posthumanist theory is being considered across a range of disciplines including design practice and research. For educational researchers, this follows as a way to "review and renew socially just pedagogies in higher education" (Bozalek & Zembylas, 2016, p. 9). For design researchers, such an approach informs how "emergent design perspectives might better support values such as equality and justice for humans and nonhumans that have been traditionally ignored in design processes" (Forlano, 2017, p. 16). As Forlano explains:

> The hybrid figure of the *posthuman* – and related concepts, such as the *nonhuman, the multispecies, the anthropocene, the more than human, the transhuman and the decentering of the human*—greatly expands our understandings of the multiple agencies, dependencies, entanglements, and relations that make up our world. (p. 17, original emphasis)

Kimbell, a well-known scholar in design thinking has referred to Barad's post-humanism work in her article *Rethinking Design Thinking Part II* (2012). Here she works with Barad's position that it is "through practice that the sociomaterial world is constituted" (Kimbell, 2012, p. 133). She does this to further her own argument that "practice theory offers a way to see design activity as distributed across a number of different people and artifacts that together enact designing and designs" (p. 133).

What is significant here is Kimbell's interest in design and designers' working process as being relationally constituted through intra-action, where "intra-action results in specific configurations, constituting particular kinds of designs, subjects, and knowledge…" (p. 136). This resonates with my study in that Kimbell, in her efforts to challenge modes of generalising and celebrating design thinking, has explored alternatives that "switch the unit of analysis from individual actors or society and its norms, to a messy, contingent combination of minds, things, bodies, structures, processes, and agencies" (p. 141).

3.4.3 Critical posthumanism in South African HEIs

A critical posthuman stance is also well articulated by others in South African HEI contexts of research, for example, Motala (2018) who engages with the concept as a methodological frame in his doctoral thesis work. His study draws on posthumanism as a navigational and analytical tool in exploring the potential of a digital storytelling intervention in an undergraduate geomatics diploma programme. In his reading of geomatics with posthumanism, his exploration and inquiry into his pedagogy as a potentially radical practice is "aimed at awakening consciousness of, and at best, undoing of the humanistic power structures that support the supposedly neutral system of geomatics knowledge production" (Motala, 2018, p. 187).

Perold-Bull (2018), in a chapter she authored in *Educating citizen designers in South Africa*, has argued that in "theoretically exploring design and its education from posthuman perspectives… embracing monism and relational ontology can challenge and extend the anthropocentric tendencies within the notion of critical citizenship education" (p. 195). Importantly, she suggests that such an extension can aid in advancing the kind of change that 'critical citizenship education' (Johnson & Morris, 2010) "hints at, but often fails to affect in tangible, everyday ways" (p. 195). In exploring design from posthuman and new materialist perspectives, Perold-Bull and Costandius (2019) have, in the context of their Visual Communication Design

curriculum, experimented with a post-qualitative methodological approach in "processes of subjectification that transpired throughout the doing of a specific case of design/research/teaching" (p. 42).

They argue that through structuring their research process to enable a "continuous re-looking and re-thinking of a fairly narrow set of interpretive conclusions", and collapsing role distinctions (i.e. student, researcher, teacher) this allowed for "serendipity to become an active part of the research process" (p. 60). Out of this, they comment on how creative play, flexibility and adaptability with representational practice (in design practice and research) allowed an "openness necessary for continual re-alignment between thinking and doing" (p. 60). This experience created time that opened up questioning of personal assumptions and interpretations with students "through personal interaction and sharing", and helped facilitate experimentation with representational praxis, which in their view can enable receptiveness to the potential for productive change" (p. 60).

As I have already mentioned several of the key aspects of a posthuman perspective developed by Haraway (1997), Braidotti (2006, 2013), and Barad (2003, 2011) in my conceptual framings section in Chapter 1 and within this literature review, I will now introduce the concept of 'diffraction' as an important navigational and analytical approach in my research.

3.4.4 On diffraction

Barad (2007) and Haraway (1997) describe diffraction in their early work from the physicist, social science and feminist understandings of diffraction as a metaphor for rethinking the geometry and optics of relationaility. Barad (2007) describes diffraction as having to do "with the way waves combine when they overlap and the apparent bending and spreading of waves that occurs when waves encounter an obstruction" (Barad, 2007, p. 28). She cites an everyday example of the diffraction patterns that occur when a stone is dropped into a pond and the ripples overlap. In terms of physics, "diffraction patterns are simply the result of differences… in overlapping waves" (p. 80). What is key to this concept, is that it is in the overlapping of waves caused by their intra-action with an obstacle, that diffraction becomes significant. Diffraction, therefore, is the continual effect of interference and difference, where the remnants of the old wave continue within the transformation of new waves.

Hultman and Lenz Taguchi (2010) in their article *Challenging anthropocentric analysis of visual data: a relational materialist methodological approach to educational research,* draw this concept of how the "effects of difference matters" (Barad, 2007, p. 72) into the realm of educational research. They point out that the concept of diffraction relates to Deleuzian thinking "on how subjects can be understood as assemblages of encounters that will differentiate with each new encounter (or interference) in their continuous processes of transformation" (Hultman & Lenz Taguchi, 2010, p. 535).

Diffraction is not only regarded as an optical metaphor but as a method and a research practice that is attentive to material engagement with data and most importantly, with the 'relations of difference and how they matter' (Barad, 2007, p. 71). Diffraction, following Barad's perspective, can be used to acknowledge the influential role of the knower in knowledge production and particularly how we learn about phenomena as the "material configurations of the world's becoming" (p. 91). As Bozalek and Zembylas (2016) explain, for Barad, "diffraction is a useful tool highlighting the entanglement of material-discursive phenomena in the world. Diffraction is thus predicated on a relational ontology, an ongoing process in which matter and meaning are co-constituted" (p. 2).

In an article titled *Diffraction or reflection? Sketching the contours of two methodologies in educational research*, Bozalek and Zembylas (2016) put the two methodologies of reflection and diffraction "in conversation with each other… [in a process of] exploring their continuities and breaks as well as examining the consequences for research methodologies in education" (p. 1). As my research has been significantly informed by well-established designerly ways of knowing and the methodology and practice of reflection-in and on-action (Schön, 1983), the work of Bozalek and Zembylas presents a valuable analysis of the intersections and differences between these two metaphors and implied methodologies. In sum, Bozalek and Zembylas (2016) note that although both differ as "methodologies and as practices, being grounded in different ontologies, epistemologies and ethics, there is some continuity in the historical development of ideas from one to the other" (pp. 13-14). Although both methodologies share a commonality in the idea of the situatedness of knowledge and offer wider perspectives on the research process, diffraction "goes beyond the idea of reflexivity and interpretation and produces new entangled ways of theorizing and performing research practices, co-constituting new possibilities of strengthening and challenging knowledges" (p. 14).

The methodology and metaphor of diffraction have thus been a powerful and affirmative means of engaging discursively with the material and emergent learning phenomena that have resulted from the experimental pedagogy in my study. This leads to the next section where I unpack three conceptual frames that further open up and articulate my inquiry into how our pedagogy of experiment has engaged with pluralist and diverse forms of knowledge. In the following Chapter 4 on Methods, I further position diffracting as a methodological means in my research approach and as a metaphorical framing of the kind of relational design pedagogy that this study argues for and proposes.

3.5 Broad conceptual frames

In this section, I present a brief review of literature pertaining to the more situated and experiential aspects of the experimental design project-cases that are the focus of my inquiry. These conceptual aspects of learning are presented as three conceptual frames, namely the speculative, performative, and locative. These three concepts and their related aspects have been utilised throughout my research work to help describe and unpack our case-based processes of experiential and inquiry-based learning (Crichton, 2014).

3.5.1 Speculative

Speculative design has its origins in the critical design work of Dunne and Raby (2013) at the Royal College of Art and has as its aim to raise awareness, expose assumptions, provoke action and spark debate. Dunne and Raby, in their book *Speculative Everything* (2013) describe speculative design as contributing to the "reimagining not only of reality itself but also our relationship to reality" (p. 161). The concept puts forward the idea that "socially constructive imaginary futures" proposed collaboratively by designers and others may help society to "participate more actively as citizen-consumers" (p. 6). This is useful in the critical framing of possible design learning spaces that engender discussion and debate around wider conceptions of the kind of futures that may be good for all.

Parisi (2013) adds to this notion of the speculative by defining it as being abductive in its method and that there is "a background of potentialities stemming from within an object" as it operates between the factual and the mutated (p. 236). Designers, and those who research and describe the design process continually describe design as "a way of organizing complexity or finding clarity in chaos" (Kolko, 2009, p. 15). Complexity and chaos are difficult concepts to deal with at

an educational level, but Kolko describes how abductive thinking aids in design synthesis as inference or intuition directly assisted by personal experience. He argues that "unlike deduction or induction, abductive logic allows for the creation of new knowledge and insight – C is introduced as a best guess for why B is occurring, yet C is not part of the original set of premises" (p. 20). This would appear close to Schön's (1992) notion of 'move experiments', the simplest unit of design experimentation being the designers' 'seeing-moving-seeing' process of creating meaning. In design learning settings, these iterative and heuristic moves become the step-by-step process that allows students to engage with the wicked problems of today.

Designed fictions are speculative according to Bleecker (2009) as they represent parts of imagined near future worlds, "where things are different from how we might imagine the 'future' to be" (p. 7). Margolin (2007) similarly describes designers as creators of prototypes and propositions, that occupy a dialectical space between the world that is and the world that could be, and that, informed by the past and the present, their activity is oriented towards the future. This notion is challenging for design educators when creating suitable learning environments for students about to enter a profession that performs this kind of futuring. In the book *Design Transitions*, Tonkinwise (2013) is critical of the "short-termism of market economies" and the difficulty this presents designers as they constantly work in the realm of futuring, "visualizing rich pictures of future scenarios where both material environments and lifestyles co-evolve" (p. 218). He states this in the light of what he terms, an unsustainable societal "modernist ambivalence" (p. 362) and the detrimental effects this has on any potential change away from the current consumerist market economy.

The question for my research in this regard is, how does the concept of speculation in design translate into learning environments and what kind of learning is happening as a result? The concept of speculative design contributing to the reimagining of our relationship to reality (Dunne & Raby, 2013) aligns well with conceptions of learning as knowledge building and idea improvement that is less prescriptive (Scardamalia & Bereiter, 2006). A question that emerges here is, how can speculative approaches in a context of design learning be directed towards the imagining of sustainable futures? If it is understood that "agent, activity, and the world mutually constitute each other" (Lave & Wenger, 1991, p. 33) then educators need, in my view, to facilitate learning within an intra-active space that provokes speculative design processes that can sustainably energise a mutually constitutive world.

3.5.2 Performative

"If designers engage in a conversation with the situation they are shaping, then how is design materialized through these conversations?" This is the question posed by Dong (2007, p. 5) on the performative aspects of design. To answer this, he argues from the perspective that if performance is "the production of a subject through the performance, then design practice and the designed work is the effect of a [designerly] performance" (p. 1). I add the term 'designerly' here to qualify performance in Schönian terms as a "conversation with ideas… [as] part of a series of dialogs in this performance" (1992, p. 5).

Dong states that the theory of performativity claims that the language of design produces "design through (1) aggregation - to blend ideas and concepts; (2) accumulation - to scaffold ideas and concepts; and (3) appraisal - to evaluate and assess ideas and concepts" (2007, p. 6). This is well established in design education as the way that learning evolves through the visual and verbal articulation of ideas in what amounts to a conversational process. This relates to Schön's (1992) notion of the design process being a reflective conversation with the materials of the situation if it is understood that people, contexts, and relations are considered as material,

and are material to the situation. More formal modes of presentation at various stages of the design process also aid in designing the evolution and progression of an idea becoming a solution. It is through these wider performative aspects that the language of design enacts design and actualises the designed work.

Performance in design education offers productive ways of opening up a dialogue that is imaginary, playful, and less hierarchical. Lock (2013) offers an account of an anachronistic intervention that allowed a step back to appreciate "bigger, broader issues relating to the general practice of creative design" (p. 35). He explains the approach as being an interventionist strategy that framed a case study that allowed his team to "disrupt and perturb the audience's perception of systems" in order to gain fresh insights (p. 35). Equally useful for my study is the term 'informance' design' that Lock borrows from Burns, Dishman, Verplank, and Lassiter (1994), which combines information and performance to describe performance in front of a design audience using a prototype device to open up dialogue. Such a performative approach is evident in the first two project-cases reported on in my thesis work.

Tonkinwise (2013) proposes that "Design Thinking is, in fact, a performing art" due to designers having to be highly honed observers and interviewers that "need to understand performance: improvisation, character, expressiveness and self-awareness" (Yee, Jefferies, & Tan, 2013, p. 219). He makes this point with regard to the effect of the changing role of design on undergraduate design education, and the transition of design away from the fine arts and its integration with the liberal arts. In this move, designers need to have far "richer perspectives on the people for whom, and with whom, they are designing", as the "person under study is viewed as being an ensemble of trajectories and latencies" (p. 219). There is resonance here with the kind of design project-cases central to this research, as the nomadic nature of the projects involved design educator-researchers and students traversing a variety of sites and situations rich in varied perspectives, from front-line communities and informal settlements in urban and rural areas affected by climate change and poverty, to a creative urban precinct and a festival heterotopia, an academic conference, and back to the campus design studio.

Binder et al. (2011) argued at the time of writing their book *Design Things* that very little had been written about the relationship between performance theories and design studies. To do this the authors draw on the work of philosophers, Dewey, Dilthey and the anthropologist Turner, to explore characteristics of expression, experience and design as a "'meta-manipulation' of culture" (p. 109). In this process of drawing from the wider literature of performance and education, the authors make the point that meaning, as experience for someone, is never fully complete until it is intelligibly communicated or expressed to others and that culture can be seen as an ensemble of such expressions. This has profound implications when considering the impact of design on culture, and the need for critical design literacies in design education to be consciously and sensitively developed.

In re-reading these perspectives diffractively through the lens of posthumanism, we are offered by Barad (2003) the view that performativity is "a contestation of the excessive power granted to language to determine what is real" (p. 802). Such a view resonates with the thrust of my thesis study and its extension of designerly ways to enhance learning that might break with conventional and habitual modes of designing and educating for design.

The performative modes of learning that have occurred during the project-cases have had little to do with privileging language or finished design solutions as a means of making meaning. Rather these performative modes have been about embodied explorations that have involved speculative play, immersive engagement with constraints and potentialities of the context, and

performative experiment in the moment that has enabled a material-discursive intra-activity. This is explored thoroughly in the second project-case in my thesis. Through performative and agentive intra-actions between design students, and between students and others and the specific project-case environments, "a differential sense of being… [was] enacted in the ongoing ebb and flow of agency" (Barad, 2003, p. 817). This comes close to Barad's notion of the world being in a constantly dynamic process of becoming, resulting from such agentive intra-actions between humans and non-humans in local contexts determined by boundaries, properties, and meanings.

These approaches bring to the fore important matters of "ontology, materiality, and agency" (Barad, 2003, p. 802). In this, I proffer that Barad extends Dong's (2007) notion of performativity by suggesting that "performativity is linked not only to the formation of the subject but also to the production of the matter of bodies" (Barad, 2003, p. 808). And moreover, in Barad's words, "intelligibility is an ontological performance of the world in its ongoing articulation… [that] is not a human-dependent characteristic but a feature of the world in its differential becoming" (2007, p. 149).

3.5.3 Locative

The term locative used in my research has multiple connotations, which need to be described concisely if it is to be useful in this study. From a very broad notion of the experience of learning, Dewey (2007) urges educators to consider carefully the "surroundings, physical and social, that exist so as to extract from them all that they have to contribute to building up experiences that are worthwhile" (p. 40). Ingold (2018), inspired by Dewey, suggest that what makes a learning "environment is the way in which these conditions are drawn, over time, into a pattern of conjoint activity" (2018, p. 5). In this framing, the notion of learning spaces being shaped and informed by multiple, potentials bound up in varied locative aspects in a context, can heighten engagement and agency for students of design.

Fendler (2013) describes learning as a mobile project, one that is "capable of giving an account of learning experiences that transition within, beyond and around formal educational settings" (p. 788). The question of what method could be used to discuss nomadic qualities of learning mobilities is posed in her article that is "attentive to the deterritorializations, transgressions and disruptions that characterize the learning process" (p. 786). Her point is well made when describing the concept of the 'eventful space' of learning being highly experiential and defined by a 'double movement', where learning practice becomes a) mobile through displacement and b) where learning becomes its own form of displacement in the form of a shift in worldview. Fendler's contribution in this article is that mapping or social cartography (which is interesting in light of maps being used traditionally to promote totalising visions) provides a fruitful way to inquire into personal learning process, providing a filter for "understanding how we build and sustain our sense of self in relation to the world around us" (p. 792).

McFarlane (2011) debates the idea of learning as emergent in the process of making, contesting and reproducing knowledge. He is more definitive when he describes learning as being about "specific processes, practices and interactions through which knowledge is created, contested and transformed, and for how perception emerges and changes" (p. 3). In his book *Learning the City*, McFarlane (2011) introduces the concept of "*assemblage* as a spatial grammar of urban learning" defining its use to "emphasize the labour through which knowledge, resources, materials and histories become aligned and contested" (p. 1). That is, it "connotes the processual, generative and practice-based nature of urban learning, as well as its unequal, contested and potentially transformative character" (p. 1). Although this book is about conceptualising urban learning in policy and planning contexts, the observations and

recommendations have profound implications for design education especially in the context of my study and notably in our urban project work. Following this idea, the work of design educators and students during the project-cases involved an assemblage of "dispersed logics, practices, meanings and experiences" (p. 36), a spatial grammar of design learning that explored "knowledge, resources, materials and histories" (p. 1) as they became aligned and contested as the process unfolded. In such a "process of assembly, different 'lively things' are learnt through their interrelation with one another" (p. 36).

Killi & Morrison (2015) propose the concept of 'apposite pedagogic action' within the framework of a sociocultural perspective on dialogically framed learning. This refers to "situated, locative, temporal and content elements" and the "interplay of materials, tools, technologies, mediational events and activities in the making of meaning" (p. 749) in an educational setting. This speaks to the element of timing in the facilitation of design projects and the vital need for pedagogical action to be appropriately timed for the various stages of learning, for instance, intense inputs for explicit knowledge creation as distinct from the time required for tacit knowledge creation and reflection.

However, as Cresswell (2010) warns, the 'new mobility paradigm' "runs the risk of suggesting that the (allegedly) immobile–notions such as boundaries and borders, place, territory, and landscape–is of the past and no longer relevant to the dynamic world of the 21st century" (p. 18). Cresswell argues that mobilities also need moorings, and that "mobility exists in the same relation to movement as place does to location… involving a fragile entanglement of physical movement, representations, and practices" (2010, p. 18).

In Barad's (2003) agential realist and posthuman terms, holding the idea of the human, and learning I might add, as "fixed excludes an entire range of possibilities in advance, eliding important dimensions of the workings of power" (p. 826). Again, this speaks to the mode of the experimental project-cases where our pedagogy unsettled and deterritorialised conventional power hierarchies usually associated in studio-based culture.

Together these perspectives conceptually develop the locative and mobile aspects of learning spaces, which provides a valuable means of understanding and inquiring into the nomadic pedagogy which is a signature of the project-cases in this study.

3.6 Design education research in South Africa

3.6.1 Broad context of change

The key role of design education in creating an understanding of designs' wider socio-cultural role, and addressing issues related to the totality of its national environment and culture, was articulated by Sauthoff (2004) when she argued for design fulfilling its contribution towards sustainable economic and social development in post-apartheid South Africa. She challenged designers in South Africa to "move from a position that privileges creative intuition, the subjective domain, self-development, and tacit knowledge to the adoption of a multifaceted confrontation and wider engagement with historical and contemporary circumstances relating to design in this country" (p. 49).

As part of this challenge, and due to the dearth of literature at the time, she points to the important role of research in design education in developing insight and expertise "in relation to theoretical and methodological aspects that enable coherent and sustained research" (Sauthoff, p. 48). Although this was written in 2004 and set against an emergent search for values,

understanding, and identity within the broader context of change in the country, much of this still holds in my view.

3.6.2 A design ecosystem

This PhD research is also set against imperatives defined by the Western Cape Design Strategy (The Craft and Design Institute, n.d.) where design education is identified as one of three pillars that is key to a thriving design ecosystem requiring strategic support from the provincial government. This document estimates that 80 000 people work in design-related businesses contributing just 895 million Euro to the country's GDP, which indicates a sector that is well positioned as a catalyst for economic growth in the region. The strategy document picks up on current debate that, due to the expansion of design from the aesthetics of product and communication design, towards the design of services, systems, and solutions to social issues, design students as young practitioners need an increasingly diverse skills-set to be able to provide integrated solutions. It also acknowledges that design, and by inference design education, needs more multidisciplinary inputs from "consumer research, engineering, technology, strategic planning, business management, marketing, psychology, anthropology and sociology" (p. 3).

This design strategy was influential in 2014 when Cape Town was designated as ICSID's World Design Capital (City of Cape Town, 2014). This is mentioned in the light of recent events in Cape Town where design education has come under a global spotlight that has energised debate around how design can catalyse social change for the improvement of the people's quality of life. During this time my faculty hosted Professor Ezio Manzini as a visiting scholar, who led debate within the university and in public forums, around the issue of design for sustainability and its education. In a survey (Manzini, 2014) of the officially recognised projects that made up the year-long programme, his findings show evidence of the shift from a neoliberal capitalist product-based notion of wellbeing towards design as sense-making that "requires common and relational goods as lively relationships, healthy environments, safe neighborhoods, [and] trusty institutions" (p. 98). These are factors that have informed my research interest and focus of this thesis work.

3.6.3 Educating citizen designers

More recently, and of interest to design educators and researchers, the publication of *Educating citizen designers in South Africa* (Costandius & Botes, 2018), described as the first of its kind to appear in post-apartheid South Africa, offers a wide variety of critical citizenship design teaching and learning pedagogies from the fields of architecture, graphic and product design. Authors in this book present cases and points of view that critique the field of design as "a fertile ground upon which to contest boundaries of social inclusion" (p. i). Furthermore, and to the thrust of my research, authors in this book highlight the importance of design educators and education being sensitive to tensions evident in the "fragmented social geography and the lived experience and internal consciousness of… [South African] citizens" (p. i). Design education should not only be sensitive to these tensions but proactively "facilitate their articulation in order to open them to transformation and thereby strengthen the social fabric" (p. i).

3.7 Summary

In choosing to structure and review the literature in this way I have moved from the general issues of design education to the particular of learning spaces and what counts as key orientations and specific concepts in this study. In doing so I have moved beyond the professional vernacular of design education practitioners so as to develop a conceptual and

theoretical language appropriate for an inquiry into experimental pedagogy that forms part of a developing framework concerning teaching and learning for sustainability in a design faculty at CPUT. The literature reviewed has followed themes that have emerged over the past two decades in design education, notably the theme involving challenges for design practice, education and research to recognise the urgent need for transition in society, business, and educational institutions towards sustainable ways of living and doing business.

In my experience within design education settings, the paradox of self-organising flow, and structured categorisation manifests often as tensions between pedagogic approaches that are creatively enabling on the one hand, and those that are driven by outcomes and discreet packages of knowledge on the other. These approaches are often defended vigorously by academics that have come to teach in ways that reflect their own journey of learning and discovery. These approaches can be anywhere in a continuum between the creation of learning environments that are more conducive to collaborative scenarios, and environments that are teacher-, subject- and institutionally centred.

The internal, divisive pressure on the curricula of academic programmes is well articulated by Hunt (2011) as being between form-giving and contextual attunement, manifesting as struggles between faculty members "clinging to a proud… heritage of appropriate form-making, while others demand more attention to the user, the audience or our imperiled world" (p. 87). Harmony is favoured between the two positions that would provide innovative educational curricula where students are equipped to be "reflective practitioners and strategic, critical thinkers" (p. 88).

A balance of experience is needed for any student to be able to make sense of their learning journey. The literature that appears here outlines and reveals research gaps towards achieving this so that learning may be achieved as a joint endeavour of all concerned, both in its place within academia and also without, where multiple spaces for learning become the rich ground out of which young design students can grow as they transition into the world of work and wider society.

Learning framed as sociocultural, highly complex, situated, shared and co-created provides a powerful impetus for the emancipation of individuals to claim their learning journeys, yet this framing also poses the question of how design educators and students should navigate the "complexity of multiplying descriptions of the world" (Barnett, 2012, p. 76) in a meaningful way.A posthuman perspective proposes, in my view, a powerful way of navigating such complexity, offering not solutions or tidy descriptions of what is complex, but keeping open the ethico-onto-epistemological difficulties and potentialities inherent in any process of designing that engages with real-world issues.

Due to the fact that education systems are notoriously slow to change course and adapt, it becomes imperative, in my view, for experimental pedagogy to be understood and evaluated for what it can do to ensure that educational structures are more resilient and able to respond quickly to changing times (Davis, 2011). In this way design projects that have been run as extra-curricular, para-projects become the speculative probes that trial new content and processes for design programmes. In my reading of literature pertaining to the issues concerning the above imperative and to do with design, pedagogy, and sustainability there appears to be a scarcity of literature involving inquiry into such practice-based experimentation. This is the gap that this study addresses in exploring the value of this designerly approach in pedagogy design.

4

4 Approach and methods

As has been stated in Chapter 1, this is a practice-based study situated in a South African HEI design faculty. My research interest focusses on how exploratory design pedagogy might enable transformative learning that is productive of dispositions oriented towards sustainable design practice. In my role, along with colleagues as participatory action researchers (Reason & Bradbury, 2008) and in collaborating with students in processes of creating learning environments, we engaged in designing and making in speculative and performative ways. These approaches involved pedagogically attending to student learning as and in movement between the campus studio and varying real-world project locations, as a means of exploring design pedagogy possibilities that would challenge habitual modes of learning.

This chapter, which outlines my research design, is structured as follows. From opening this section with the theoretical perspective and knowledge claim from which this study has grown, I discuss the methodology that has guided and defined it. I then present a section covering the research methods used in engaging with the phenomena of the study. The last sections detail the design tools and techniques utilised in making and eliciting data, which is followed by a conclusion.

4.1 Research methodology

4.1.1 Participant observation through action research

As stated in my brief overview of the research methodology in Chapter 1, the paradigm of my inquiry is primarily critical, with strong leanings toward an advocacy and participatory approach where I adopt the role of practitioner-researcher and design educator with an action agenda for transitioning curricular and pedagogical reform (Creswell, 2003). This is due to my research embracing a socio-cultural perspective on learning in the context of design education, where my ontological stance acknowledges the situated, experiential and intra-active nature of learning and knowledge building as it is collaboratively co-created by design educators with students in context-sensitive ways.

Importantly, a critical posthumanist perspective and post-qualitative approach inflect my research stance in ways that acknowledge our embedded and relational roles as design-educator-researchers, not only in relation to other humans but towards non-human others and the very places where we take our students to. The latter perspectives are significant in that my study is an inquiry into pedagogical transition and change, with attention towards "thinking ontology differently" (St. Pierre, 2014, p. 14). In this, my focus is on how design pedagogy as praxis might be re-imagined ontologically in ways that enhance learning spaces that might be conducive for long-term sustainable designing.

My relationship with what is to be known through this research process is best described as participant observation through action research, where the knowledge produced has come about through intra-actions between myself and other actors in urban, peri-urban and natural settings, and the data that have been examined. This onto-epistemological stance is further exemplified by the transformative agenda of design education as its practitioners engage with the enactment of curriculum and pedagogy, rather than a positivist mode of transmission. The types of knowledge produced in this research emerge from tacit, embodied, and encultured modes and move towards the procedural. That is, my research methods have allowed me to engage with the intersections of HEI design pedagogy in transition, ways of knowing in design, and design learning spaces out in the world that address the issue of sustainable futures.

4.1.2 Researcher position

Being a participant-research-observer within the facilitated projects has enabled me to engage with the "data and the relations of difference and how they matter" (Barad, 2007, p. 71). In this way, the methodology of this research echoes the participatory pedagogical philosophy and approach in the various cases under analysis. This is exemplified in how educator colleagues and I experienced similar deterritorialisation of our personal and professional selves along with our students as the project work unfolded. Viewed this way, a pedagogical praxis for an uncertain world requires educators to "make themselves vulnerable, mirroring some of the learning processes they expect the students to undergo" (Leibowitz et al., 2010, p. 123). In light of my emergent argument in Chapters 1 and 2 on the need for educators to expand and critique their current practice through practice-led research, these shifts are important for design educators if they are to develop their personal capacity to mentor and guide design students through the sticky conflicts and dilemmas inherent in designing for sustainability.

Figure 1, on the following page, details the relational and boundary-crossing nature of this approach showing how overlapping roles create opportunities for participatory learning and knowledge generation within an experimental design project context, and how this has informed a process of participatory action research. Heape (2015) describes this as a process of generative dialogue that is central to action research where, "with those involved, the learning that arises as a result of initiating a research experiment or situation and its evaluation then influences how I make or amend the next moves" (pp. 1364-1365). Similarly, Lammes (2018) describes how methods can emerge in a "reciprocal process of hybridization" where the researchers' position is "co-produced through what we engage with and (re)distribute" (p. 146). This approach is significant for this study in its investigation of experimental pedagogy that, in its coverage of new ground, requires methods that are equal to the characteristic nomadic shifts involved in such pedagogy.

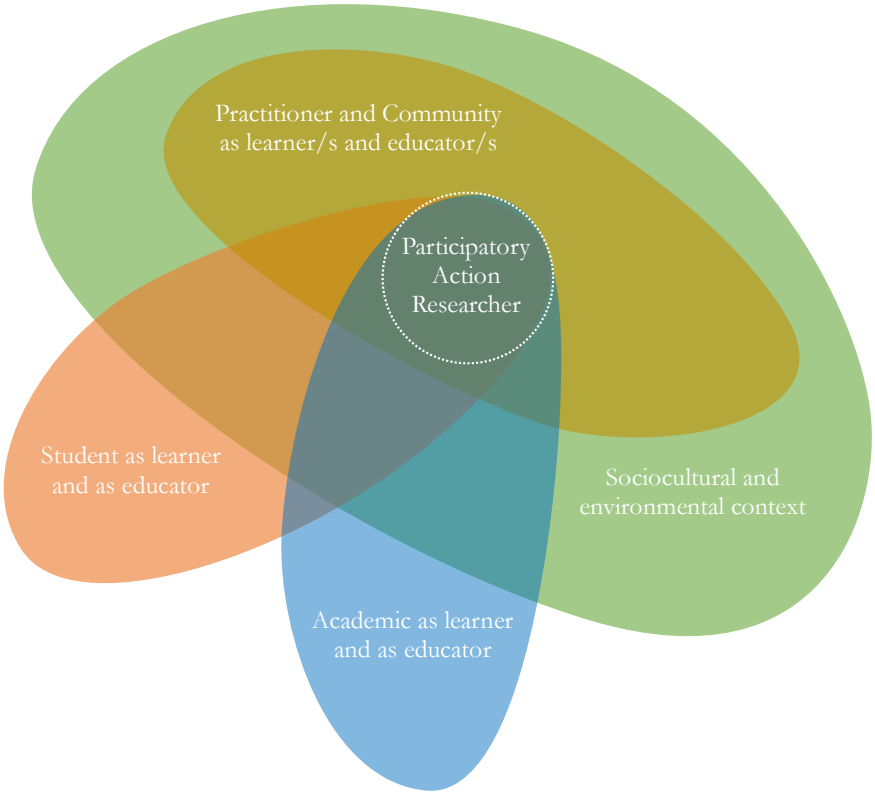


Figure 1. Fluid positionality of participatory action researcher is characterised by reciprocal processes co-produced through who and what is engaged with. Illustration: Bruce Snaddon, adapted from Taylor & Fransman (2004, p. 21)

4.1.3 Diffracting as methodology

As my research spans multiple domains of design, education, and philosophy I make use of an expanded methodological repertoire from the social sciences, humanities, and design. An interdisciplinary approach is highly relevant for my topic and its inquiry into shifts concerning design sustainability education.

The challenge for design educator-researchers is in making visible the entanglements of design practice with socio-economic, political and environmental concerns, and so I argue that design educators, through their pedagogy and research, should be attentive to what is going on as we collaboratively enact sustainable design futuring project scenarios. I have argued for nomadism as key to pedagogy that is attentive to mobility in learning, and here I must emphasise that this term is less about physical movement and more about transformative dispositional shifts in design students' learning, concerning resilience and adaptability to changed design practice that is oriented towards long-term sustainable design.

4.1.4 Ontology of knowing

Following the nomadic pedagogy stance already described, I use Barad's concept of 'diffractive analysis' as a methodological 'cut' to open up and illuminate the emergent learning phenomena that are pedagogically enabled in such settings. A diffractive reading of data "spreads thought in unpredictable patterns producing different knowledge" (Mazzei, 2014, p. 742). The term diffracting was first used by Haraway and further elaborated by Barad as a scholarly approach to "highlight, exhibit, and make evident the entangled structure of the changing and contingent ontology of the world, including the ontology of knowing" (Barad, 2007, p. 73).

In the *Routledge Handbook of Interdisciplinary Research Methods* (2018), Dawney makes the point that diffracting is a "practice of attending to relationality, process and messiness in the always-incomplete [research] object" (p. 110). Furthermore, in expressing how researchers performatively (across the disciplines) insert themselves and "participate in world- and knowledge-making", she acknowledges that this has particular effects insofar as the "role of the research process in the 'making' of objects and worlds" (Dawney, 2018, p. 111). Murris and Bozalek (2019) further iterates this approach saying that diffraction "as a methodology troubles humans' epistemic arrogance of locating knowledge, intelligence and meaning-making in the subject and only in the human subject" (p. 3).

4.1.5 Experimental participation

Closely coupled with this affirmative approach and central to this study is the notion of experimenting as methodology, as problem redefinition and as means of "flexing, or disruption, of ways of thinking" doing and being (Jellis, 2018, p. 54). Participatory action research methodology is experimental in how it shows up through attentive participation "what we [as a group] have done – and struggled with – and the affective swash of these encounters and their after-effects" (Jellis, 2018, p. 55). Research into our experimental pedagogy has, for us, been a case of experimentally making the very 'thing' of analysis. That is, we planned and enacted the pedagogy and then through processes of collecting, analysing and meaning making, we were able to present our experiments as an "ongoing assemblage" of "contingent articulations and [further] questionings" (Holbrook & Pourchier, 2014, p. 755).

By expanding on these important concepts here, I lay out the methodological principles and "argumentative grammar" that connects the theoretical framework and my methods of analysis to one another (Kelly, 2004, p. 118). Informed by a diffractive reading of data insights and core theoretical concepts through one another I then offer a synthesis of my argument in chapter 5. Having introduced the "methodological relations in which the practices of methods take place" (Lury, 2018, p. 21), I now discuss the methods, design techniques, and tools in relation to the varied research activities and data that have emerged.

4.2 Research methods

4.2.1 Critical inquiry and change

As has been stated already, this research is framed within a critical inquiry paradigm concerning change, where designing and learning are approached experimentally through practice-based investigations (Mainsah & Morrison, 2014). A mix of methods is used to capture and compose thick and compelling descriptions that are rich in contextualisation, and where possible, participative representations and recounting of events and processes. Multiple modes of data and documentation gathering are included as an explicit part of developing a research design that

draws on interdisciplinary research methods and design techniques and their interplay. I have engaged with these critically so as to evolve nuanced understandings of nomadic learning spaces. The research design allows access to a diversity of perspectives on shared and complex processes in multiple project locations over time and has enabled the articulation of these through a critical mix of media and mediations.

4.2.2 Qualitative and post-qualitative methods

Through a variety of connected research methods in qualitative and post-qualitative inquiry (St Pierre, 2014), colleagues and I have been able to design, develop, implement, document, observe, and investigate relations in a nomadic pedagogy between students and educators and especially between students in varied collaborative learning environments. Inquiry done this way is influenced by anthropology and ethnography and has involved a process of moving "back-and-forth between cases and concepts" informed by participant observation and interviews (Ragin, 2018, p. 105). Drawing on an assemblage of research methods to engage with the phenomena, outcomes, and settings relating to my topic, I have then used the data as means to generate a multivocal and dialoguing approach (Tracy, 2010) to develop and synthesise understandings of the core concepts in this research. In adopting this approach of seeking to "introduce answerability into a problem" I follow Lury and Wakeford's (2012) rationale, that "it is not possible to apply a method as if it were indifferent or external to the problem it seeks to address" (pp. 2-3).

4.2.3 The -ing in design research

Lury (2018) emphasise the "do-*ing"* of a method or methods and the "following out of the with", the "among" and "between" of interdisciplinary research as "ways to intervene in and make the present active" (p. 21). In this research, I follow the argument that "approaching interdisciplinary methods as ways of giving a problem the form of the active present necessarily obliges the researcher to be attentive to the methodological potential of complex (spatio-)temporalities" (Lury, 2018, p. 3). Similarly, Denzin (2017) in advocating for critical qualitative inquiry, highlights the importance of interpretation, collaboration, and performative meaning making through "intervening, participating in, and collaborating with a moral community" (p. 15). Travel and dislocation from the studio, therefore, form part of a mix of methods in this study, where disruptions to the design studio norm are interventions to provoke learning and design literacies suited to coping with uncertain times. These interventions characterised by their "practice of rootedness in processual awareness" (Lury, 2018, p. 22) have created the case studies (outlined in Chapter 1), interview and ethnographic methods making up the descriptive materials of this study (Denzin, 2017).

These are methods that are relevant in articulating my research with its attention to emergent student identity and agency as they are pedagogically engaged in moving through learning thresholds prompted by boundary-crossing and context-sensitive project settings, spaces, and temporalities. Reflexive, and I would argue, diffractive engagement of this kind has been a critical component of all the project-cases in this study, as we designer-educator-researchers have participated in the nomadic displacements, sharing the mutually co-constitutive learning space with students and participating others (e.g. Snaddon, 2019; Snaddon & Chisin, 2017; Snaddon et al., 2017; Snaddon et al., 2019).

In the following sections, I discuss the various methods used to engage with the emergent learning phenomena within the various project-cases in this study.

4.2.4 Participant observation

Participant observation has its roots in anthropological method and community research, and according to Reason and Bradbury (2008), it is "justifiable only to the degree that the results are imminently useful to the community" (p. 37). In this mode of inquiry, researchers enter into the process of what is being studied as a full participant, getting an 'insider's view' while remaining aware of the political dimension of such involvement (Reason & Bradbury, 2008).

With this research study being practice-based with a focus on a participatory mode of pedagogical praxis, we as educators are multiply positioned; as instigators of the various pedagogies, as investigators of our experimental inflections, and as "vectors of the inflection itself" (Jellis, 2018, p. 53). In this mode of what Jellis calls 'attentive participation' (Jellis, p. 54) colleagues and I played multiple roles as projects unfolded. These included activities such as facilitating workshops with communities, coping with uncomfortable sticky situations arising from uncertainty and miscommunication, facilitating designing and crafting, dealing with coordinating travel/accommodation logistics and adapting to unforeseen circumstances and consequences. Over the project durations, these roles became diffused and shared as student collaboration increased, providing surprisingly rich learning and growth opportunities for them.

Students in these project-cases are predominantly undergraduate level but some projects have involved pre-diploma students as well as a number of students completing their Masters studies, for example, Publication 2 (Snaddon & Chisin, 2017). In terms of mixing disciplines, publications 3 and 4 cite cases where students of urbanism and design engage in co-creating agentive urban learning ecologies as dynamic engagement in re-making the city. These contexts include local South African urban areas as well as project-cases drawn from the collaborative research partnership with AHO in Norway. Publication 5 cites an instance where CPUT industrial design students worked together with engineering students on a design challenge to develop sustainable renewable energy systems for a local context in urban and peri-urban areas around Cape Town, South Africa. In all cases, consent was granted by students for the use of material drawn from interviews and participatory projects.

As attentive participants in multiple project-cases we, as educators, also enabled an iterative process of relaying various pedagogical matters of concern from one project to the next, and in so doing amplified "the ways in which experimental hubs exceed particular locales" (Jellis, 2018, p. 55). An example of the durative nature of our work is evident in how the semi-fictive persona of Fiscilla (Snaddon et al., 2017) transcended her original function to become a centerpiece of a second project in a new location with a different cohort of students, while still being able to serve as a diagetic device for climate change dialogue. Additionally, in relaying experience gained from a sequence of projects over time, a pedagogical approach has emerged that forms the basis of this research study, and that informs my ongoing pedagogical praxis.

4.2.5 Interviewing

As a key part of the research design of my thesis, I conducted and selected semi-structured and unstructured interviews with student participants in the project-cases under review. I carried these out over a period of time both during the project-cases as well as after the project events.

In pursuing a process of interview in this research I aimed for diversity in terms of gender, culture, race, and temperament, along with a broad representation of fourth-year undergraduate and master's-level students across several design disciplines, namely industrial, graphic, and surface design. The selection of such a sample has been important as it is this diversity that has

been found to be most generative of collaborative, creative, and other synergies during the project-cases.

By engaging with students during and after the project-cases I acknowledge and welcome the "multiple durations of interview encounters" (Ayres & Bissell, 2018, p. 77). By this durative aspect I mean the multiple temporalities and varying intensities, "speeds, slownesses and transformations through time" (Ayres & Bissell, p. 79) that the interviews in this research opened up.

Due to the fact that these projects have occurred over several years, there is the element of a certain chronology with regard to the pedagogical praxis of building on the experience that is gained and applied through practice. This has also meant that certain students interviewed have been participants in multiple projects over an expanded period of time during which we were evolving our experimental pedagogy. Some interviews with students who have now graduated, and are in the workplace, provide valuable insight into how they are dealing with issues of sustainability in their jobs.

Figure 2. Students interviewed during the project-cases offer insights into their learning experience as events unfolded, which has informed interpretive dialogue with research colleagues. Images: Mathew Rosmarin (left) and Troy Davies (right).

Interviews taken over time within projects and post-event have allowed different intensities of response from students, demanding something akin to a methodological sensibility of 'suspension' that requires the researcher to attend carefully to student articulation of agentive learning transformation. For example, suspending too much of a focus on a predefined research question and allowing the conversation to flow prompted the following comments by a student when reflecting on her emotions in a collaborative work during a Biomimicry project:

> [It was a] dramatic performance as we shared ideas… that feeling of possibility… almost like that feeling of being in love" […] Creativity is deeply personal but can be hugely sparked and exciting when it happens in a group setting. (Lizanne, 2017)

Treating interviews as encounters opens up a conversational process that is conducive to the singular twists and turns that might happen during the process. Interviews recorded during the project for the documentary video allowed students to reflect on their learning experience in an informal manner as they recounted and projected forward to events in the project continuum. Evidence of the educational value for students emerged in post-project interviews in comments on how this process allowed time to slow down their group activity and reflect on their personal unfolding learning narrative.

The semi-structured interview questions posed to students once back on campus focused on emergent moments where participants self-organised to find their place in the projects as they moved through various phases, spaces, and locations. I used open-ended questions to start a dialogue such as, Where in the project did you notice yourself engaging differently with fellow students or the context?, How did your participation in the project shift your behaviour as a design student?, Were you aware of any tensions during the project?. In following such a phenomenological approach I engaged carefully with students' lived experience of their learning in various project contexts. These interviews were recorded, transcribed and the content then arranged according to emergent themes in the conversations. These emergent themes then became prompts for further dialogue and framing of more questioning for colleagues and myself.

4.2.6 Arranging as nomadic inquiry

As a process of nomadic inquiry has unfolded in this research I have, along with colleagues and students explored ways in which we might become willing and able "to take risks, to move back and forth between the personal and the political, the biographical and the historical" (Denzin, 2017, p. 14). Our collaborative writing and ensuing inquiry have evoked our "desire to be curious, to destabilise and to trouble the givens of accepted discourses, knowledge constructions and ways of thinking and doing" (Gale & Wyatt, 2009, p. 8). These are ways that decentre the researcher so as to enable the "inquiry of our inter-connectedness with the world" (Hultman & Lenz Taguchi, 2010, p. 538).

Far from being linear, the process of arranging the data from interviews, video, photographs, and workshops has involved travelling to and fro along a spectrum of activities of generating, gathering, filtering, sorting, juxtaposing, and "crafting relationships among pieces of information to determine which arrangement might offer a new perspective or prompt a new question" (Bench, 2018, p. 45). For example, this process informed the development and design of the *Kairos* webtext where I attempt, through its journey-based interface and spatial rhetoric, to allow a diffractive reading of a multilevel, sensory, embodied process of learning in and across spaces.

Figure 3 shows the webtext interface with its clickable icon aesthetic resembling a route map with physical and reflective points along the way. The scrollable window presents textual, video and photographic material that can be flexibly accessed via the route map or logically from the formal drop-down content menu. In our educational context of transformation, it has been important to exhibit this work in a more accessible online format. The webtext has been a useful way in educational seminars in my faculty to discuss both formal and informal aspects of this work and to prompt a wide range of discussion based on how the video clips have been arranged along with conceptual framings, analysis and concluding propositions.

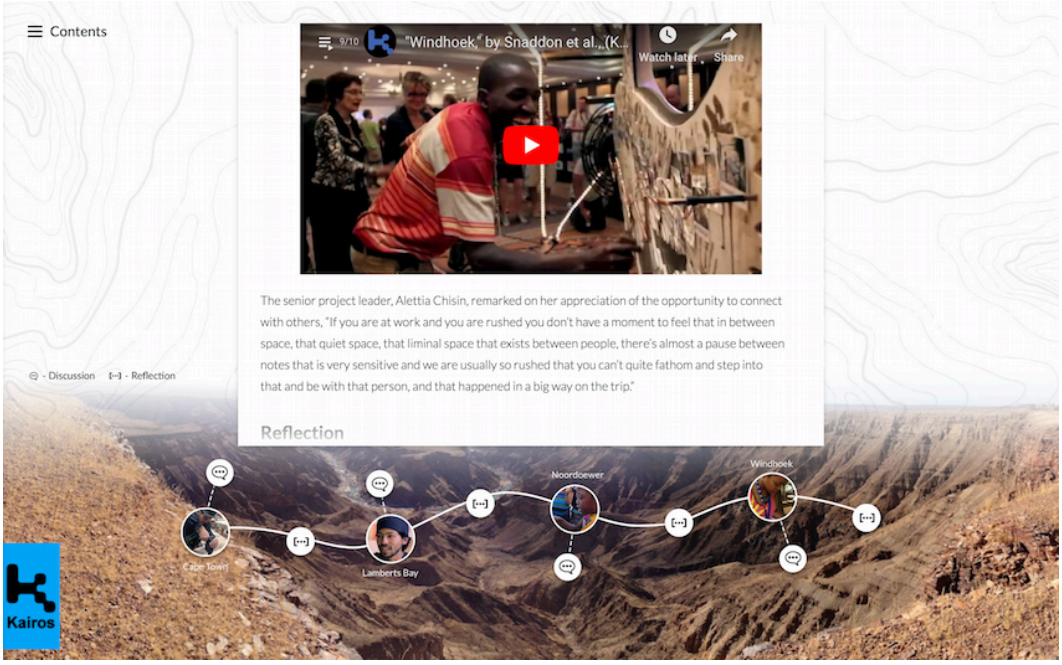


Figure 3. A screenshot of the interactive webtext in the *Kairos* online publication, showing the design and arrangement made possible and accessible through this medium. Photographs and design: Bruce Snaddon.

4.2.7 Writing and conversation

Writing collaboratively has taken various forms ranging from formal co-authoring on publications to informal writing workshops in a number of different locations on and off campus. This resonates with the idea of 'nomadic inquiry', where writing is described as "a seductive and tangled method of discovery" that enables us to write ourselves into producing knowledge differently (Richardson & St. Pierre, 2005, p. 967). Writing alone and collaboratively in this way blurs distinctions between data and analysis as ideas and understandings of data are collected in the process of writing (Richardson & St. Pierre, 2005). These are ways in which I have attempted to write compelling and thick descriptions of our lived experience as we have moved our pedagogies across physical and learning landscapes.

Recorded and transcribed conversations have also been a rich source of diffractive analysis as I have engaged with colleagues in exploring conceptual framings as a means to re-enter our nomadic pedagogies. In using a language of diffraction to discuss the effects of our pedagogy we have opened up a space for a discursive dialogue concerning the multiple factors at play. These conversations, along with personal voice memos have aided my writing process more as in-the-moment performative meaning making, where dialogue and monologue become a more fluid means of moving from the tacit to explicit articulation of ideas and concepts.

4.2.8 Research questions

In keeping with the practice-based nature of this study, the research questions framing it are equally practice-based in how they have been conceptualised around design education, with a

focus on exploratory pedagogy. In this manner of doing design research, I have posed research questions in the mode of 'methodological bricolage' (Yee & Bremner, 2011). Through moving methodologies, a questioning space is created and accounted for where educators and students are produced and producible in, and as movement through places of learning (Higgins & Madden, 2018). In this way, the research questions are oriented by, and through, design practice and pedagogical praxis in its exploratory, collaborative, contextual and participatory engagement. In so framing my research questions, my aim in this thesis resonates with what Denzin (2017) describes as seeking "a writing form that is performative, dialogical, pedagogical, it tells by showing" (p. 9).

In the previous sections I have discussed the mix of methods and approaches that I have used to engage with the emergent phenomena of this study, and that is both in tune with how design is practiced (Yee & Bremner, 2011), and explorative of "relationships among movement, methodology, and knowledge claims" (Higgins & Madden, 2018, p. 7). I now briefly reiterate the research questions driving this study as an orientation for the reader. They are as follows: How might current design pedagogy transition toward emerging and complex contexts through designerly curricular experimentation that is oriented towards sustainable futures? Further sub-questions that provide a focus for three peer-reviewed articles and two conference papers are: What roles may the speculative, performative and locative aspects of design pedagogy play in creating dynamic learning spaces? What are the qualities of an immersive pedagogy that is productive of sustainable design dispositions in students?

Additional questions that have surfaced through the published offerings in this research have to do with what the productive characteristics of pedagogical experiment might be, and how the use of designerly tools and the making of alternative material-discursive artefacts unlock new spaces within which to learn and act for students. Together these questions relate to pedagogical experiments that challenge the given and prescribed in design education curricula, and that explore transitioning alternatives where educators play a participatory role with students, within contextual situations in seeking ways to design that might be more sustainable.

I address these research questions through a process consisting of two interrelated phases. Firstly, as this is practice-based research I draw on several design project-cases through post-event inquiry as well as consider implications for current pedagogical practice. In this mode, I have carried out inter-subjective interviews with participants (Alvesson, 2011) along with workshops and documentary videos to facilitate interpretive dialogue with colleagues regarding our pedagogy and the learning that unfolded as a result.

Secondly, in responding to these project-cases, I have drawn on the contextual specifics of the cases to connect up theory and conceptual framings so as to engage deeply with my research questions and to strategically build this research around the different published outcomes. This has entailed study into the overlapping and related fields of design, learning, and sustainability. It also connects design as a process of inventing the world with philosophy understood as an act of inventing concepts (Marenko & Brassett, 2015).

The published outcomes in this thesis fall into four case-oriented thematics relating to the varied spatiotemporal nature and pedagogical intent within our project-casework. These four themes will emerge in Chapter 5 as key to the structure and synthesis of the argument that this study offers. They are as follows:

1. A journey-based nomadic pedagogy, with a focus on story-gathering and climate change
2. Design pedagogy located in a heterotopic space with performative storytelling

3. Agentive, participatory urban learning ecologies
4. Relating design agency and learning identity within a wider ecological system.

These case-oriented thematics have all come about through a mix of research activities that have shared methods, design techniques and tools. An overview of these shared methods, techniques, and tools can be seen in Table 1 on the following two pages. The table lists vertically the different research activity modalities and indicates under nine points the description, purpose, harvesting method, participants, location, and function that the research activity serves. Lastly, the table orients the reader to where these activities can be found across the published outcomes of this research.

Research activities	**1 Description** *What is it?*	**2 Purpose** *Why relevant?*	**3 Harvesting** *How gathered?*
Semi-structured interviewing	Three interviews with students participating in the Namibian project	Reflections on learning experience	Transcriptions from recorded interviews
	Four interviews with students participating in Afrikaburn project	Reflections on learning experience	Transcriptions from recorded interviews
	Six interviews with students participating in several projects introducing biomimicry	Reflections on learning experience resulting from exploratory pedagogy	Transcriptions from recorded interviews
Participating and observation	All multi-sited projects: planning, co-teaching, video commentary, personal notes	Observing, understanding and contributing to project objectives in real-time	Annotated documentary video, sketching and field notes
Writing collaboratively, workshopping and conversing	Formal and informal writing with colleagues and students. Development and reporting	Speculative and participatory planning of projects, adaptations in the field, and post-event analysis	Posters, charts, sketches, and transcriptions of conversations
Reflecting using notebook, annotated diagrams, and audio recordings	Process work during post-project research phase	Idea development, thinking through drawing and performative speech	Personal notebooks and audio repository
Documenting through video and photographs	Video documentary of Namibian road trip project – Produced by A. Broom & directed by Rosmarin. Photographs taken by educator-researchers	Tracking journey progress in its multiple locations and interviews with students/educators reflecting on their learning experience as it happened	Professionally produced video available online. Photographs stored in online repository
	Video documentary of Afrikaburn project – Produced by A. Broom & directed by Retroyspective. Photographs taken by educator-researchers	Interviews with students/educators reflecting on their learning experience as it happened	Professionally produced video available online. Photographs stored in online repository
	Photographs taken during all project work	Shows who participants are, their interactions and project dynamic	Produced by educators and participant practitioners, stored in online repository
Visualising graphically	Use of Prezi and PowerPoint as design prototyping and briefing technique and tool for *Kairos* webtext development	Visualising technique to unpack spatiotemporal flow of project event	Personal repository
Sketching and mapping	Project planning, project unpacking and research process	Core to design process. Planning facilitating and communicating amongst participants	Personal files
Mediating figurations and design artefacts	A 4m long Tigerfish dubbed *Fiscilla*, designed to generate dialogue on climate change	Mediating meaning making on issues of climate change and sustainability in varied community contexts and a design conference	Documentary video and photographs
	Afrikaburn installation *We are Water*, designed to evoke experiences around the story of water	Means of mediating meaning making on issues of climate change and sustainability within a heterotopian creative community	Documentary video and photographs
Designing prototypes	Design prototypes i.e. product design of Biogas stove	Low and hi-fidelity prototypes developed as part of sustainable design process	Student project work repository, documentary video, photographs

Table 1. This table lists the varied research activity modalities along with description, purpose, harvesting method, participants, location, and function that the research activity serves.

4 Participants *Who was involved?*	**5 Location** *Where did it happen?*	**6 Publications** *Where is it used?*	**7 Function** *What does it do?*
Educator-researcher and students	Cape Town region 2016-2017	Publication 1, *Kairos* Journal webtext	Feedback from students on personal learning journey
Educator-researcher and students	Cape Town region 2016-2017	Publication 2, NORDES Conference 2017	Feedback from students on personal learning journey
Educator-researcher and students	Cape Town region 2017-2018	Publication 2, *Artifact* Journal and Publication 5, LeNS Conference 2019	Provides feedback from students on changes in experience of their own boundaries
Educator-researcher, students, practitioners, communities and contexts	On and off campus in varied project locations	Publications 1, 3, 4 and both Conference Publications 2 and 5.	Reveals emergent participatory pedagogy and nomadic shifts in learning behaviour
Educator-researcher and students	On and off campus in varied project locations	Publications 1, 3, 4 and both Conference Publications 2 and 5.	Aids gathering of research data, its analysis and synthesis, and translation into tangible processes
Educator-researcher	Oslo and Cape Town regions 2016-2018	Publications 1, 3, 4 and both Conference Publications 2 and 5.	Explicates and records conceptual knowledge generated during research process
Educator-researcher, students, practitioners, videographer, communities, and contexts	On the road from Cape Town to Windhoek, Namibia	Publication 1, *Kairos* Journal webtext	Reveals the journey through visual narrative showing the situated and experiential learning experience as it unfolded
Educator-researcher, students, practitioners, videographer, communities, and contexts	Afrikaburn, Tankwa Karoo region	Publication 2, NORDES Conference 2017	Visual narrative showing the situated and experiential learning experience as it unfolded
Educator-researcher, students, practitioners, communities, and contexts	Cape Town region, on and off campus	Publication 4, *Artifact* Journal and Publication 5 LeNS Conference 2019	Photographs capture multi-sited immersive learning experiences in various settings
Educator-researcher	Oslo and Cape Town region	Publication 1, *Kairos* Journal webtext	Participatory method of diffracting and visualising the layered/nested spatiotemporal nature of nomadic project work
Educator-researchers	Cape Town region	Publications 1, 3, 4 and both Conference Publications 2 and 5.	Productive designerly techniques for making meaning during design practice and research
Design students, educator-researchers and participatory others	On and off campus, and journeying between Cape Town, Windhoek and Afrikaburn	Publications 1, 3, 4 and both Conference Publications 2 and 5.	Pedagogical exploration of speculative design futuring through use of durative, semi-fictive mediating artefact
Design students, educator-researchers and participatory others	On and off campus, Afrikaburn	Publication 2, NORDES Conference 2017	Pedagogical exploration of speculative, performative design futuring through use of durative, semi-fictive mediating artefacts
Design students, educator-researchers and students from other disciplines	On and off campus, Cape Town region	Publication 2, *Artifact* Journal and Publication 5 LeNS Conference 2019	Translating sustainability values and functionality into tangible outcomes

What follows now is a discussion on how these methods, designing techniques and tools presented above relate to one another.

4.3 Design techniques and tools

Within the project-cases, a range of design techniques have been utilised that are commonly used in design studios and practice-based creative development of ideas and their realisation. These include sketching, process mapping, visualising, modelling, and prototyping. Tools such as digital graphical software technologies for visualising complex and layered data have been used along with workshop tools for cutting, 3D printing, welding and joining in the making of various figurations and prototypes in both on- and off campus settings.

4.3.1 Participatory making of artefacts

Our experimental pedagogy has aligned with the design curriculum in project work where making informs a broad spectrum of activity that is inclusive of speculative imagining, conceptualising, and communicating as well as fabrication of artefacts ranging from research prototypes to more traditional industrial design prototypes. True to the design process, making forms part of the method that has informed the evolution of this research. More specifically, making in this sense is about '*making for* processes', where discovering the uncertainties in making and processing of matter is more important than materialising predefined forms with accuracy (Gürsoy, 2016).

Moreover, as Gürsoy argues, "only when the material process is favoured as a creative endeavour… over the outcome, we may then begin expecting to encounter with the uncertain" (2016, p. 852). This is significant in the light of my study focus on how our habitual modes of design making towards perfected outcomes might be disrupted and critiqued, a realignment between thinking and doing, so that students are able to explore making as a process that is exposed to principles of social and environmental justice and long-term sustainability. The value of encountering uncertainty yields the possibility of "teasing out a form from the material", where designers act "as triggers for spontaneous behaviour" (DeLanda as cited in Gürsoy, 2016, p. 852).

As an integral part of designing and design research, knowledge and meaning making is central to my research aim, which is to explore how design pedagogy can holistically orient students towards sustainability in their thinking, making and being. In both research and design terms I emphasise making as a mode of ongoing inquiry, and how making in this way illuminates learning phenomena, making emergent values tangible for participants and stakeholders in the process (Tunstall, 2013). Such a designerly "making… as research activity" (Kempton, 2019, p. 57) opens up new relations between design and formal research processes.

The incomplete, open-ended makings of artefacts that require further inputs from participatory others form an important aspect of both the pedagogy under analysis and my research process. In this way, something is built and put to use as a means of inquiring into a context; a provocation in "creating a situation or circumstance" that can aid in the purpose of later analysis (Wensveen & Mathews, 2015, p. 275). This is a practice-based process commonly known in design research terms as research-through-design (Frayling, 1993/1994), or research-by-design (Morrison & Sevaldson, 2010) where, as active participant practitioners we align ourselves with designerly ways of knowing (Cross, 2006). Importantly for designers doing design research, this approach allows designers to do what they do (i.e. design) as a way of creating "a stepping-stone

to theory generation" and "investigating what a potential future might be" (Zimmerman, Stolterman, & Forlizzi, 2010, p. 313).

A process of the internal becoming external is performed here that draws internal imaginings out and extends them into the external world as outcomes in the forms of material or verbal artefacts (Scarry, 1985). From this perspective, when we make, the "'responsibility' we take for the act itself is… intrinsically ideological" (Fensham & Heller-Nicholas, 2018, p. 30). With regard to the topic of this study, making as method has enabled an inquisitive and performative process of explication. That is, shape is given to a reflexive process of collaborative questioning and making that gathers varied participatory inputs that are particular to a context. Giving material shape to our inquiry has enabled participants within the projects and myself as an educator-researcher to enact our exploration of design literacies and dispositions that might be relevant for student designers learning about how to design with sustainability. Examples of this playing out have been reported on within several of the publications where making conceptual prototypes have facilitated knowledge-making for the student group as a community of inquiry (Snaddon et al., 2017; Snaddon & Chisin, 2017). I make a brief reference to two examples below.

The making of a mediating design artefact in the form of an indigenous Tigerfish, allowed for interaction and additional makings as it travelled through water-stressed front-line communities to a participatory design conference in a neighbouring country. Fiscilla, the Tigerfish was made as a speculative type of epistemic artefact whose fictive stance and experimental status (Markussen & Knutz, 2013) facilitated the gathering of stories during the journey and as an interactive installation exhibited at the conference. In this case, our nomadic pedagogy promoted designing "*for* a relationality that is perpetually in the making and laden with the potential to reconfigure established boundaries" (Ellsworth, 2005, p. 46). Student reflections on their learning during this project journey reveal how they made sense of their experience of crafting such an artefact while negotiating the challenging spatio-temporal shifts that were characteristic of the journey.

A second example (see Figure 4, left) of collaborative making within a difficult environmental and sociocultural contextual setting challenged students and educators to convey the message of water scarcity as part of a heterotopian community embodying sustainability principles. A water bar and interactive space including a performance stage were built to invite participation from the creative festival participants and "disrupt ingrained habits of use" around the concept of *We are Water* (Gibson & Owens, 2015, p. 393.

Figure 4. The durative figuration of Fiscilla reveals how the incomplete and ongoing shaping of this artefact allowed for varied interaction, story gathering and making in two very different settings, first in Namibia and then in the Tankwa karoo at the Afrikaburn creative festival. Images: Bruce Snaddon (left) and Graham Newton (right).

4.3.2 Design prototyping

In a number of project-cases in this study traditional design prototyping was carried out as a key part of the design process, as means of iteratively seeing "where theoretically informed design leads" (Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2012, p. 62). Prototyping in this sense is enabling of collaborative and cyclical process involving ideating and conceptualising, refining and testing of a concept, and communicating structural and aesthetic accuracy. For instance, in the case of students developing sustainable renewable energy systems for a local context, a Biomimicry inspired biogas cooking stove prototype was developed after a lengthy process of contextual observation followed by "making and re-making of roughly articulated prototypes [to] allow members… to use dialogic exchanges" (Gibson & Owens, 2015, p. 393).

Importantly in the case of this project, a different exchange was initiated at the outset through careful observation of natural strategies, which is particular to the Biomimicry methodology. What students noticed was that a strelitzia flower has its own valve-like mechanism. This was the inspiration for the shut-off valve for the gas stove illustrated. This deep attention to an ecological strategy lead the student group through multiple prototypes to design this biogas stove with a simple gas shut-off valve to limit the chance of fire if knocked over. In South Africa, fire caused by unstable paraffin stoves is a major challenge for people living in crowded living conditions in informal settlements.

Figure 5. Left: A research prototype developed by industrial design students in a renewable energy project challenge (see publication 5). Image: Andrea Grant Broom. Right: During a project concerning solid waste management for informal settlements, a moulded prototype waste bin was tested in its context of use. This industrial level of prototyping went through many iterations in preparation for production. Image: Andrea Couvert.

4.3.3 Documentary video and journaling

Documenting learning events through video and through journaling in design research are effective modes that explicate the design process and offer opportunities for reflection on design activity in practice-led research (Pedgley, 2007). Learning journals are commonly used to improve thinking skills and, according to Moon (2006), can be a useful "means of enhancing the development of critical thinking and epistemological maturity" (p. 46).

In this thesis, documenting processes of making artefacts for dialogue and meaning making through video has allowed for reflection-in-action as students and staff were interviewed in a mode of gathering thoughts, impressions and sense making as the projects unfolded. The making of documentary videos, *The Fish and The Desert* and *We Are Water* are both examples of this. These videos along with photographs taken during the project-cases and subsequent interviews form a vital link for myself, students and colleagues as a process of "video elicitation" (Jewitt, 2012, p. 4) to stimulate recall and as a basis for reflection in three of the publications making up this thesis. Additionally, in the *Kairos* webtext (Publication 1), the documentary video is also the source for clips and stills used in building the multi-modal journey-based narrative interface.

However, I recognise the partial nature of video in that it includes and excludes aspects of events (Jewitt, 2012). Although the use of video in our projects was to report on a funded research project, a balance was found between documenting the events for this purpose and sensitively capturing "temporal-sequential interaction" during the projects (Jewitt, 2012, p. 5). An example of the latter is the use of both real-time and time-lapse video to show the temporal aspects of the design build process in the *We Are Water* documentary filmed at Afrikaburn. Success in this balancing process was largely due to the creative expertise of my fellow educator-researcher, Andrea Grant Broom, and her close collaboration with the video production teams in both documentary videos.

Journaling in the project-cases has taken the form of visual diaries as a means of working with events and experiences as students make sense of the world and how they are engaging with it (Boud, 2001). These diary documentations have been mandatory and required items in most of the project-cases being reviewed here, and are rich in writing, illustration and sketching as students make meaning of their learning experiences. In this study, I have drawn on students' reflective diaries that were created during and after many of the project-cases. They have provided valuable insight into threshold-crossing learning moments for students as they engage with their learning through "emotional responses to circumstances, along with moments of serendipity and comments on perceived roles within social situations" (Pedgley, 2007, p. 471). The views expressed and sketching reveal dynamic and at times divergent design learning processes, activities and shared making of meaning.

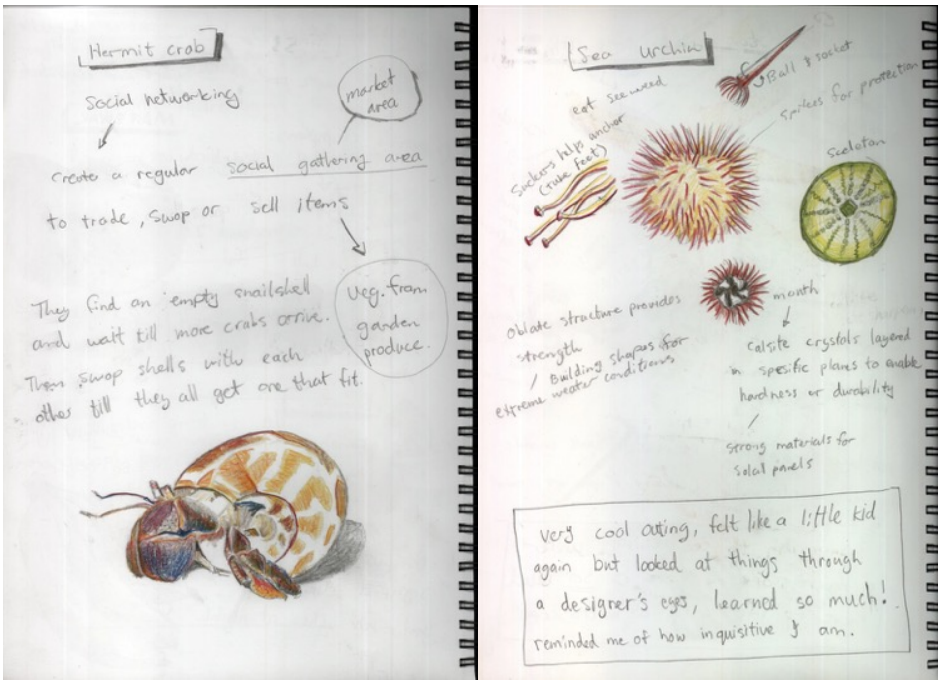


Figure 6. A student journal kept during a project where Biomimicry was introduced, indicating an awakening of curiosity while performing her role as a designer. Image: Andrea Grant Broom.

4.3.4 Sketching and visualising

Sketching and visualising are core tools and techniques adopted in design pedagogy and design-based inquiry (Kumar, 2012). These are modes and methods of doings that "put ourselves into the method as (disciplinary and disciplined) subjects" (Uprichard, 2018, p. 85). Furthermore, temporality is inscribed in the way that these "methods move things into being and becoming different to what they are", method shapes the world and the world recursively shapes method (Uprichard, p. 83).

All the project-cases in this study involved multi-disciplinary groups of students working collaboratively together on design challenges. As is to be expected, collaboration is no simple task and involves multiple moments where communication is key to the group successfully moving forward. In these instances, drawing using sketchpads in formal situations as well as informal ones provided a means of communication and conceptual development for the project teams. These sketches ranged in quality and finish from pencil and coloured markers to quickly summarise planning sessions, to more finished digital renders. In one case, fast sketching in the desert sand provided a way out of a deadlock in decision making so that the project could move on (e.g. Snaddon & Chisin, 2017).

As part of my research process for Publication 1, I have used graphic presentation software to firstly, experiment with how to represent the data and its interpretation, and secondly, as a means of briefing a webtext designer on how I hoped a reader might experience the online text. In this case, I wanted to find a balance between a multimodal and spatio-temporal experience while still delivering a formal academic text.

Figure 7. By using the functionality of Prezi presentation software, I was able to layer various elements of the learning journey in one of the project-cases and to explore how to develop a spatial rhetoric and reader experience for the *Kairos* webtext. Design: Bruce Snaddon.

4.4 Conclusion

In this chapter, I have shown how I have utilised a mesh of interdisciplinary and connected research methods in a qualitative and post-qualitative inquiry. As has been stated in the Methodology section of Chapter 1, during the writing of this exegesis the evolution from a traditional humanist qualitative methodology towards a post-qualitative perspective reveals a more accurate framing of my research. The key point on which this evolution turns is that the project-cases which form the basis of this inquiry, involved myself and other educator-researchers placing ourselves within the pedagogical experimentation process, so as to open up a critique of current structures, familiar assumptions and modes of design education practice associated with given and traditional modes. Such a research stance is one that displaces the given "material-discursive structure… [enabling] something else to be thought and to happen" (St. Pierre, 2014, p. 4).

In moving with students through various co-created pedagogical situations and conducting interviews along the way (through our participative discussions with students and in video documentaries) our mode of inquiry "resituates the interview as a process-based, intra-active event", a "cocreation among (not between) multiple bodies and forces–the interview as intraview" (Kuntz, 2012, p. 2). This approach along with design methods, techniques and tools have aided processes of engagement with phenomena emerging from our experimental pedagogy across a range of design project-cases. This has led to more "diffractive ways of seeing and nomadic thinking" (Kuntz, p. 3) and enabled dynamic dialogue with a cross-section of participating staff and students.

Coupled with methods associated with research-through-design, I have embraced a processual approach that has yielded data in multiple forms. In diffractively reading this data through an array of conceptual perspectives in an expanded methodological repertoire from the social

sciences, humanities, and design, I have produced published outcomes in varied textual and interactive modes. These I have pursued in a process of explicating detailed examinations of contextual meaning making for students and for myself as an educator-researcher, along with colleagues within the cases under analysis. In the next chapter of this exegesis, I present a synthesis of what I have come to know through this research process and form an argument around a proposed framework for transitioning design pedagogy nomadically, relationally and sustainably.

5

5 A perspective on transitioning sustainable design pedagogy as and via a diffracting view

In the preceding chapters, I have presented an overview of the context out of which this study has emerged, the literature that has guided the conceptual framings and the methodological concerns regarding my research approach. In this chapter, I offer a synthesised argument that represents the core of what this exegesis lays out. I close the chapter by proposing a framework for transitioning sustainable design pedagogy. In Chapter 6, the last chapter, I discuss the implications for such a framework in HEIs in South Africa and globally.

This chapter is structured as follows. In order to set up the argument, I open with a brief overview of the status of the inquiry, the contextual challenges and opportunities within which it is situated, and a reiteration of the research questions driving the study. I then cover the conceptual framings that have informed this research in three sections that move from notions of deterritorialising and reterritorialising the nomadic agentive self. A section follows that clarifies a diffracting methodology as grounding for analysis and navigation through the data in this study. Next, I pace and trace the emergent argument through four key thematic pathways that have been defined by the exploratory project-cases under review. Lastly, I present a synthesis of my argument in the form of an integrated pedagogical framework and close with brief concluding remarks.

5.1 Questioning the status quo

This study has to do with 'transitional change' and 'transformation' in design education. That is, 'transitional change' in design education that is oriented towards sustainable futures, with a focus on exploratory pedagogy as a vehicle for change. 'Transformation' in this study concerns a design student's personal learning journey and how, together, agency and worldview become transformed through exploration of "different scales of context from the perspectives of different value-systems" (Wahl & Baxter, 2008, p. 82). I use the term agency in referring to individual and shared capacities to imagine and act. Learning that is truly transformative is complex and involves mediated movement across learning thresholds that are anything but clearly defined and sequential, and is often a "long-term, chaotic, and contextual process" (Yee et al., 2019, p. 15).

Movement for a design student from one level of understanding to deeper more transformational ones is not guaranteed, and can be extremely challenging in educational contexts where the following factors prevail:

1. Habits and habitus already entrenched in learning environments that categorise design literacies too narrowly and artificially separate nature and culture, mind and body, self and world
2. Fractured curricula and pedagogy with entrenched hierarchical and transactional master-apprentice modes of teaching and learning that maintain a bounded individualism
3. Design discipline specialisation that is complicit in, and unquestioning of the dominant profit-driven paradigm that entrenches structural inequalities in society, culture, and the environment
4. Design curriculum and research that remain tied to material outputs only, where the inclusion of meta levels of design and the turn toward immaterial modes of designing are under-developed
5. University campus unrest where a culture of protest action has challenged academic programme delivery, student learning and educators' pedagogical philosophy.

As has been described in Chapter 2, many of these factors are present in the local context within which this study has taken place. The research work in this study has arisen not merely as a response to these factors, but also through a positive desire to push the boundaries of our design pedagogy in ways that are exploratory of alternative scenarios, for where and how we behave differently as educators with our students.

Such an approach is articulated in the main research question framing this research inquiry, which is, how might current design pedagogy transition toward emerging and complex contexts through designerly curricular experimentation that is oriented towards sustainable futures? Regarding the sub-questions and in seeking understanding as to how we are to develop design dispositions in students that are different from the status quo, I have inquired into various experimental pedagogical tactics that we have developed in cases where the speculative, locative and performative aspects of learning have been activated. More specifically, this PhD research study is an inquiry into what the micro-dynamics and qualities of a nomadic and immersive pedagogy in complex contexts might be. It seeks to foster debate around a shift in pedagogy away from "old paradigms… that no longer serve us well in extraordinary times" (Sterling, 2010, p. 522), and steps willingly towards spaces of experiment. In this regard, Braidotti's nomadic theory marks out and "expresses a process ontology that privileges change" and affirmatively supports "becoming-minorities" (2013, p. 29). In my thesis, such an approach has been important when unpacking pedagogy for an emergent minority of designers transitioning away from dominant, majority practices catering to the capitalist market economy.

As such, my research project aims to challenge the 'resilient' and unchanging nature of the dominant status quo, which is ironic considering resilience is a term often positively associated with sustainability. As Sterling (2010) points out, "many people's worldviews and frameworks for understanding are themselves resilient systems" (p. 520). The term will surface again later as a distinct quality in my proposed pedagogical framework, where resilience is valued in sustainability project situations where students need to cope with discomfort, setbacks, and uncertainty through modes of anticipatory and futuring design.

HEI design courses and programmes in South Africa are actively challenging the above-mentioned inhibiting factors through innovative project-based learning and research scholarship that is steadily gaining ground in the field of design education (see Costandius & Bitzer, 2018), and in the humanities field (see Leibowitz & Bozalek, 2016). My thesis study contributes to this growing body of work through research inquiry into teaching and learning practices within a design faculty in the context of Cape Town. It also connects up this local work with project and research work done in Norway as part of CPUT's design and research collaboration with AHO.

This has provided an additional element of diversity when interpreting and applying our shared conceptual frameworks within design and research projects in very different global locations. Contributions from both regions show up nuanced differences and similarities as we have engaged with education-based research and research-based education in pursuit of furthering education that is sustainable, responsible and future-oriented.

As this study deals with how current design pedagogy might transition toward emerging and complex contexts through pedagogical experimentation, it does not and cannot propose a set of answers. In the mode of transitioning, it describes a seeding phase concerning the creation of conducive spaces for sustainable design emergence to come about, where emergent phenomena in the form of pedagogical pivots for educators' and students' sustainable design dispositions result from collaborative and dialogical processes. These are processes of transition particular to a certain university context and need to be read through the particularities of the described context. Far from presenting a utopian vison of ideal sustainable design learning environments, it is my aim in this thesis that the reader may find resonance and affinity in how this transitional process is described, and that in such a reading there may be inspirations, prompts and curiosity to either start a similar process or to continue with innovative pedagogical momentum already established.

5.2 Conceptual framings of design learning situations

In pursuing activist design educator roles, colleagues and I have evolved our pedagogy to actively pivot on transformative learning for design students through different scales of design project contexts (Ellsworth, 2005; Wahl & Baxter, 2008). As has been described in the published outcomes of this study, the project cases have all been about situational spaces and places where such transformative learning has been actively enabled. We have nomadically mobilised our pedagogical praxis and exploratory design projects through a variety of local contexts and found rich learning to have taken place in real-world places and in-between spaces when journeying from place to place. By "extending the learning environment" (Yee et al., 2019, p. 14) and moving beyond the mediating institutional normativity of city, university, campus, studio and course we have sought alternative spatiotemporal situations for learning.

For design students exploring their nascent roles as sustainable design practitioners, these are situations with the "capacity to provoke new relations" (Tironi, 2018, p. 294). Most importantly, these are situations where a student's emergent ontological state of "being 'in the presence of'" (p. 294) and negotiation around the values of others, can enable and activate crucial dispositional awareness of expanded and sustainable design literacies. Being in this way balances what is emergent through relational ontologies with systems of thought and "epistemologies (operative ways of knowing and thinking that frame people's perception of and interaction with the world)" (Sterling, 2010, p. 520).

5.2.1 Deterritorialising and decentering

Nomadism in design pedagogy framed this way is about seeking out the places and situations, often anomalous and unexpected, along with the in-between transitions that are productive of eventful learning spaces that enable what Fendler describes as a "double movement" (2015, p. 788). In this double movement, a student's habitual learning practices are displaced and deterritorialised, and learning is its own form of displacement (a crossing of thresholds) involving a shift in worldview and a new understanding of their agentive designing selves.

In following this argument, I build on Fendler's notion of deterritorialisation, "which is the very disruption that allows learning to take place" (2015, p. 792) and venture to add that 'decentering the human' is a key part of challenging design students in their learning journey towards becoming sustainable designers. In this, I refer to the critical posthumanist perspective of placing the human in dynamic relation with our natural biosphere, rather than the enduring modernist view of an anthropocentric position that is ecologically separate.

In terms of a nomadic design pedagogy, this involves engaging with hidden power dynamics at play in design and in the learning environments we create. Drawing design students into relational relations in situations with others and their surroundings in a mode of participatory parity through iterative dialogue, intra-actions, and experiment opens up and interrogates territorial notions of who designs, as well as where and how designing happens.

5.2.2 Reterritorialising a new assemblage of dispositions

However, for meaningful transformational learning to be dynamic and productive, a decentering shift that unsettles a design student's worldview must have a reterritorialising effect, enabling of "a refunctioning of a territory" as an emergent assemblage characterised by new means of expression and new behaviour (Parr, 2010, p. 18). Parr, in *The Deleuze Dictionary*, emphasises that Deleuze's concept of deterritorialisation and reterritorialisation is not another dualism but rather a means of finding "between the terms…whether they are two or more, a narrow gorge like a border or a frontier which will turn the set into a multiplicity, independently of the number of parts" (Deleuze as cited in Parr, 2010, p. 20). In my use of the Deleuzian notion of an emergent assemblage of new potentials generated through such a refunctioning of territory for design students, I seek to augment and connect the concept of transformative learning with nomadic pedagogy and its attention to hidden power dynamics and multiple agencies in real-world socio-ecological settings.

Without an iterative crossing of liminal thresholds that involve movements of deterritorialising and reterritorialising student agency in relation to the wicked problems of our times, there can be no true transformation of the student's sense of agency in relation to others. Transformational learning is inherently a process of transition. Such transition involves speculatively opening up alternatives to current modes of design education and creating learning spaces conducive for the development of ecological, futures-oriented literacies and dispositions. Transformational learning is defined as having a profound effect for students, such that their conceptual schema or worldview is irreversibly transformed and a changed way of knowing and use of discourse becomes evident (Mezirow, 1990; Meyer et al., 2010).

I propose that a nomadic design pedagogy enables and supports students as they move through liminal learning spaces that bring about a changed way of knowing when problem-solving with design. This entails a student exercising design literacy agility that pivots on cycles of deterritorialising and "[un]learning" (Kaiser & Nash, 2015, p. 1619), the individualistic growth-oriented status quo, and reterritorialising their agentive selves so that shared agency is emergent through intra-actions with a wider set of variable potentialities. These iterative cycles require a design educator to be "good company at the edge" with students (Berger, 2004, p. 346), helping them recognise liminal edges as they journey through spaces where their learning experience is shaped by a more dynamic set of variable contextual situations than what prevails in orthodox design courses. In this way, an assemblage of experience plays out for a student that is ideally innovative and productive of "a new reality, by making numerous, often unexpected, connections" (Parr, 2010, p. 19).

Support is key here for students to prevent them from becoming stuck in a liminal space, remaining in a perpetual cycle governed by the prevailing status quo in design. Carefully directed support in various forms enables students to negotiate their way through the sticky situations that present in the strange new learning situations that long-term sustainable design practice will demand. However, it must be said that support in these terms must not be overt and may at times need to be backgrounded to allow for inventive possibilities to flourish. I discuss this in more detail in section 5.4.2 of this chapter and further when addressing more broadly the implications of this pedagogical approach in Chapter 6.

Additionally, I argue that enabling a student's exploration of new learning territories is dependent on learning that is grounded in "feeling good and doing good" (Norrish, Williams, O'Connor, & Robinson, 2013, p. 149). Firstly, this has to do with meaning-making and the effect of affect on a student's developing sense of identity. As students (re)discover their own agentive designing selves as a constituent part of a constantly emergent world shaped by design, there is evidence in my research that the feeling of how this happens becomes a significant enabler of a changed way of thinking about their role as sustainable designers (see section 5.4.4 in this chapter). This goes to the concept of how a student's learning might be conceived affirmatively as thriving and wellbeing that is nurtured within pedagogical environments. These are environments where a student might flourish through feeling good about how to transition from past and current states while adapting to difficult emotions and experiences.

Secondly, doing good has to do with skills and knowledge that will help students thrive in the face of design challenges involving "ecosocial" (Lemke, 2000, p. 273) situations, where "pro-social behaviours and choices that benefit others and the wider community" (Norrish et al., 2013, p. 149) include the ecosystem of earthly conditions and limitations. These aspects of affect in learning highlight the notion of 'wellbeing' as a crucial factor in transformative learning, especially in how feelings of positive purpose around contributing meaningfully to society and the environment can be enabling of sustainable dispositions conducive for life-long learning. Here I refer to behaviour and capacity to enact sustainable design practice that can be sustained for a design practitioners in the longer course of their lives.

To reiterate, I have used the term 'dispositions' throughout this study to describe behaviours and capacities in design students that assist their processes of becoming agentive, confident and motivated to explore the use of their design literacy skills more broadly, and in more ecologically oriented ways. Such dispositions have emerged during and after project cases where students' habitual learning practices have been displaced and deterritorialised, where their learning became its own form of displacement involving shifts in worldview and a new understanding of their agentive designing selves. Importantly, and to the premise of this study, we have seen how the emergence of behavioural dispositions for students in certain pedagogical situations have aligned with design literacies that can lead to "new capacities to act and create ecologically viable ways of living over time" (Boehnert, 2018, Kindle location 1773).

In this chapter so far, I have (re)presented a synthesis of the core conceptual framings already mentioned in this study so as to gradually lift up leading aspects of my argument. In the next section, I advance this argument by realigning with my research methodology and draw on the concept of 'diffracting' as a means of revealing the microdynamics of our pedagogy and to describe what is going on in the learning situations that were enabled through the project cases making up this study.

5.3 A diffracting analysis – noticing differences that matter

In my Literature Review and Methods chapters, I introduced Barad's (2007) concept of 'diffracting' as a methodological 'cut' to open up and illuminate the emergent learning phenomena that are enabled through experimental pedagogy in this case-based study. This offers a methodological approach that is relevant to both my research and my pedagogical philosophy, as being a composer and active participant in the co-creation of pedagogical praxis I see my pedagogy as always having a research(ing) stance that is attentive to the micro-dynamics at play. Essentially, I am advocating for a process of learning about learning that acknowledges our diffracting effect as actors in a processual and participatory pedagogy. In this way, we aim to display the "intricate patterns and reverberations [and] all the vibrancy, richness, and vitality" (Barad, 2007, p. 30) inherent in such praxis.

I now take up this concept as a compelling means of discussing in the next sections, our varied and variable "practices of knowing as they are enacted in the materiality of the world, in a state of interdependence with other parts of the world" (Bozalek & Zembylas, 2016, p. 8). This conceptual language is evocative when describing our pedagogical 'practices of knowing' that operate from a 'situational strategy' perspective. That is, this applies to curated situations where students and educators "develop[ed] strategies for reading the new and unfamiliar" (Cope & Kalantzis, 2009, p. 177), learning to "think, operate and ultimately design in other ways and by other means" (Farías & Sánchez Criado, 2018, p. 28). These are situations where knowledge was generated through enacted processes that are tacit within a student's experience, yet become explicit through performative dimensions that enable co-created outcomes. Lastly, these are situations where our exercising of pedagogical attentiveness enabled us as educators and students, to explore together matters of knowing in a process of relating emergent design dispositions to design knowledge (Barnett & Coate, 2005, p. 107).

Diffracting is not merely about tangling or multiplying differences, but is "about the entangled nature of *differences that matter*" (Barad, 2007, p. 381, emphasis added). I argue that a nomadic, relational and diffracting design pedagogy that illuminates layered differences that matter while it is enacted by all stakeholders in a situation, becomes a viable and ethical means of ensuring that the emergent learning and dispositions are shaped by material-discursive conversations that really do matter in context-sensitive situations.

By diffractively showing up emergent dispositions and "sensibilities as experimental things, that is, elements of situations that can be experienced and experimented with" (Farías & Sánchez Criado, 2018, p. 28) we are able to interrogate what matters in relational terms, and how our design pedagogy might adjust accordingly. In opening up a wider scope for agency, we are faced with "layers upon layers of difference" and "agencies in the massively plural" (Cope & Kalantzis, 2009, p. 173). These are complex and contested spaces where ethico-onto-epistemological questions become entangled, where a diffracting approach highlights relational agency and the "entangled structure of the changing and contingent ontology of world" (Barad, 2007, p. 73) that long-term sustainable design must happen within if it is to be futuring and flourishing for all.

Relational agency has to do with "agentic action with others" (Edwards, 2007, p. 3) and, more importantly for this study, the concept of distributed and collaborative intelligence to include multiple others, including the non-human and natural world. Here, the use of Barad's (2007) term, "agential realism" (p. 26) further articulates such agentic action as intelligibility understood to be "an ontological performance of the world in its ongoing articulation" where "knowing is not a bounded or closed practice but an ongoing performance of the world" (p. 149). In Barad's words, in "an agential realist account, discursive practices are not human-based activities but

specific material (re)configurings of the world through which boundaries, properties, and meanings are differentially enacted" (2007, p. 183). This is a core idea in my study where I extend the concept of performativity into modes that are productive of agency and meaning-making in design learning spaces. In Publication 2 of this thesis, I draw attention to performativity in a particular project case where imaginative design meaning-making was performatively produced in a heterotopian space (Snaddon & Chisin, 2017).

"Design that matters has always been about coming to consensus on what matters" (Dubberly, 2017, p. 5). Dubberly's statement is a political one and goes straight to the issue of what sustainable design education should be concerned with. This opens up questions of ethics and caring for the wellbeing of all, and how design research and practice might become supportive of the flourishing and ecological sustainment of humans and the non-human natural world. In first noticing, and secondly attending carefully to what matters during pedagogical pivot points and iterative movement through liminal learning phases, educators and students stand a better chance of collaboratively negotiating, and exercising sustainable design dispositions and multiliteracies that materialise in the process. These variable and varied literacies that are pedagogically enabled are co-constituted within and through "sticky" (Orr & Shreeve, 2018, p. 23) context-sensitive situations. They manifest where agency is dynamically distributed (who and what has voice), and in where, when and how design learning happens.

Throughout this thesis and the published outcomes, I have lifted up and articulated an assemblage of emergent student dispositions as they relate to specific situations and project case contexts. These are summarised below as a means of highlighting that the overall behavioural qualities of these dispositions are ones of:

1. Resilience, adaptability, and responsiveness to uncertainty
2. Generosity of spirit and empathic understanding within varied contexts
3. Thoughtfulness, humility and ethical awareness
4. Wellbeing, feeling good about doing good which in turn is motivational
5. Engagement through collaborative intelligence and distributed design agency
6. Curiosity and confidence to take action
7. Awareness of self in relation to others
8. Abductive and abstract knowledge creation.

I propose that becoming design literate in ways that are considerate of long-term sustainable flourishing for all can be broadly described as involving the tempering of dispositions that display the above qualities. Crucial to my argument is that a diffracting approach to pedagogy reveals how developing such dispositions in students enhances currently ill-defined ecological design literacies. Development of an expanded spectrum of literacies will be vital for design students, enabling new capacities to act as they learn how to "design in sync with the ecological context that sustains us" (Boehnert, 2018, Kindle location 4143). Boehnert (2018) proposes that ecological literacy "itself can be understood as an emergent phenomenon" (Kindle location 2294). This she argues is due to how relational, systemic and critical thinking are emergent processes emanating out of response strategies to the complex and wicked problems of our times. In brief, ecological literacies as they relate more specifically to design are "systems aware, enabling, collaborative and aligned with the patterns and processes of nature" (Kindle location 2097). I will expand on the notion of ecological design literacies in section 5.4.4, where I reference our experimental pedagogy that specifically engages student design project work in close relation with patterns and processes of nature.

In the next section, and as a means of building the argument central to this study, I will further connect theoretical perspectives with evidence of emergent designing dispositions and literacies as elements of our experimental pedagogical situations. To do this I will draw on the four case-oriented thematics previously introduced in the Methods chapter, and abstract my core arguments accordingly. In so doing, this will offer a diffractive reading of data insights and core theoretical concepts through one another, allowing a nuanced and compelling argument to emerge, which in turn frames my point of view on pedagogy that is oriented towards long-term sustainable futures.

5.4 Defining my argument through four thematic pathways

In our pedagogical attempts at blurring boundaries and introducing "hybrid, non-binary, relational modes of thinking about being in the world" (Forlano, 2017, p. 17), we have explored a diffracting process of living inquiry that many scholars have written about theoretically. By researching into this enactment of pedagogical praxis I am contributing to the important translation work and locally specific developmental association of practice needed to connect up with such theoretical approaches. It is this processual offering that constitutes the generation of new knowledge that my thesis articulates.

In this section, I pace and place the argument according to how the data have emerged through four key thematics that span this study. In this, I present what have I come to know, and how this has unfolded in a process of what Mazzei (2014) describes as "reading-the-data-while-thinking-the-theory" (p. 743). Consequently, the case-rich material from which the data have been drawn and developed into published research outcomes can be thematised along four pathways:

1. A journey-based nomadic pedagogy, with a focus on story-gathering and climate change (a webtext in an online journal explores this)
2. Design pedagogy located in a heterotopic space with performative storytelling (a conference paper elaborates on this)
3. Agentive, participatory urban learning ecologies (two journal articles follow this theme)
4. Relating design agency and learning identity through a wider ecological system (a paper presented at an international distributed conference offers an analysis of this).

These interconnected thematic pathways are defined by the exploratory design project cases under review and are further explicated conceptually and analytically as a result of the subsequent research process and this exegesis. A research-through-design process becomes visible here as it is through our experimental design of projects, the associated pedagogy, and design processes/techniques/tools that we are engaging in the designerly process and pedagogical praxis of enacting, making and illuminating the emergent learning phenomena.

5.4.1 Theme 1: A journey-based nomadic pedagogy with a focus on story-gathering and climate change

My first case-oriented thematic deals with what has emerged as a core pedagogical theme throughout this research, one of 'nomadic shifts' in terms of learning and design process. Publication 1 in this PhD thesis (Snaddon et al., 2017) proposed that journeying and physically relocating design students and educators beyond given frames for learning, open up complex and variable context-sensitive possibilities while also enabling a reimagining of location as "a temporal and spatial site of co-production of the subject" (Braidotti, 2006, p. 29).

The concept of nomadism has therefore been a highly relevant one in articulating what our design pedagogy sought to bring about. That is, to bring design student's learning into real-world settings where they might experience "qualitatively different degrees of access and entitlement to power" (Braidotti, 2006, p. 79), and learn how to relate deeply to and reflect on these experiences as young designers. For example, by moving the design project (and its aims of developing designerly strategies to mitigate against climate change) through local communities using a story-gathering artefact in the form of a tigerfish, students engaged with stories about local community hardships in relation to continued contest about material resources such as land and water. This was the setting for the design project to evolve as we problematised, responded to, and iterated the conceptual, material, design, and logistical aspects of the task.

In pedagogically expanding a situational space for design learning oriented towards alternative modes and methods of engendering sustainability awareness, we co-created with students a playful and *speculative* means of engaging with local knowledge to do with the very serious issue of climate change. The fish, as a designed artefact of mediation and not merely a material product, became a means of brokering engagement between a varied group of students, educators, and local community members. For the travelling group, positioning themselves through stories of climate change revealed how beliefs, varying perspectives, and social norms shape identity and the way we understand the world around us. This performative and communicative process brought about transformative learning for some as they made meaning of their experience and questioned assumptions based on prior experience and views (Cranton, 2016).

Through these material-discursive entanglements and engagements, participants were able to evoke a rich narrative that could be communicated to wider audiences. Students located themselves and their learning gradually over time in this project as it moved sites, gathering momentum, stories, and ciphers, eventually culminating in a shared exposition of their collaborative expertise at a participatory design conference in Windhoek, Namibia. The fish (dubbed Fiscilla) would also gather momentum as a persona serving to further mediate and blur distinctions between agents and artefacts, and connect up this project with another in the following year in a different location.

Figure 8. Left: Children engaging with Fiscilla at one of the sites of story gathering and community interaction. Image: Bruce Snaddon. Right: The tigerfish on the move. Image: Mathew Rosmarin.

Students' voices evoked transformational learning as it unfolded in this journey. Hafizah, a graphic design student commented that "every time something happened the more real this experience started becoming" (2016). Stehan, an industrial design student added, "when we met

with people from different communities and we started engaging with them and hearing their stories and getting to know their context – it almost became more three-dimensional" (2016). A situated and experiential reality check of this kind placed students in situations where they had to draw on underdeveloped capacities within themselves and the group. Being resilient and resourceful in the face of uncertainty led Khanya, an industrial design student to remark, "you've got to make do with what's in front of you, you can't leave, you can't turn away… what was remarkable was how much creativity came from that, just on the fly… we have a problem, how do we fix the problem… that for me was one of the key things on that trip" (2016). Learning to deal with 'what was in front of them' in varied settings as the project unfolded, offered up opportunities for storied understandings of people coping with climate change to impact the project as living inquiry. Key here was an engendered and shared sense of respect and responsibility; towards each other within the travelling group, the communities we engaged with, the project aims, and ultimately for our planet.

Here I lift out the argument that, as educators, we need to evolve hybridised modes for dynamic engagement of our students' learning regarding the challenge of sustainability in design education. I argue that a pedagogy of diffraction speculatively opens out and highlights hybrid entanglements of material-discursive phenomena through itinerant and porous learning spaces that:

> 1. bring matter and ethical matterings into a meaningful conversation with one another within contested real-world contexts,
> 2. challenge a student's own location and co-constituted participation in ecologies of knowledge production,
> 3. enable relational ontologies of shared knowing for students in a developmental process of becoming designers who are aware of contingent intra-actions with others as they are enacted, and
> 4. are conducive to participatory parity, where all stakeholders in a learning situation render each other capable through carefully empathic listening, observing and reflective behaviours.

In summary and to abstract a core argument from this, it is in mobilising and materialising the pedagogical forces at play in varied context-sensitive situations that educators can become aware of, be attentive to, and work with the emergent transformative learning phenomena as it happens for students.

5.4.2 Theme 2: Design pedagogy located in a heterotopic space with performative storytelling

I now use my second case-oriented thematic as a vehicle to lift up my argument concerning the 'performative' aspects of design learning as meaning making in a 'heterotopic' context. By using the term heterotopic in relation to pedagogy I am referring to experimental learning spaces, a world within a world that enables "a form of critical practice and reflexivity that is attuned to the complexity of spatial production and to potential enactments of alternative spaces" (Beyes & Michels, 2011, p. 522). In publication 2 (Snaddon & Chisin, 2017) I inquire into a project case that involved travelling beyond the bounds of campus and studio to a place where limited physical resources and the guiding principles of a creative festival community both constrained and liberated design possibilities to do with the communication of climate change and water scarcity. In moving away from hidden power structures our pedagogical kinetics mobilised a performative enactment of meaning making in an eventful space, where students were freed-up from the hegemony of design solutioning for a consumerist world (Fendler, 2013; Tonkinwise,

2013). By immersing design students in the semi-desert context of the Afrikaburn festival, they had to self-organise as a multi-disciplinary group and actively cultivate their "response-ability" (Haraway, 2016, p. 12) through a heightened awareness of intra-actions between self and others, including the environment (Braidotti, 2013).

As students embraced the creative possibilities of the Afrikaburn festival, we saw how a pedagogical shift from the usual power hierarchies in design process and design education allowed a democratised space. Such a space became conducive for sociocultural and ecosocial processes of juxtaposition, overlap, and continuity, where a flattened yet dynamic enabling of relational ontological lenses magnified epistemological depth. The egalitarian quality of the creative festival space, where every participant has to be self-sufficient for life in the desert with no taps and no money in a gifting economy was a suitable setting for our project, with its similar principles of self-organisation, no grading, and performative offering. Fiscilla the fish from our earlier project now shifted shape to become the centrepiece of an ecological message portraying the indispensable role of water for the survival of all species. The student group further developed what the previous travelling group in Namibia had achieved the year before with the fish as a story-gathering and -telling artefact, and created an installation that would draw festival-goers into a performative space where the story of water would be communicated.

Working as designers in the relatively freed-up space of the art and music festival drew out an expanded array of dispositions in students. They found liberation in seeing themselves differently (dressed up as they were to suit the theme of 'we are water') and interacting with the festival community differently than with clients (real or hypothetical). A performative element to their learning coaxed out capacities of play, experimentation, and resilience in the face of the deserts constraints and festival opportunities. For example, ludic play inherent in the "work of the collectivity in performing symbolic actions" (Turner, 1982, p. 32) became a factor as some students, in not putting their intention into words simply used a piece of shimmering water-like fabric to engage with other festival participants in a playful conversation. In pedagogical terms, the heterotopian and liminal space provided the opportunity for this to happen, a pocket in time where the impromptu visual spectacle could be marvelled at.

Figure 9. Students using water-like fabric to symbolically perform the flow of water in the arid environment were surprised by the playful intra-actions this enabled within the festival setting. Their performative enactment had not been pre-conceived, yet students openly explored the emergent intra-actions afforded by the space, the participants and the notion that we are water. Image: Troy Davies.

This instance supports my argument that a diffracting pedagogy can open up and enable multiple modalities for design conversation and learning, rendering students capable as they engage in discursive value negotiation through a more exploratory and playful design process. A pedagogy of "collective creative action" (Binder et al., 2011, p. 115) can be a powerful means of tackling the complex issue of climate change and the design literacies needed to broach the subject. In this way, students experiment with modes and means of negotiating and translating sustainable "values into tangible experiences for all" (Tunstall, 2013, p. 238). As shared values emerged through performative action, doing became the "centrepiece of learning" (Fullan & Scott, 2014, p. 5). Material participation in the form of designing an installation as a material setting or environment invited the festival public to act in relation to the issue of climate change (Marres, 2012).

Again, in articulating my argument, I refer back to student reflections leading to data insights that are revealing of learning experience to do with a pedagogy of performativity in a heterotopic space. Lizanne, an industrial design student, remarked that with less competitiveness amongst students there was no "platform to be better or for other people to be worse, you just brought what you had and that was enough" (2017). Participants not only found their place within the teamwork but also became aware of their own emergent agentive selves. Khanyiso, a pre-diploma student expressed how it "triggered another inner self that I didn't know about…" (2017). Lizanne, remarking on how the group drew on its diversity to mutually negotiate in a more generous way said, "If you put [students] in such a different environment they open up their network and they start sharing information which otherwise would have been kept to themselves… they open up to you in this weird caring, empathic way, that you aren't used to" (2017). Mikhail, an industrial design student, described the value of self-organising and having to make decisions on the fly as "bumping heads" and "…dancing around a bit [before] we fell into our positions" (2017). Even though a careful pre-festival phase had involved planning, conceptualising and making, the physical context of the desert festival ultimately presented the key challenges that needed to be addressed quickly. This allowed for students to step into the problem space and mutually perform a process of enacting a way out of the difficulty and a way in to the next phase of design. For example, in adjusting to a flattened hierarchy, inter-disciplinary communication and materials shortages students had to quickly adapt their design process and techniques to the situation as it evolved. They soon realised that any and all decisions made would either make or break the success of the planned installation and the 'world' of their creation.

Core to this thematic of a performative enactment of sustainability-oriented design learning is the argument that a pedagogy that enables this should:

> 1. freely encourage exploratory ways for students to enact a collaborative design process that draws on and makes contextually appropriate values tangible for all participants,
> 2. deterritorialise and democratise power relations as a counter to hegemonic value impositions that are external to a design project context,
> 3. give credence to the biographies of all participants and seek to bring design students' sociocultural learning ecologies in step with the environmental ecology, and
> 4. expose and empower emergent ontological relations between design students and a co-created world of their making.

In summary, a pedagogical and spatio-temporal shift in register away from hegemonic power structures allows for creatively performative enactment and translation of sustainable values through tangible design-led intra-actions and making based on needs arising within a particular context. Our role as design educators in this fluid space embodied the etymological root meaning

of the word pedagogy – we accompanied the students while the curated situation became their 'teacher'. We made ourselves vulnerable, mirroring the learning processes we expected our students to experience (Leibowitz et al., 2010). In holding the learning space lightly, we took care in allowing for dispositions of self-organising to unfold for the student group. This resonates with Miller's (2018) notion of futures literacies, whereby the "context-sensitive collective intelligence process" (p. 16) that evolved for the students and others, enabled inventive possibilities within the design project space. Students experienced a heterotopian and socioculturally liminal space in a remote natural place, where an expanded set of design literacies could develop in synergy with the festival principles of radical inclusion, tolerance, respect, sharing and zero environmental impact. In this way, students got to explore alternative ways of being and communicating as designers, in a liminal space where the "seeds of cultural transformation" (Turner, 1974, p. 76) might be sown and nurtured.

5.4.3 Theme 3: Agentive, participatory urban learning ecologies

Moving from a desert heterotopia back into the gritty reality of the city, the third thematic in this research is one of pedagogy that seeks to unsettle the known and given, exploring ways to expose students to the futuring potential of design by offering alternative future visions, critiques and a reimagining of the city. This thematic is explored in two published articles where colleagues and I expand on the concept of 'learning ecologies' to explore socioculturally mediated and networked learning within seven urban project cases in South Africa and Norway (see Morrison, Erstad, et al., 2019; Snaddon et al., 2019).

Common to these publications and varied academic and research contexts is a pedagogical approach that explores connections between students' own emergent understanding and contextual experiences of learning in and through aspects of the city by way of their own design-based productive inquiry. In these explorations of learning individually and collectively, involving mutual learning partners "across old institutional and organizational borders" (Eikeland, 2012, p. 114), these enlivened processes have shown up new possibilities for design action. In all project cases in this thematic, this is significant for how students became active and productive through processes of meaning-making and exploration of their own and shared agency in relation to local communities and public institutions. Such processes may be particularly important for design students as they learn how to play roles that entail escaping socially and politically reinforced norms and shaping different futures (Braidotti, 2006; Costandius & Botes, 2018). This is especially pertinent to the South African project cases with their focus on social justice and the student's role as agentive designers operating within such situations of socioeconomic, environmental and political inequality.

In using the concept of learning ecologies to frame a complex and deeply layered field of relations, we explore an ecosystem view on learning that considers distributed agency and resource potentials across the often-siloed territories of academia, business, government, and community. How students play their roles in "micro-ecologies" (Lemke, 1997, p. 2) of situated activities informs how their "identity-in-practice" (p. 3) develops as a result. Here again, similar to the previous thematic, we see a relational and situational space that is transformative not only for the individual knower but reciprocally transforming of the world in which the knower acts, lives and makes meaning.

Student reflections revealed how learning for them became more than an individual act and more of "an interdependent relationship built on trust" (Baumgartner, 2001, p. 19). Simbonge, a town and regional planning student, commented that she saw her involvement as a factor that mobilised the community so that they could be "activists of their own needs and also assisting in

a bottom-up approach in grassrooted communities" (2013). This is significant in that the student sees her own design agency being a factor in enabling the agency of others, to become activists in addressing their own needs. Simbonge added that "it was important to visit the community for understanding their values and their daily activities and routines before anything could be proposed" (2013). This is a time-consuming process where a collaborative learning space should be largely driven by the pace of participant activities rather than city or academic timeframes. Through felt expression and shared emotions, such a process unfolds gradually, making future possibilities visible through performance and dialogue.

The main argument to be lifted through this thematic is that collaborative learning partnerships that meaningfully connect academia with and in public spheres in projects involving pressing societal and environmental needs, can be productive of futuring design dispositions enabled through participatory design pedagogies. Substantive to my argument here is that this is not just about learning alongside one another, it is about knowledge-making that is jointly transformative for all participants being a powerful feedback loop that compels and motivates forward movement for the community of practice. What counts as value and meaning for the co-design group and for the individual student is emergent through dynamic contextual reinvention and intra-action that gives the emergent world its "specific material form" (Barad, 2007, p. 91).

In many of the cases examined we have seen how students' co-learning and co-creating with front-line communities in need of social and material change, evolved collaborative communities of practice that transcended the separate bodies of academia, local community or government. Student agency along with personal identity development became synergistic with evidence of real change in the community of practice and ultimately change in terms of the communities' living conditions. An example of this is the Flamingo Crescent re-blocking project in Cape Town, which is one of the project-cases referred to in Publication 3, an article I co-authored in the *Oxford Review of Education* (Morrison et al., 2019a).

Figure 10. Students engaging with the Flamingo Crescent community members to re-imagine how their informal settlement might be improved for better service delivery and quality of life. Image: Nicholas Pinfold.

The dynamics of learning ecologies entail constant alignment and realignment between personal experience of a student's own competence and an emergent community definition of it through explorations and articulation in use. This intra-action then also serves to infuse and motivate wider learning actions within an ecology of emergent learning practices. Learning facilitated fluidly as an ecology through such intra-action in complex settings enables shifts in student perception away from historically static and given views of marginalised communities represented geographically on maps, towards understanding the socially constructed and hence changeable nature of such places. During a project where students used biomimicry as a lens and methodology to conceive future urban design scenarios inspired and modelled on natural ecosystems, Craig, a graphic design student, remarked on how their careful observation on the streets revealed how "broken systems edged alongside each other without communication… could benefit from one another in well-optimised relationships" (2011). Although this particular project ended with speculative proposals, these became prompts for urban and design activists working and living in the urban context where the project was located to try out and bring some of the student proposals into being. As a relational dynamic involving academia, local business, local government and community, a community of practice emerged that has been part of the transformation of this urban area in Cape Town. Projects like this are incorporated as cases within Publication 4 of this thesis (Snaddon et al., 2019).

In this sense, a conceptual framing of ecologies for learning can be seen to be diffractively revealing of the political and hidden power relations in these context-sensitive design projects. In making these relational dynamics apparent, the possibility for change that can be translated into activities leading to alternate design-infused futures becomes viable.

In summary, I argue that pedagogy that is enabling of such futuring design practices should:

1. lead students into learning opportunities where they engage in and co-create with diverse and dynamically emergent bodies of knowledge
2. engage students face to face with complex situations that embody prevailing social, cultural and political norms and pressures, where student understanding of agentive self in relation to others can be dynamically explored
3. immerse student learning processes within situations where relations of trust, empathy, and collaborative action seek to bring about transformative learning for both students as well as for community participants in a community of practice
4. enable student designers to actively explore their roles in facilitating a dynamic connection between future possibilities and past injustices through present moment actions, and
5. attend to possibilities that are contextually mediated and released: through walking and mapping, speculative questioning and imagining, sketching and visualising, playing with and in time, making and prototyping, communicating and researching.

5.4.4 Theme 4: Relating design agency and learning identity through wider ecological systems

This final thematic highlights the negotiation of self in a societal as well as a wider environmental frame. It draws off design project cases where design students were immersed in varied learning environments, both natural and human-made. In these cases, our pedagogical intent has been to engage students in learning about themselves as responsible designers in systemic relation with the biosphere, and that as designers they are a contributing and constitutive part of the world. Learning that they are in fact part of nature, functioning within the Earth's operating conditions along with the rest of life on this planet has a profoundly enabling effect for design students. An embodied experience of understanding and seeing themselves as networked individuals (socially

and professionally) functioning within an ecosystem (instead of an individualistic egosystem) (re)focuses their ontological lens. In turn, such experience lays a deeper epistemological groundwork for designing sustainably. Design has long been described as being "fundamentally worldview-dependent" (Wahl & Baxter, 2008, p. 75). In this thematic, I draw particular attention to how our exploratory pedagogy has aimed at engendering a more inclusive worldview for design students. Publication 5 in this thesis is an inquiry into learning enabled through such pedagogy and takes the form of a conference paper presented at the 3rd Learning Network on Sustainability international (LeNSin) World Distributed Conference (Snaddon, 2019).

In this thematic, I build on the argument in the previous one that proposes a view on ecologies for learning. Here I expand on how alignment and realignment between personal experience of a student's own design competence and an emergent ecosocial definition of it, can be explored through immersive learning experience in "dynamic relations of proximity" (Braidotti, 2013, p. 29) with multiple others including the non-human natural environment. Importantly, as Lemke (1997) points out in his definition of the term ecosocial, it is not just the principles that govern the flow of matter and energy in all ecosystems, but what these flows mean for us regarding transformational learning – and consequently, what our designing behaviour within a system might be.

In tackling this wicked problem, we have shown in our experimental pedagogy that in starting small and local we have been able to draw students' learning towards meaningful exchanges that empower their emergent designing agency by locating design learning behaviour within a systems view. In coming close to what Barad (2007) describes as an ethico-onto-epistemological approach, we have found that weaving in what is often separated out in traditional design courses to be significant for students as they navigate the contested terrain of sustainable design practice. In this way, we as educators must "create, draw upon and steward collective knowledge resources" (Facer, 2011, p. 103) and processes that challenge students to consider issues of responsibility and accountability for how they act as designers. In taking the time to slowly develop crucial learning capacities of observation, listening, exploration and evaluation, in pedagogically supportive spaces, it becomes possible for these emergent capacities or dispositions to render ecological literacy in design students. By grounding and honing these capacities through design projects that diffuse the human/nature binary within natural environmental situations, it becomes possible to start a conversation with students about systemic connectivity and the question of how design practice might become sustainably aligned.

My position on design pedagogy that achieves this resonates with what Lemke (2002) refers to in his use of the old saying, that it takes a village to raise a child. His reference goes towards how we "become our villages" as we participate in and internalise the diversity of viewpoints and values that "collectively make sense of all that goes on in the community" (p. 34). I believe that in orienting our design pedagogy towards long-term sustainable practice, we need to be more expansive of what is assumed to be 'the village'. A nascent design student's sense making and becoming need to be informed and shaped through curious participation with human and more-than-human ecologies, ones that include plants, buildings, tools, bacteria, designed artefacts, mountains, and trees.

Pedagogical participation of this kind actively seeks to create design learning situations where a student can start to make sense of how life flourishes in the natural ecology, so that deep lessons may be learnt that can inform long-term sustainable design literacies and dispositions. As colleagues and I have focused carefully on what transpires within such learning situations, we have seen how immersive learning experiences have moved students in ways that enabled

dispositions of curiosity, confidence, and action in dealing with complex sociocultural and environmental problems.

In seeking ways to bring about transformative learning experiences for our design students, one such approach has been the introduction of biomimicry into coursework as a framework and lens that offers value not only to their design process but to a student's emergent ontological sense of identity. More than mere mimicry and copying for further human economic gain, biomimesis must and should remind designers of the material and ethical entanglements of which they are a part (Barad, 2007). As already stated above, it is not only the principles of earthly life that govern the flow of matter and energy but what these flows mean for us. Posing such questions moves students beyond "epistemic arrogance of locating knowledge, intelligence and meaning-making in the subject and only in the human subject" (Murris & Bozalek, 2019, p. 3). Looking to nature as a model, mentor and as a measure for how to create products and processes that adapt well to life on earth, is part of a stepped and developmental process of deterritorialising and reterritorialising a student's agentive identity.

Such a pedagogical move is a "way of understanding the world from within and as part of it, as a diffractive methodology requires" (Barad, 2007, p. 88). It is about attending to learning as it crosses thresholds for students, moving through the in-between spaces where "relationality between inside and outside" (Ellsworth, 2005, p. 46) might be meaningfully brought into play. This is interplay and intra-action on many levels that awakens students to the "wisdom of ecological systems" (Burns, 2015, p. 266), where their agentive becoming can be newly understood as the relations that constitute a "relational ontology" (Barad, 2007, p. 93). In Escobar's (2016) words, "things and beings are their relations, they do not exist prior to them" (p. 18). I argue that these are crucial relational states for learning if we are to seriously consider meaningful and transformational learning for design students that breaks with the dominant paradigm of individualism and separation. Something akin to Escobar's (2016) eloquently put concept of "thinking-feeling with the earth" (p. 12) that is found in indigenous communities whose lived worlds are deeply interwoven with the environment.

The point to be made here is that pedagogy that invites design students to inhabit learning spaces that are a dynamic part of the world, can be a vital way of shifting common perceptions that humans merely occupy an inert world that is waiting to be occupied (Ingold, 2011). For design students, the biomimetic process of "abstracting biological strategies into more broadly applicable design principles and implementing them to solve human challenges" (Kennedy, Fecheyr-Lippens, Hsiung, Niewiarowski, & Kolodziej, 2015, p. 67) is epistemically empowering. Learning from natural strategies as exemplars of sustainability at work, shows students inspirational examples to be analysed, abstracted from, and "compared with [design] work in progress" (Carless & Boud, 2018, p. 1321). But even more important, and to the main argument of this study, is the relational ontology awakened for a student through learning opportunities that reveal their enmeshed state within a world in constant flux and becoming.

Biomimetic-inflected pedagogy actively engages with a transitional habitus that enables learning spaces and situations of horizontal overlap between anthropocentric modes of occupying, and systemically responsible modes of inhabiting the earth along with others. In doing this kind of pedagogy we seek enabling ways for students to find themselves in the continuum of rebalancing agency, to recognise the "representational trace" (Cope & Kalantzis, 2009, p. 188) of meaning-making made by others (human and non-human), and to become active catalysts of their own further transformation. I suggest that, in posthumanist terms, such pedagogy "habit(u)ates difference(s) differently" (Thiele, 2014, p. 204).

Figure 11. Through the practice of quiet observation, students reconnect with nature in sensorial and affective ways. Images: Andrea Grant Broom.

As student reflections have attested to their experience of entering a changed state of learning and a shift in consciousness, I now lift up some of their comments as a means to illustrate the points I have made above. Reflecting on the perceived stigma attached to 'being in nature' Tashma, an industrial design student, said that "when you are taken out of the class environment and into nature you let all of that drop… everything is new to you; everyone is on the same level" (2017). This egalitarian space of participatory parity would become a significant means of eroding judgmental behaviour and disciplinary (and other) boundaries, engaging participants in a learning state of heightened awareness. Students learnt how to suspend their usual competitive rush for task completion, listen to each other and also widen their view of where inspiration might come from. Some likened the experience to first-year all over again with its feeling of discomfort and unsettling of assumptions, yet all commented on the value and confidence gained through the use of Biomimicry 3.8 Life's Principles checklist (Biomimicry 3.8, 2013).

For Lizanne, an industrial design student, the biomimetic methods and processes were a catalyst for her creative process. She commented that along with "dreaming and motivation it helped her come up with wild ideas for real world problems" (2017). She also remarked on a strong sense of emotion as part of her learning experience, describing her felt sense of euphoria as similar to 'being in love' as her group shared ideas inspired by the deep questioning inherent in the biomimetic framework. Confidence in this group grew as their transformed sense of design agency gained momentum. Nicolla, a graphic design student, in summing up what she found most enticing about the biomimetic process said that it gave her insight into "how to act like nature but not disrupt it" (2017). In touching back on these student reflections, I aim to briefly reconnect with their articulations of the felt experience of learning that took them out of their previously known and habituated practices of designing, enabling them in Nicolla's words, to become "different kinds of designers" (2017). That is, "*difference in itself* is what is primary here" (Hultman & Lenz Taguchi, 2010, p. 528), where difference is understood as differential becoming of the agentive self. Such transformational differential becoming is what a diffracting design pedagogy can reveal, through learning pathways that are characterised by movement through permeable learning thresholds as students intra-act across social, ecological and other disciplinary boundaries.

In summary, the main argument that emanates from this thematic is supportive of pedagogy that creates space for design students to transform through mutual engagement and intra-action of social learning in relation to the emergent possibilities inherent in nature's strategies. As students experience their emergent design agency and broadened design literacies to be more than socially constructed, they begin to explore an expanded space of design possibility that reconnects and implicates them within a nature-culture continuum. Through immersive learning and exposure to how life, in nature, constantly creates the conditions that are conducive to life (Benyus, 2002), they are challenged to reimagine themselves as designers capable of designing products and services that are conducive for the sustainment of life.

In drawing on and abstracting from natural strategies that are inherently sustainable within the functions of an ecosystem, student agency transforms as an effect of the intra-actions that emerge from the biomimetic processes of modelling, being mentored and evaluating design choices according to nature. Such transformation becomes possible within pedagogically charged spaces where "enactive action locates individual action within the broader context of its consequences" (Sachdev, 2014, p. 438).

These are moments that effectively enable design students to understand and more confidently create their social learning ecologies through collaborative interactions with their design peers, other disciplines, local front-line communities, and natural ecologies. I argue that these pivotal learning moments contribute to ecological literacies and dispositions that are consistent with the skills and agency desired for knowing how to be long-term sustainable designers in a rapidly changing and fragile world.

5.5 Towards an emergent pedagogical framework

In this study, I have investigated a series of design project cases where, as educator-researchers, colleagues and I have worked collaboratively with students in pedagogically charged situations over several years. We have intentionally sought situations with potential for discomfort, discovery, surprise and critical awareness as developmental factors in a design student's nascent state of becoming an ethical and sustainable designer. These contextual spaces and situations for design learning have been characterised by entanglements where we have not shied away from the difficult, sticky situations that designing should be engaged with.

Our process has been experimental, and it is in the method of experiment that we are so very closely bound to design process in our pedagogy. Dubberly (2017) describes designing as not only about making things, but being about "*adding information* to things… building-in what we have learned… designing is learning—a series of experiments, a trial-and-error process directed toward a goal…" (p. 3). Designing in these terms is "knowledge-in-action" (Dubberly, p. 4) through learning, which is an idea that prompts the question, how can designing as learning and learning as designing become sustainable? In my view, a diffracting design pedagogical praxis that is generative, responsive to and productive of knowledge-in-action in context-sensitive learning spaces, is a valuable start in reframing the dominant discourse and practices of design, so that the learning and information that our students build into their designs can be sustainably oriented.

5.5.1 Knowledge-through-enacted-action

I propose that learning to design for long-term sustainability needs an ethico-onto epistemological approach that can be described as 'knowledge-through-enacted-action'. In

devising this composite phrase I draw attention to the intertwining of ethics, knowing, and being through embodied and enactive processes of bringing forth meaning through performative engagement with the world.

Barad's point that "knowing is a matter of part of the world making itself intelligible to another part" (Barad, 2007, p. 185) is central and pivotal to my argument in how sustainable design pedagogy might serve in transitioning towards this dynamic translation of intelligibility. Crucial here is creating the kind of pedagogy that enables dispositions of responsiveness to feedback and decision making within a moment-to-moment unfolding of situations, as well as through slower and longer phases of coming to know differently. Responsiveness to what arises through negotiated dialogue and enacted decision making based on the voice of multiple agencies is arguably a core competence for sustainable design practitioners. Such responsiveness or "feedback literacy" (Carless & Boud, 2018, p. 1315) can be pivotal in making the intelligibility of the world known and visible to design students as they dynamically participate in the challenging process of learning how to bring a more sustainable world into being through their designing.

Here I must emphasise the Baradian (2007) concept, that if "intra-actions reconfigure the possibilities for change[, then]… ethicality is part of the fabric of the world; the call to respond and be responsible is part of what is" (p. 182). This resonates with my argument, that attentiveness to the microdynamics of design pedagogy can create conducive spaces where questions of responsibility and accountability might present themselves, "where each moment is alive with different possibilities for the world's becoming and different reconfigurings of what may yet be possible" (p. 182). Such an intensely futuring and ethical proposition sits well with the overall ethos of the experimental pedagogy that is at the heart of this study.

In the project-cases in this study, we have sought to challenge notions of designers being exterior to the world within which they live and practice and to engage rather with the effects and affect of learning experience that intra-actively enables ethical "opportunities for being" for all participants in any particular project context (Brassett, 2017, p. 4). In this way, students' immersive engagement in "different material-discursive practices produce different material configurings of the world" (Barad, 2007, p. 184). This is key to my main argument based on pedagogical experiment and builds on similar perspectives such as the Deleuzian one developed by Brassett (2017). In this Brassett highlights that such "opportunities for being are immanent to the possible relations according to which they could be manifest[,] and ethics is immanent again to all of this not simply as a reactive reflection on such opportunities, but *an active creation of them too*" (2017, p. 4, emphasis added). Through such opportunities for being within emergent ethical imminence, students explored their newly forming roles in ethical relations with others, designers and non-designers, both human and non-human.

Examples of such relational ontology can be found in this study's project case-work, where outcomes were not fully prescribed prior to deep material-discursive engagement with the agentive forces at play within the various contexts. For example, speculative, performative and ontologically relational design approaches in project contexts ranging from heterotopean situations to real-world inner city and informal settlement contexts meant students engaged with processes of change in their learning, and meaning making. They also experienced first-hand how their co-created and tangible interventions affected behaviours and lives through story gathering and telling, ultimately enabling new ways of thinking by doing (Marenko & Brassett, 2015). Learning how to dance (Meadows, 1999) with emergent responses and opportunities, and ultimately learning how to influence them (Miller, 2018) are enacted qualities of a diffracting pedagogical praxis that enables students' learning dispositions of resilient coping with complexity and difference as it played out. Within such an agentive mode of knowing, doing and being it

becomes possible for design students to engage and intra-act as designers in the generative and "momentary coalescence of future possibilities" as they materialise in the moment (Marenko & Brassett, 2015, p. 6).

This notion of the ongoing ebb and flow of agency so conceived leads well into the final section in this chapter where I propose a navigational framework for design pedagogy praxis in transition towards long-term sustainable design practice.

5.5.2 A pedagogical framework emerges

In this chapter, I have consolidated the core arguments that have emerged through the four major thematics in this study and landed on a point of view that articulates a response to the research questions guiding this study.

By coupling diffracting as process back to nomadic design pedagogy in ways that relate to the research questions driving this thesis, I draw attention to my main argument that has been developed in this exegesis. In this, I propose that developing sustainable dispositions for design students requires a pedagogy of nomadism that is 'diffractively attentive' to hidden power dynamics and multiple agencies in real-world socio-ecological settings. In focusing less on narrow design disciplinary and outcomes-driven approaches, the relationship between power and knowledge becomes apparent, making it possible to address and challenge "interests that support 'business as usual'" (Boehnert, 2013, p. 11). By being diffractively attentive I mean an attentiveness towards generative intra-actions and emergent relational dynamics between multiple actors in context-sensitive project situations, where designerly agency is attributed to human and non-human actors. In this regard, diffracting as process relates to being attentive to anomalies, serendipity, and strange collisions arising through the pedagogical apparatus of nomadism. That is, pedagogical nomadism set in motion by design educators, and given momentum through ongoing intra-action within ecologies for learning, can enable an unfolding of generative possibilities for redirected and long-term sustainable design practice.

In the next sections, I propose an integrated pedagogical framework for what I call a 'diffracting design pedagogy', comprising a set of four mutually reinforcing modalities. In connecting up theoretical perspectives with new knowledge gleaned from the design project cases in this study, these modalities are part of the pragmatic contribution resulting from this exegesis and are proffered as navigational principles that can potentially afford design educators an exciting and useful mode of designerly 'diffracting-in-action'. In coining this term, I adjust the well-known Schönian (1988) term, reflection-in-action to highlight the necessarily entangled and co-constitutive nature of doing sustainable design. I offer this concept of diffracting-in-action as a key idea and outcome of this exegesis and as an expansive means of describing a pedagogical praxis based on action and diffraction.

Following Lury (2018), I use the gerund form diffract*ing* here intentionally in its active present tense form that functions as a noun, and as a way of highlighting the notion of diffracting as constitutive of an assemblage of interdisciplinary methods that can potentially enable "interruptions of the (historical) present" (p. 3). This resonates well with the main premise of my thesis and inquiry into the creation of pedagogical situations that were empowered "with the capacity to provoke new relations" (Tironi, 2018, p. 294).
Diffracting in this sense is first, an intra-active mode that potentially allows for the release and realisation of inherent potentials in such settings and situations. That is, through the diffracting effects of interferences such as de- and re-territorialisation and positive engagement with multiple agencies that bring forth and release new possibilities for action, such an approach

strengthens student dispositions and the potential realisation of long-term sustainable and perhaps regenerative design practice.

Secondly, such an attentive mode of being and caring that heightens awareness of the effects of our conjoint behavior. These are effects and learning phenomena that are enabled through design pedagogies of sensitive contextual immersion, and speculative and performative making for processes that open up a dialogue concerning questions of social and ecological justice. This entails educators and students acting together in varied contexts of "situated, local accomplishment involving diverse and multiple actors" (Kimbell, 2012, p. 129).

A 'diffracting design pedagogy', as I propose it, is therefore a dynamic and creative means of exploring a continuous working process and pedagogical praxis of bringing forth learning spaces that are characterised by the following modalities:

1) Moving nomadically towards pedagogically charged contexts and situations where students can learn to think, anticipate, operate and design differently in relation to complex contemporary problems. This is not proposed as an 'either-or' scenario in relation to traditional design curricula, rather it is an 'and' proposition whereby the pedagogical project is mobilised towards situations where authentic social and environmental needs of the present can be seen and felt. These are varied and permeable learning spaces where students come into contact with new knowledge and agencies, where new literacies and capacities bring about the transformation of a student's ontological and epistemic subjectivity. Nomadism has an activist stance and goes to the political and locative aspects of learning, understood as a double movement where students' habitual learning practices are displaced and deterritorialised, and their learning is its own form of displacement involving a shift in worldview and a new understanding of their agentive designing selves in relation to such a shift.

Learning contexts such as these have a broadened scope and depth where the design-based project is established to reveal rather than conceal how design is affected by and impacts the multiple power relations of consumer capitalism (Boehnert, 2018). Such contexts decenter the designer and temporarily suspend dominant capitalist logic to allow in new ways of collaborative thinking and acting. New ways involving a sharing and caring economy of ideas and actions that are liberated through enacted design dispositions, that in turn inflect and perturb newly forming literacies that are ecological and relational. This speaks to Tham's (2019) notion of designers needing to develop "epistemological agility" in the face of complexity, where complexity is understood to be distributed across many knowledge holders, and where "knowing in complexity must also be distributed across many ways of knowing, and across multiple senses" (p. 140, Kindle Edition).

2) Creating conducive and generative learning spaces that allow for sustainable design practice to be experimented with and experienced relationally with existing and emergent issues in context-sensitive design projects. These are itinerant and porous learning spaces that allow in previously hidden potentials, the "genius of place" (Hooker, 2017, para. 1) that can be so elusive. This can mean stepping back as educators to reduce the possibility of pre-empting or being seen as overtly engineering a situation. Furthermore, this goes to students decentering themselves as designers in project contexts so as to allow in multiple voices and agency that may have been sidelined and taken for granted. This aligns with a critical posthumanism perspective of not prescriptively defining what comes before, thereby opening up a condition of possibility that "participates in its generation" (Brassett & Marenko, 2015, p. 22). Such an egalitarian space will be marked by participatory parity, where the principle of equality applies in terms of rights and opportunities for all within a context. Such a pedagogical move exposes hegemonic power

structures inherent in dominant "ethical, ontological and epistemological assumptions of subjectivity" (Gray van Heerden, 2017, p. 8).

A significant aspect of this is to engage design learning in situations that truly "reveal ecological circumstances and nurture ecological ways of knowing" (Boehnert, 2018, p. 17). An example of this can be seen in project cases where bio-thinking and a biomimetic methodology was introduced into design projects and course work to reveal authentic sustainability principles at play and to invite students to reconnect with nature in sensorial and affective ways.

3) Exploring performative making of things and meanings, bringing matter and ethical matterings into meaningful conversation with one another. Emergent learning phenomena that arise through reciprocal intra-actions are tried and tested within the scope of the design challenge at hand, through designerly techniques of speculative imagining, performative making, prototyping, testing, and use. Here is the space for making as process and the creation of design artefacts as imaginaries and provocations that enable different thinking, where material-discursive entanglements and engagements of "design and making, form and matter, as well as minds and things are interdependent" (Gürsoy, 2016, p. 855).

In terms of their applied learning, students' forward movement is given dynamic momentum as newly tempered dispositions offer opportunities of becoming ethically and empathically agentive, confident and motivated to explore the use of their expanded design literacy and skills in more innovative ways. This is evident, for example, in project-cases in this thesis where students designed and built speculative prototypes for and with varied communities concerning matters of social and environmental change. In these ways "processes of formation and flows of matter" (Gürsoy, 2016, p. 852) were engaged with collaboratively, as an invitation for all to participate in alternative design mediations relating to social and environmental concern.

4) Attending to the effects of difference as learning phenomena emerge during modes 1, 2 and 3 – noticing how an engendered dispositional shift for students becomes part of a new mix of situational materials with which participants can converse and work. This is the intensive phase for educators to nurture emergent learning phenomena, to pay attention to how capacities in students emerge that are valuable and productive of choices and actions that can yield design decisions that are ethical and sustainable in the long-term. Significantly for students, these are moments of intra-action where their ontological becoming and agentive identity is shaped and shapes up in relation to varied settings and stakeholders, with humans and non-humans in the "world given and the world of our own creation" (Fry, 2012, p. 3). Such dispositional emergence can engender the long-term sustainable literacies necessary for bringing about a world that, in its differential becoming, has been ecologically and sustainably co-created. As design students enact participatory processes of intra-action along with multiple agencies in design project contexts, they experience and comprehend their emergent relational ontology as constitutive of the differential becoming of the world within which they are participatory actors.

In my view, a design process framed in these terms stands a good chance of yielding sustainable products and services that are actually needed and that won't impact negatively on the wellbeing of all living things. However, such potential can only really be harnessed in situations of trust and hope, where the co-creation of the previously mentioned space and time (in modes 1 and 2) is genuinely conducive and open to learning with people and within natural environments "facing oppressions and hardships" (Boehnert, 2018, Kindle location 655).

The above four modalities are framed as a response to the main research question in this thesis, which is, how might current design pedagogy transition toward emerging and complex contexts

through curricular experimentation that is oriented towards sustainable futures by design? More specifically, these modalities speak to my research sub-questions which focus my inquiry towards what the qualities of an immersive pedagogy might be, one where speculative, performative and locative aspects of learning are productive of sustainable design dispositions in students.

5.6 Coming down to earth

So understood, a diffracting design pedagogy framework with the above-mentioned modalities acknowledges the ongoing and demanding work required for a steady transitioning of design education towards long-term sustainability, where "sustainability is not a specifiable target state, but the continuous exploratory pursuit, through open-ended learning, of ways to ensure that life goes on …" (Foster, 2008, p. 145). Furthermore, as I have proposed in this thesis, this requires going beyond current notions of sustainability in design education. This resonates with Du Plessis and Brandon's (2015) point that the purpose of the sustainability paradigm is:

> …not to conserve the status quo, but to strengthen the health, adaptive capacity, and evolutionary potential of the fully integrated global social-ecological system so that it can continue regenerating itself, thereby creating the conditions for a thriving and abundant future – not only for the human species, but for all life. (p. 14)

In this regard, they make the shift towards the term 'regenerative design', which is defined as "a new way of seeing and being in the world" (Du Plessis & Brandon, p. 11). This term holds in my view, as it echoes my main argument for a diffracting design pedagogy that is regenerative in its attentiveness to the relational intra-actions that play out as designers engage in complex project contexts.

Working in this educational way requires some urgency, and may yet enable us as humans to "come down to earth" as Latour (2018, p. 2) has proposed, and become attuned again to the earth as "an actor that reacts and will continue to react to human actions" (p. 41). In this, he is referring to how climate change in our earthly environment is reminding us that the territories we assumed we occupied without impacting on the whole are in fact deeply connected and that the earth as a whole is beginning "to participate in history, to fight back, in short, to concern itself with us" (Latour, p. 41). In the light of climate denial and blinkered ways of thinking about the world, it is now more important than ever that we take affirmative and regenerative steps as design educators towards reconnecting and reaffirming the embedded nature of our living and designing on this earth.

How designers respond and orient themselves to this will characterise what it is to become ecologically and futures literate designers, capable of making the kinds of cognisant, empathic and wise design decisions concerning regenerative sustainability that favour the flourishing of all life systems on earth, rather than an exclusively human subset.

A discussion on the implications and questions relating to the framework proposed above will follow in the last chapter of this exegesis. These I will address in relation to my design faculty, in a South African HEI landscape and more broadly.

6

6 Conclusion

6.1 A pedagogical praxis of experiential, collaborative experiment

The story of modern humankind exhausting the planet's resources is well documented. Yet, we are still faced with climate change denial, resistance to change, rapid economic growth and consumption, an increasing world population, and, most worryingly for upcoming generations of young people, lagging educational approaches that are failing to engage with these challenges in meaningful and action-oriented ways. This concern is especially pertinent for the field of design education if there is to be any transition away from design education and practice merely being caught up in an unquestioning service relationship with a market-driven agenda.

As my thesis has shown, this is a concern that colleagues and I within the design faculty at CPUT and other South African HEIs have engaged with over a number of years. We have had some measure of success at CPUT, we believe, and the thesis presented here is my considered inquiry into the kind of learning that our experimental design projects have enabled. The methodology of our teaching practice and my research resonate with one another in that both are investigatory and inquiring. Our pedagogical praxis has been experiential, collaborative and experimental in trying out modes and methods of enabling learning that supports and facilitates sustainable dispositions in design students and rehearsals for meeting their worlds of work and shaping futures. My research has equally been a journey of sense-making and future-shaping as I have published outcomes in varied forms and platforms to communicate my inquiry.

The aim of this research has been to explicate the collaborative processes that unfolded in exploratory design project-cases, with a focus on how students are learning, reflecting and making meaning of sustainability through immersion in projects located in widely varying situations and contexts. These are situations where the context is understood as fluid and relational, where a design project is placed within such a setting so as to invite possibilities of dynamic and shared interaction for all participants. Moreover, these are contexts that are not bound by the institutional relationships and structures of the university and are rather ones that have an emergent quality through participatory activity in the form of exploratory design practices that are collaborative, speculative, performative, and interdisciplinary.

The findings I have presented have revealed how pivotal moments during students' learning process were found to have effectively shifted dispositions and cultivated attributes of thoughtfulness, self-awareness, resilience, performative adaptability, and relational awareness arising through dynamic engagement within the project situations. These are pedagogical moments that enable design students to engage more confidently in the process of building whole-person learning identities consistent with the skills and agency desired for knowing, acting and being sustainable designers in a transitioning world. It is through such an approach that I

have argued for pedagogy that enables student designers to experience and reflect on their intrinsic connection to a larger whole. This, I suggest, would go a long way towards locating design learning within the bigger systemic picture within which it is embedded and implicated.

In terms of research methodology, I have linked traditional qualitative approaches with a post-qualitative inquiry. Encompassing a diffracting methodology, I have drawn on the experimental design project-cases in this study and read them "together and apart" (Barad, 2007, p. 179) with theory and analysis. I have done so while navigating a new synthesis of understanding with regard to how our pedagogical praxis might enable design-based learning ecologies to sustain relations that are conducive to life and learning. The project-cases which form the basis for my study have been imperfect yet powerful experimental interventions in a process of questioning what design pedagogy for long-term sustainability might entail. A diffracting approach is, therefore, a questioning one, showing up the effects of pedagogical difference, that in an attentive and ongoing process of feedback heuristics might allow for adjustments to pedagogy – a diffracting-in-action so to speak, after Schön.

In this regard, I draw attention here to the research questions driving this study and which have guided my engagement through practice-based research into past project-cases. The main question framing my study has been, how current design pedagogy might transition toward emerging and complex contexts of experience and engagement for design students through designerly curricular experimentation that is oriented towards sustainable futures. In pursuing this question and further sub-questions I have inquired into the effects of our pedagogical difference through project case experiments. Through a diffractive and action research mode of inquiry into the speculative, locative, performative and immersive aspects of our design pedagogy, my study has revealed how student design dispositions arising out of the many learning situations within project-cases have been attuned locally to contextual needs and potentials in surprisingly resilient ways.

6.1.2 A diffracting design pedagogy

In responding to these research questions, in this exegesis, I have presented a diffractively analytical framework comprising four modalities of what I have called a 'diffracting design pedagogy'. In summary, these modalities are framed through a pedagogical praxis of diffracting-in-action and are characterised as modes of:

1) Moving nomadically towards pedagogically charged contexts and situations,
2) Creating conducive and generative learning spaces that allow for sustainable design practice to be experimented with and experienced,
3) Exploring performative making of things and meanings, bringing matter and ethical matterings into meaningful conversation with one another, and
4) Attending to the effects of difference as learning phenomena emerge.

These modalities are presented as a synthesis of propositions developed in all five of my research publications that together make up this exegesis. I offer these four interdependent modes as iterative heuristics and navigational principles that can be planned before, recognised during, and assessed after experimental design projects are carried out. In this way, the praxis of design pedagogy is drawn into a closer relationship with design curriculum. Furthermore, such a pedagogical approach is positioned as a driver of curriculum renewal through a "weaving of [learning] lives within socio-cultural worlds" (Grimmett and Halvorson 2010, p. 248) that situates designers within the bigger systemic picture within which design practice is embedded and implicated.

6.2 Limitations, potentials and implications arising from this study

In considering the limitations, potentials, and implications of this study, I acknowledge that new questions also arise out of this work due to the ongoing nature of my pedagogical praxis and processes of transition within my institution and beyond. These are questions that require further research. For example, further research is needed to follow up on how the proposed framework in this study is being translated and applied within and across design departments at CPUT, what the successes and failures are, and how transitions towards social and environmental justice in design programmes are evolving across the country. I address a number of these issues and implications in these next sections, the purpose of which is to open out a space for further discussions, collaboration, and critique.

6.2.1 Localised nomadism and design pedagogy

A key question in relation to the nomadic pedagogical practices described within this study is whether these kinds of approaches depend on physically relocating students and design projects away from the university campus and studio. My suggestion is that although a radical shift away from the typical studio appears to be beneficial for the changed modes of learning presented, even localised shifts within the university campus grounds and urban surrounds can mobilise these changes. In our experience, as a team of educators and researchers, the simple act of taking students into a nearby field for a project briefing, or into neighbouring areas of urban neglect can deterritorialise power relationships that are often tacitly bound up in traditional studio settings. Nomadism in these terms is about subversion of set conventions, a consciousness-raising that enacts "a creative sort of becoming… a performative gesture that allows for otherwise unlikely encounters and unsuspected sources of interaction, experience and knowledge" (Braidotti, 2014, p. 182).

Such pedagogical kinetics, whereby students and educators move beyond the given frames for learning such as studio briefs in design with pre-determined deliverables, into unknown terrains and territories, can set the scene for ongoing participatory parity throughout the timeframe of design projects. In this way, students are encouraged to play more active and critical roles in their learning activities.

All of the pedagogical qualities discussed in this thesis are achievable in any real-world setting where intent and expectation for all participants are primed for transformative learning to take place. Priming in this sense entails working within situations and settings that can be experientially immersive for students, allow for a multi-disciplinary mix of participants, and enable the needs of the context to emerge without prescriptive process or behaviour on the part of educators. A keen attentiveness on the part of educators is a necessary part of such a process. By this, I mean attentiveness to nuanced behaviours and learning phenomena that present through transformative learning experiences for students, ones that can be explored for any potential qualities that are generative of sustainable design practice.

In this view, and for the project of design pedagogy, nomadism concerns three key 'moves'. First, as described above, a physical and spatial move that situates and immerses learning in a situational context is what sets design learning on a different trajectory. Secondly, nomadic movement for educators - as they enable pedagogy to become more porous and open to alternative flows of agency - entails being attentive to the effect of their presence in co-constructed learning situations. Thirdly, nomadic learning for students concerns ways of developing and embracing movement in their learning experience. This can be described as an attitudinal and "eventful space" (Fendler, 2013, p. 787), where students are encouraged and

motivated to remain open to deterritorialising and reterritorialising movement associated with transformative learning. As such, movement here concerns learning where a "review of basic premises occurs" (Boehnert, 2018, Kindle Location 1854) and is transformative in terms of the "change incurred when subjects enter into unfamiliar territory, in a process of discovery" (Fendler, 2013, p. 787).

6.2.2 Inter- and transdisciplinary hybridity

Further to the notion of movement mentioned above, this thesis deals with design projects and learning spaces that transcend multiple boundaries, where we have been involved in "moving back and forth between disciplines as well as moving across and beyond disciplines to engagement with the rest of the world, to a new state or a new place" (Melioranski, 2019, p. 248, citing McGregor, 2014). As an example, in our participatory and experimental pedagogy that crosses "both disciplinary boundaries and sectors of society" (Bruun et al., 2005, p. 31), I refer briefly to the instance of Fiscilla, the creative figuration made as a semi-complete harvester of stories concerning climate change. Harnessed as a diegetic artefact, she travelled as an object, a metaphor and as a concept, transcending boundaries and drawing attention to dualistic barriers artificially separating humans and non-humans, privileged and under-privileged, nature and culture (Snaddon et al., 2017).

The suggested value of disciplinary hybridity is such that "transgressions of disciplinary boundaries" (Farías & Sánchez Criado, 2018, p. 21) are highly relevant for design pedagogy that aims to draw design students beyond disciplinary givens and educational norms. A regenerative approach entails moving into complex learning spaces for what amounts to re-education and "re-learning" (Farías & Sánchez Criado, 2018, p. 20) concerning design for long-term sustainability. Such a space for inquiry is by its nature hybrid and interdisciplinary in how design intent and making is always an active process of engagement in the complex, messy and intertwined social, economic, political and environmental issues of the world. However, in White's (2016) words, we need to view "'the human' as both a political agent but also produced by diverse socio-ecological systems, co-evolutionarily evolved in inter-action with all manner of non-human agencies and socio-technological forces and agencies…" (p. 43).

My research process has followed such "hybrid knowledge creation" (Melioranski, 2019, p. 255), involving bringing together an assemblage of research approaches that are harvested from the fields of philosophy, social science, humanities, and design. This I have done to better understand and question the role that experimental design pedagogy might play in problematising core aspects of design education. In this, my research work resonates with the provocation that Lury (2018) puts forward, which concerns "how interdisciplinary methods might constitute some aspect of what is given, the present… in all its geopolitical complexity… as a problem… a situation that may be methodologically activated…" (p. 3).

Such transdisciplinary hybridity is not carried out to overly complexify the design pedagogy I seek to explore. The aim in drawing together an ecology of perspectives and methodological stances from these fields has been to follow a designerly process of holistically seeking likely relational connections and inventive encounters. In this way, the project-cases and research approach in this thesis has been about collaboration across traditional disciplinary boundaries, where "the context of application rather than any intra-disciplinary – or even inter-disciplinary – agenda determines what knowledge resources are needed and how they should be configured" (Bruun et al., 2005, p. 47).

This goes to Dubberly's (2017) point about designing in an age of entanglement requir[ing] us "to 'connect things' – to think and act in terms of whole systems" (p. 7). Furthermore, "exploring a progressively wider range of connections in everyday experience and how different types of connections affect the structure of action" (Buchanan, 1992, p. 10) is a futuring process, and a designerly one characterised by making as research.

Such disciplinary hybridity is evident in how we, as educator-researchers practicing in a complex and uncertain world, have through our pedagogy and curricular activity, been attentive to what happens as our experimental approaches have shaped and been shaped by learning experience in terms of "complex adaptive systems" (Boehnert, 2018, Kindle location 1418). Complex adaptive systems are ecological dynamics in systems that display the ability to self-organise while dealing with new information and responding to feedback. Such ecological dynamics have properties such as "emergence, resilience, adaptability and robustness" (Boehnert, Kindle location 1412). An ecological view on learning such as this highlights two key issues in relation to my thesis. First, it frames learning phenomena as dynamic and emergent in settings and situations where students learn to self-organise in relation to new experiences, new knowledge, and change. Secondly, for nascent designers learning to practice design sustainably, their roles and actions are repositioned in dynamic relations to "person, place, material and process" in contexts of application (Lury, 2018, p. 5).

Overall, such nomadic research hybridity has enabled a space for deep engagement in our pedagogical praxis, thus enabling methodological activation for the experimental design pedagogy under review through a mix of interdisciplinary methods.

However, nomadic research hybridity requires certain transitions in academic research activities. Implications concerning the introduction of inter and transdisciplinary approaches in design research will necessitate more courageous behaviour in faculty research committees during research proposal approval phases. For students and staff setting out to conduct such boundary-crossing work, encouragement needs to be generously given for researchers to take bold steps in forging new modes of inquiry into design, its processes, education, and research. This is especially pertinent regarding research into innovative designing approaches, requiring a broader view of "new areas on the periphery of the disciplines… [that can be] approached through the creative recombination and hybridisation of disciplinary methodologies" (Melioranski, 2019, p. 248). Reticence in this regard can put design research at risk of remaining pedestrian and stuck within the present and pre-given, and less inclined towards what is emergent through inquiry into increasingly "radically-distributed practices" of design (Farías & Sánchez Criado, 2018, pp. 16-17).

In addition, following Morrison and Mainsah, et al. (2019), "design inquiry has shifted from disciplinary, top-down approaches to contextual, processual and abductive means to knowing through and about making" (p. 2). I concur with these authors in their assertion that if we are to run more confidently in collaborative and transdisciplinary inquiry spaces, we must sharpen our "dialogical, discursive, tool-based and communicative means" of making and assessing design-based knowledge concerning "multiple aspects and components in their actual and potential shaping" (p. 1).

6.2.3 Repositioning practices of design thinking

In this section, I deal with the implications of my proposed pedagogical framework in relation to well-established modes and practices of design thinking and co-design.

In the study, and in particular this exegesis, my exploratory offering traces a critique of these design approaches regarding social innovation, design activism, and design for sustainability. Regarding design thinking, I concur with Akama and Yee (2016) who state that design discourse, design knowledge, process, and methods "are imagined as universal so it can move easily between places and people, and this explains why various versions of the Double Diamond and Stanford d-school models are commonly used" (p. 5). In such a view, iterative moves through 'divergent' and exploratory modes of gathering and 'convergent' modes of choices directed towards action, are offered as guides for design process and progress especially as it relates to business-as-usual practices. By this I mean practices that are shaped by ideology and the system structures of neoliberal capitalism that "reinforces the belief that design must always serve an economic function first and foremost" (Boehnert, 2018, Kindle location 762).

However, concerning the generic processes outlined above, I have three concerns that are perhaps masked by such universal and generalised modes and practices within the dominant paradigm of design for economic growth. One concern is that the tacitly perceived autonomy of designers in relation to the politics of social and environmental needs should be more finely questioned. Even though design thinking as a process has been strong on empathy and the participation of widely framed stakeholder groups, there still remains an "emphasis on the designer as main agent in design activity" (Kimbell, 2012, p. 141).

A second concern is the problem of 'epistemological error' discussed earlier in Chapter 1, where designers consciously or unconsciously perpetuate the rapid economic growth of dominant industrial culture, without consideration of finite ecological systems (e.g. Sterling, 2009). Such fragmentary, determinist and anthropocentric worldviews are still deeply engrained in design education, where categorising and labelling of issues entrenches boundaries in ways that are maladaptive to the current situation we find ourselves in. As designer-educator-researchers we need to actively "step… out of this paradigm" (Sterling, 2009, p. 82) by creating learning situations for ourselves and our students where we can understand the limitations and dangers of such atomistic thinking. In this transitioning mode, "learning as change" (Sterling, 2009, p. 82) becomes vital in bringing about a deeply felt and understood "ecological intelligence" (p. 77) in young designers, where designing can be conceived of as relational, holistic and interconnected within ecological systems.

A third and connected concern is that design thinking and co-design are sometimes touted as part of a social and greenwashing narrative that distracts from the main perpetrators of environmental damage in both private and public sectors, i.e. big corporate business as well as educational institutions and governments in paralysis who seek to support conspicuous consumption (e.g. Boehnert, 2013). Distraction through such tactics concerns how a general resistance to change is supported by cynical manipulation of superficial public understanding of what long-term sustainability might actually mean. As designers and educators, we should concern ourselves in how our unsustainable institutions and corporations might be abusing design thinking and co-design practices in maintaining their legitimacy. Such tactics disguise the need for the "much harder work of building capacities to address environmental problems effectively" (Boehnert, 2018, Kindle location 1826).

Central to these concerns is the connected and core idea in this thesis of problematic assumptions regarding the knowing subject being separate from what is to be known (e.g. Haraway, 1997; Barad, 2007). 'What is to be known' is not 'out there' waiting to be discovered by an autonomous subject. Neither can it be fully prescribed or defined beforehand as to what is to be known. Rather than being a bounded practice, knowing is an ongoing performance of the world (Barad, 2007). Moreover, as has been proposed in Chapter 5, a pedagogical praxis of

designerly diffracting-in-action opens up the possibility for student designers to become aware of their emergent relational and ontological modes of knowing and becoming, and how this awakens deeper understanding and responsibility with regard to how sustainable design practice might be enacted. That is, students immersed within ecologies for learning allow for relational and dynamic intra-action of multiple agentive others in an ongoing network of performances. As such, a design pedagogy that is oriented through diffracting-in-action is one that takes care in how learning ecologies might be enabled and sustained in ways that bring about design processes and outcomes that allow for the flourishing of all living things. Such a pedagogical approach that is oriented towards the concept of sustainable flourishing is framed as one where the stakeholders within learning ecologies engage with and take on the characteristics that are enabled by the system. Flourishing in this sense is "an emergent property of a complex living system" (Ehrenfeld, 2008, p. 52).

In this way, I suggest that, as designer-educators along with our students, we may stand a chance as we step out of the current unsustainable paradigm and build a critical mass of young designers with "emergent capacities for enacting personal and political change" through ecologically literate and sustainable design practice (Boehnert, 2018, Kindle location 3400).

In repositioning design thinking methods and tools in relation to the concerns I have mentioned, my pedagogical framework potentially becomes useful for design educators and students when engaging in context-sensitive work. This may perhaps also apply when facilitating design learning spaces that liberate and critique dominant socioeconomic and political agendas.

My research was therefore aimed firstly at how transitions and redefinitions of design concerning social and environmental justice, along with a post-human inflected learning ecologies and ecological literacies view, can influence pedagogical praxis and be translated into practice. Secondly, the aim was to inquire into what these experimental approaches might yield in terms of design learning that is oriented towards long-term sustainability.

In this regard, a post-human inflected design thinking approach is particularly relevant in the contemporary South African context in light of the need for designing (as a verb) to be understood as agentic action involving multiple and diverse agencies. Furthermore, when designing is viewed as relational through the practices that constitute designing, there is regenerative potential in design where "stakeholders are co-designers and designers are another kind of stakeholder" (Kimbell, 2012, p. 143). Such relationality in practice concerns issues of redress, blurring the boundaries between power-producing binaries of human/non-human, culture/nature, and black/white. Actively exploring relationality in practice can be productive of emergent design perspectives that "support values such as equality and justice for humans and nonhumans that have been traditionally ignored in design processes" (Forlano, 2017, p. 16).

6.2.4 Drawing on the metaphor of diffraction

In building an argument for diffracting as metaphor and method in processes of conducting such pedagogy, I have sought a wider ambit for considerations of the situatedness of knowledge, and nomadic positionality of student designers and designer-educator-researchers. In this, I question the optical metaphor and process of reflection with its associated assumptions of the world consisting of "autonomous, intentional and rational human actors against the backdrop of the natural environment" (Murris & Bozalek, 2019, p. 5). Rather, I consider a diffracting metaphor and method that illuminates the relational and reciprocal intra-actions that invent and co-create the world. Here the term 'intra-actions' refers to individual agencies not preceding interaction, but rather emerging through intra-action and mutual entanglement of distributed agency (Barad,

2007). In this exegesis, I have posited that this shift in metaphor evokes more accurately how pedagogy might stimulate learning experience for design students where their designing intra-actions become visible and intelligible.

In opening up and entangling the ethico-onto-epistemological difficulties and potentialities inherent in any process of designing, we are "continuously and radically *in relation with the world*, with others, and with what we make of them" (Ellsworth, 2005, p. 4, emphasis added). By approaching pedagogical praxis as nomadic, we as educators along with our students in the pedagogical situations of our making, keep questioning and re-inventing the many ways in which we can "live together so that the world that arises is the one we want to live in" (Maturana, 1999, p. 4). This is an intensively futuring and relational imperative as it involves mindfulness in the present moment that is always attentive to how we live, design and make together in ways that might lead to long-term sustainable futures that we and others would actually want to live in. Such an imperative has clear and urgent relevance for the South African context within which I am writing, researching, teaching and living.

In developing such a pedagogy, I have taken up Barad's (2003) suggestion that "performative alternatives to representationalism shift… the focus from questions of correspondence between descriptions and reality (e.g., do they mirror nature or culture?) to matters of practices/doings/actions" (p. 802). A shift towards diffraction rather than reflection in this view goes beyond design process understood as happening between people and places, from a limited relationality to "a doing—the enactment of boundaries—that always entails constitutive exclusions and therefore requisite questions of accountability" (p. 803). In this, the political and always incomplete project of 'negotiating what matters' must be engaged with in ways that openly question boundaries, exclusions, and accountability of doing design that is ethical and responsible, and therefore sustainable in the long-term. Through processes of negotiating what matters within context-sensitive design projects, the effects of negotiating such interferences and inferences are what bring about sustainable design dispositions through diffracting-in-action.

6.2.5 Negotiating structure

By implication, understanding contexts for designing as fluid and in need of negotiation requires a pedagogical approach that is equally fluid, and negotiated. This has been a hallmark of our exploratory pedagogy, and why we have sought alternative spaces and places for design learning.

Much has been said in this thesis about deterritorialising, decentering and discomfort, which raises questions of student feelings and emotions during such pedagogical interventions. Not all students immersed themselves wholeheartedly in the learning opportunities presented by our experimental design pedagogy. However, those who did chose to be fully present and to explore their emergent identities in relation to the shifting challenges and diffracting interferences presented by the varied project contexts. As designer-educator-researchers, we participated in these nomadic displacements, sharing the mutually co-constitutive learning space with students and participating others. In many respects, students and educators were taking a risk by participating in these project interventions. This was because they were offered, in most cases, as voluntary learning opportunities that were peripheral to coursework. Student comments in Chapter 5 have indicated feelings ranging from trepidation to euphoria in relation to their meaning making process within the various project-cases in which they were involved.

Many of the reflective comments concerned the negotiation of agentive selves in relation to others, especially to the multidisciplinary student group, and what it felt like as they made sense of their learning experience. A common theme was that the flattened hierarchy meant they all

drew comfort from the fact that they were 'in it together', and no design discipline was more important than another. Within a space freed from competitiveness, a spontaneous self-organising principle began to emerge in the way students sounded out each other's abilities and skills. Through heightened listening and observation within local contexts, students negotiated their sense of self in dynamic relations with multiple others.

From a pedagogical perspective, what was crucial in negotiating the scary and frustrating phases in these projects was to offer scaffolding in terms of how expectations were primed and facilitated from the outset. This meant offering a negotiated space that was shaped by enough 'agreed-to-structure' that could allow for designerly and performative explorations of problem finding, problem forming, and potential solutioning. A diffracting design pedagogy, therefore, offers a process of priming and holding a learning space lightly. By this, I mean that the learning space is 'held lightly' in a way that enables participatory negotiation around what might matter, and what is valuable in terms of the social and environmental needs of the context.

The diffracting design pedagogy framework proposed in my study can therefore potentially serve as a primer for educators when negotiating a pedagogical structure prior to, and as navigational principles during social and environmental justice design projects. However, such a framework remains a navigational framing for what must, in every new case, always be contextually and sensitively enacted through designerly practices of thinking, doing and making.

In the next section, I address the issue of assessment within and through such processual modes. Although the scope of this thesis is limited to pedagogy and curriculum and does not include inquiry into assessment practices, it is important to acknowledge how integral feedback and assessment are within pedagogical practice. If assessment is considered essentially as a system of feedback to enhance learning, then assessment practices should be well aligned with the type of learning being facilitated.

6.2.6 Student feedback literacies and assessment

In the previous chapter (section 5.3) I proposed that becoming design literate in ways that are considerate of long-term sustainable flourishing for all can be broadly described as involving the tempering of certain dispositions. These I described as having qualities of resilience, generosity, thoughtfulness, wellbeing, engagement, curiosity, awareness and abductive knowledge creation. Crucial to my argument is that a diffracting design pedagogy may reveal how active development of such dispositions enhances currently ill-defined ecological design literacies for design students through critique and transformation of dominant norms and practices in design and its systems of education.

A key part of this nomadic process has been the continuous and formative feedback arising during the dynamic real-world project situations, and how this has shaped the design work, and the students themselves, as they have progressed with it. It is through such enhanced uptake of feedback (Carless & Boud, 2018) within context-sensitive projects that students have experienced the transformative capacity of their learning identities as they have been enacted in lived relations to others (Yee et al., 2019; Ellsworth, 2005).

My study has highlighted the importance of the micro-dynamics of formative feedback within learning moments. These are moments where students and educators are complicit in and become attentive to the kind of learning dispositions that arise in context-sensitive projects. Such complicity and attentiveness affords development of feedback literacy for students, whereby they become resilient assessors of individual and shared "decisionmaking that is relational, situational,

pragmatic, and value-based" (Shay, 2004, p. 327). These are distributed learning practices occurring through informal peer critique (e.g. Hokanson, 2012; Gray, 2013), and are broadly informed by social and contextual intra-actions.

However, formative feedback emerging from contextual situations, amongst peers, and between peers and educators, must also connect with formal institutional procedures and measures. Assessment within academic design programmes needs to be a blend of formative and summative critique. Assessment in this sense raises the question of how developing dispositions and ill-defined ecological design literacies might be assessed, and if indeed they can be. This would mean developing synergy between processes of pedagogical experiment along with institutional assessment procedures. Similarly and in terms of curriculum development, Grimmett & Halvorson (2010) have argued that "if curriculum as institutional text does not co-evolve with the contemporary discourses of re-conceptualized curriculum, there is no impetus to re-direct its practices" (p. 251).

Such impetus for re-directive practice is vital if our educational institutions are to respond to and co-evolve with the experimental work that many of their senior design educators are doing. Due to the difficulty in measuring and assessing what has been traditionally named 'soft skills', it remains a challenge to incorporate meaningful assessment measures regarding the ill-defined and emergent ecological design literacies I address. Assessment rubrics would need to be re-conceptualised, re-written and aligned with the kind of learning dispositions described in this study. On this, Steinke and Fitch (2007) have conducted a useful study into assessment methods for service learning, as part of their wider interest in assessment practices that better measure skills and abilities that are needed beyond academia. Others have explored assessment of personal development skills through the use of learning journals (e.g. Moon, 2006). Moon suggests that instead of the journal being assessed directly, students can rather use the journal as a learning tool to reflect on what they have learned through working with the journal. In this way, a secondary piece of work in the form of a report or oral presentation can then be assessed and even graded.

Apropos of personal development assessment, one of my colleagues involved in teaching on some of the cases included in this study, Dr Rael Futerman, has recently been a co-creator of an online experiential learning platform that helps students develop future-ready skills, called Cartedo (see BiomimicrySA, 2019; Cartedo, 2019). This platform tracks student growth during live design projects and development of skills such as problem-solving, communication, empathy, critical thinking, and ideation. This is one example of how online blended learning platforms are being developed to offer more than instrumental educational instruction, and are becoming more responsive to how students learn in a fast-changing and connected world.

Online and blended learning platforms have been developed considerably over the last 20 years to offer multiple modes and opportunities for educators, researchers and students to shape their own learning and teaching contexts (e.g. Ng'ambi, Brown, Bozalek, Gachago, & Wood, 2016; Gachago, Morkel, Hitge, van Zyl, & Ivala, 2017). South African researchers and educators have extensively explored online modes and digital storytelling as means of connecting students in ways that enable critique of dominant power structures that divide rather than integrate (e.g. Stewart & Gachago, 2016), and how to develop capacities in students and educators of "self-care and care for others" (Swartz et al., 2018, p. 63).

A point to be made here is that varied and transparent modes of assessment and feedback on learning should not be confining, prescriptive or even about reaching consensus. Shay (2004) aptly notes that a "pluralist ethos poses difficult challenges for assessors" (p. 327). What matters,

she goes on to argue, is how we as educators respond to these challenges, and "whether dissensus can be a productive resource for the ongoing process of identifying, articulating, and negotiating the values systems that constitute our assessment interpretations" (p. 328).

I would argue that dissensus can be a highly productive resource within what I call a diffracting design pedagogy, and is what might contribute to the defining of emergent ecological design literacies for design students. As such, an extended spectrum of ecological design literacies is framed in this study as emergent through engagement within complex and contested contextual situations. These are literacies that enable design students to recognise the ecological so that their design practice might be re-oriented in ways that are not ecologically destructive. Navigating wider literacies in this mode takes design students and educators into new and difficult spaces that are hybrid and liminal and can be disruptive of entrenched and bounded approaches in design education. This requires assessment practices to be sensitive and adaptive through ongoing negotiation around the values systems that emerge out of our pedagogical and curricular experimentation, and how such nomadic negotiation might shape our assessment interpretations.

6.3 Transitioning design pedagogy in the South African HEI context

In concluding this thesis, I will re-situate this study within the South African university and design education context by discussing current and future possibilities associated with the proposed pedagogical framework that I have presented. These stem largely from the experimental status of the design pedagogy under inquiry, and hence there is a focus on how to further develop, test and scale this work in ways that might build on what momentum has been established.

6.3.1 Connecting with local exploratory practice

Translating experimental processes and applying them in formal courses will be an ongoing challenge, one that can best be tackled through collaboration with similar endeavours. A primary move as a consequence of this study would be to connect more robustly with other courses and researchers in the design faculty at CPUT carrying out experimental pedagogy that expands on the given modes of delivery (e.g. Barnes & Gachago, 2015). For example, in the department of Architecture and Technology, there is a long-standing tradition in their Live and Design-build projects as part of their Design Build Research Studio. Perold and Delport (2018) report on this work that takes students into local community settings where design-build projects are carried out with community participation, resulting in built outcomes that make a material difference in the lives of people living in marginal and resource-stressed communities.

Connecting with exploratory practice and research that has a similar pedagogical focus would, in my view, benefit from the creation of a faculty forum to actively critique and translate experimental pedagogical practice into other areas of courses across disciplines and faculties and HEIs. This would also further conversation around the position of the design faculty within the broader university, and aid exploration of disciplinary hybridity especially concerning what design can contribute regarding contextual, processual and abductive means of knowing through making. To date, some of this experimental work has been reported on in various formal faculty and institutional forums but these lack the kind of focused and critical attention that is required in taking this work further.

Further to this, there is a need for academics across CPUT who are doing critical change-oriented educational work and research to forge stronger knowledge-sharing relationships. For example, the doctoral work of my colleague Dr Siddique Motala (Motala, 2018) in our

Engineering Faculty, has explored the potential of digital storytelling in an undergraduate geomatics diploma programme. In his work, he has theorised using a critical posthumanist relational ontologies and sustainable ethics perspective to interrogate his exploratory instances of storytelling as an intervention to activate a critical sensibility in his students. Such critical sensibility challenges the dominant norms within geomatics pedagogy through a combination of counter-mapping and storytelling. In this, Motala's research seeks to trouble the ways in which maps have been deployed, often as a means of bounding and sedimenting hegemonic power structures in an "anthropocentric vice-grip" (2018, p. 193). Motala's work resonates with my research in that we share both a theoretical/conceptual perspective and an experimental ethos in our pedagogical praxis. Our future collaboration could be to build on our experimental praxis and research work concerning how our pedagogies move across current boundaries, disciplines, hierarchies, and dualisms. Together we share an interest in moving our pedagogies away from self-centred anthropocentric individualism towards what Braidotti describes as an enlarged sense of ecological "inter-connection between self and others, including the non-human or 'earth' others" (2013, p. 48).

As part of a process of transitioning existing curricula within CPUT, it would be useful to engage in a similar exercise followed by Botes (2018) who mapped the critical citizenship framework developed by Johnson and Morris (2010) onto the National Diploma in Graphic Design curriculum at South African UoT's to reveal where competencies and dispositions aligned, or not (Botes, 2018). The purpose of this exercise for Botes was to use a theoretical framework to interrogate and improve the offering of critical citizenship education within current design diploma courses in South Africa. The critical citizenship framework developed by Johnson and Morris aims to develop the knowledge, skills, values, and dispositions of citizens according to the following conceptions of critical citizenship: politics/ideology, social/collective, self/subjectivity and praxis/engagement (Johnson & Morris, 2010).

Similarly, a workshopped and collaborative exercise of mapping my proposed framework for a diffracting design pedagogy onto current pedagogy and course curricula could serve as a means of furthering my research work with other colleagues in my department and faculty. This would offer a joint process of establishing potentials and challenges, overlaps and absences that could then be addressed concerning transition between current practices and futuring ones.

Existing platforms for collaboration such as the Design Education Forum of South Africa (DEFSA) and the Higher Education Learning and Teaching Association of Southern Africa (HELTASA) afford valuable biannual and annual conference exchanges for design researchers, academics and students to share ongoing research and teaching work, and to investigate the urgent issues of the moment. The recent 2019 DEFSA *Designed Futures* conference theme was a provocation around how "design is sometimes portrayed as a practice that can address our damaged environment, mitigate the negative impact of technology, contribute to the global economy and help us to adapt to societal changes" (DEFSA, 2019). To this theme, Prof. Andrew Morrison (co-author on a number of my publications and my thesis supervisor) delivered a keynote address titled, *Design Futures Literacies* where he spoke of design and the designer's role in 'taking care ahead of time'. In his case-rich address that included examples of student climate change design projects from Norway and South Africa, he asked, how do we "move forward with care, ahead of time… walking with the given and moving into the prospective?". In offering some idea of where design is in this, he proposed that "a new tense is mine, ours. The future present. Through design, we become together, the future present". It is to exchanges such as these and others that have yet to be had, that I look with anticipation and interest for further challenging and nomadic explorations into design futuring territories.

Furthermore, local networking through academic projects, research outputs, and books with design educators across the HEI design landscape will be an ongoing imperative. To this point, there is already some informal discussion amongst academics across several HEIs regarding a follow-up book to *Educating citizen designers in South Africa* with a focus on sustainable design education. Currently, two CPUT colleagues are working on and editing a book that critically explores the 'one size fits all' approach of design thinking and how this may be valuable for higher education institutions. Interviews and case studies are being gathered and, in this regard, I have been asked to share the approaches and learning gathered through my PhD study. The book's provisional title is *Designing Academia: Context, Creativity, and Change in Higher Education* (in press).

Lastly, it would seem opportune to strategically mesh sustainability in design education with current imperatives concerning the decolonising of curricula, as many HEIs in South Africa confront issues of the enduring agency of colonial power in their institutions and course offerings. In moving swiftly with this agenda, which demands universities and academics to question how their courses are oriented towards knowledge production that is open to epistemic diversity, the transition imperatives of sustainable design can be aligned and find a shared impetus.

6.3.2 International communities of research inquiry and practice

Similarly, and in a nomadic mode of extending local practices and shared research, it is essential to continue in research and knowledge creation partnerships with other design HEIs internationally. This is especially pertinent concerning efforts in the global South to support our practice and explorations relating to epistemologies of the South articulated by Escobar (2016). By working with existing and burgeoning momentum we will continue to build on local and global networks of design educators – acting locally and sharing globally. This will entail using already established and distributed networks such as the Learning Network on Sustainability international (LeNSin) (LeNS International, n.d.) and Design for Social Innovation and Sustainability (DESIS) network (DESIS Network, 2016).

Acting this way follows the theme of designing in an ecological view that requires us "to think and act in terms of whole systems… connect[ing] people and things, ideas and artefacts, products and services, hardware and software, and thinking and doing" (Dubberly, 2017, p. 7). Importantly, this is more than networked activity with regard to reporting on past and shared projects but would entail building a community of research inquiry and practice through online and face-to-face platforms that support the production of research outputs along with strong knowledge-sharing relationships, locally and globally.

Currently, I am formally involved as CPUT's project co-ordinator for the designBRICS partnership between my institution, the Oslo School of Architecture and Design (AHO), and Hunan University (China). This exciting partnership project aims to enable dialogue and co-created knowledge between the so-called 'developed global North' and the 'developing global South' and comprises three workshop modules offered by the above institutions that facilitate student and staff exchange. In this way, the emphasis will be on design education that moves its current focus from designing for affluent societies governed by consumption, towards designing for quality of life that is inclusive of both social and natural ecosystems. The aim is that these modules can be scaled up and extended within and beyond the participating partners. The designBRICS is supported and funded by the Norwegian Centre for International Cooperation in Education and the Research Council of Norway and aims to build a platform for a lean

network of different design institutes in BRICS countries (Brazil, Russia, India, China, and South Africa) and AHO (see designBRICS, 2019).

The first module on future scenario building, design4Futures, was offered by AHO in early 2019 (see Exhibition AHO Gallery. n.d.). The second module, design4Manufacture, concerning distributed and localised design manufacturing is being run at the time of this writing. In 2020, CPUT will be offering the design4Ecology module which will situate design as a key part of the contingent interplay between environmental, social, cultural and economic factors.

In formulating this third modular offering, I am drawing significantly on this PhD thesis work, and not only applying it to this shared module but also within our institutional development of new postgraduate courses and curricula at CPUT. It is perhaps important to mention here that this designBRICS project work forms part of a long-term relationship between CPUT and AHO and seeded by the C–CLIMA–Futures project. To date, this dynamic trans-institutional relationship has several student cohorts and produced six research publications and a Masters qualification, along with this PhD study which is listed amongst its outputs.

6.3.3 Alumni support

A crucial implication and need that derives from the above point about the durative aspects of our project work has to do with the support of student alumni who have participated in our course work. Aiding and supporting students who have been a part of our experimental work is a pressing imperative if any critical mass is to be built. Support needs to be built in the liminal transition space for students after graduating and as they move into their first jobs as ecologically literate design practitioners.

As Yee et al. (2019) point out, a long-term support model is often required to enable transformative learning to continue. This would be structured around the need for alumni to share tactics and strategies for designing sustainably as they move from an educational community of practice into work-place communities with varying levels of commitment and understanding of design for sustainability. This idea is echoed in a comment by Nicolla, a graphic design student, during one of the conversational interviews I conducted in this research. She makes the point that "ideologies are one thing, but making sure that someone has the ability to notice the opportunities when to make things a little bit more sustainable, I think that's what design students need to learn" (2017). Her view was that when trying to exercise sustainable design practice in her post-study work experience, it was about having the skill to notice when to make those moments happen.

Support for alumni as they navigate the largely unsustainable workplace would potentially offer motivation and constructive feedback as they face the transition-related challenges alluded to above. Additionally, inviting alumni as guest speakers and co-teachers will not only bring their experiences of sustainable design practice back into academia but will also challenge them, through teaching, to broaden their own understanding of their experience through performing the necessary acts of clear articulation and communication to our diverse student groups.

Naturally, not all students have been motivated enough by the design sustainability projects we have run to continue with the methods and approaches they were introduced to. However, one student when interviewed revealed that her honours project in the following year was directly influenced by our biomimicry thinking module and project work. Subsequently, when she was hired by an interior design company under the pretext of working on a sustainable product range, she resigned after a few months in protest over the company merely greenwashing their

production process. A year later she accepted a second offer from the same company after they had significantly adapted their operation, and she now holds a senior position influencing company decisions.

Others that have remained in touch with colleagues and myself have shared similar stories of finding jobs where they are able to authentically apply their ecological design literacies within their professional practice. Yet, due to underdeveloped networking practices between our faculty and alumni, we have insufficient stories around how critical mass might be mounting or not. Scaling up and embedding what is essentially a bottom-up approach to change and innovation through pedagogical experimentation requires more concerted efforts in building on any momentum that may be emerging within and beyond academia.

Long-term support is needed to continue a lifelong learning model, whereby young designers emerging from HEIs and entering the workplace are enabled and equipped as autonomous and self-determined lifelong learners (Blaschke, 2012). A learning ecology perspective on lifelong learning suggests that our lives are a sequence of overlapping ecologies for learning, ranging from ones that are more prescriptive (in formal education) to ones that are fully determined by students as they author their own learning lives, and help others around them to do the same (Jackson, 2016). Furthermore, overlaps in design-based learning ecologies require support as students transition from one to another, and in this, we educators need to be prepared for nomadic movement between the siloed structures of academia and the complex and changing world of work.

6.3.4 Building critical mass

Together the above implications and considerations are posed as ways in which this research work might be scaled within my faculty, institution and beyond. In this exegesis, I have provided a rationale for design pedagogical praxis that diffractively entangles and threads multiple opportunities for students to learn about becoming the kinds of designers that are able to interpret and pick their way through complex problem fields where long-term sustainable design practices might be enacted. These learning opportunities need to be extended and scaled meaningfully so as to build a critical mass amongst our student designers during, and after their studies have been completed. The experimental case-based work on which this study is based and my research process is part of a growing groundswell of design research and educational practice that is exploring imaginative and generative modes of thinking about, educating for, and doing design differently than the norm. "Scaling up and embedding ecological literacy into design education and the wider cultural context" is part of this groundswell and requires "critical skills, multiple types of literacies, multiple agencies and political engagement" (Boehnert, 2018, Kindle location 1947).

In this sense scaling is a long-term project of transition for design education, yet is one that is becoming increasingly urgent in a world where "diversity… has become a paradoxical universal" (Cope & Kalantzis, 2009, p. 173). In this regard, enabling design students to navigate across multiple domains is paramount. That is, a student needs to be "resilient in their capacity to articulate and enact their own identities… find[ing] ways of entering into dialogue with and learning new and unfamiliar social languages" (Cope & Kalantzis, pp. 173-174). To this I would add that unfamiliar language for a sustainable designer must include the ecological, and extend beyond the social and verbal to embrace enacted, embodied, visual, performative and pattern languages that arise through the exercise of careful listening, respect, and empathy in social and environmental contexts.

In this endeavour, I acknowledge the work of colleagues and myself to be a small drop in the ocean. Yet what we are doing is nonetheless a crucial part of scaling up efforts at transitioning our pedagogy and curricula, creating synergies between our efforts and others, and building critical mass amongst like-minded educators, students and researchers. These are networks and people who actively seek to explore and bring about transitions in design practice and educational efforts that play a vital role in re-imagining and remembering how deeply embedded we are "within non-human nature and dependent on ecological systems for life" (Boehnert, 2018, Kindle location 159).

On transition in design education, Gornick and Grout (2008) make the point that "in respect of critical mass it's worth reflecting on the 80/20 rule… [that] asserts that approximately 80% of the effects generated by any system are caused by 20% of the variables in that system" (p. 740). This is an optimistic concept if we interpret this to mean that "in our society, markets and economies we could say that 80% of the change comes from 20% of the people" (p. 740). I take this as encouragement for our transitioning efforts in design education concerning small changes that could be magnified over the long-term.

In this regard I agree with Gray van Heerden's (2017) proposition, adding that environmental, and "socially just pedagogies can act as *the slightest gesture*, as the grass stem, the assemblage converter - a deterritorialising movement that allows for passage from function to expression, but also for passage from climaxes to plateaus, from diversity to difference and from identity to becoming" (p. 22, emphasis added). It is in these slightest of pedagogical gestures that we must find meaning and motivation in our praxis, to enhance shared momentums and believe that these will grow.

6.4 Closing

6.4.1 Shaping futures further

In closing and re-connecting with the title of this thesis, *Learning for Future Knowing now: Investigating Transformative Pedagogic Processes Within a Design Faculty in a South African University of Technology,* I return to the topic of this thesis. My investigation into how design education can engage with futuring learning processes concerning knowledge that can be relevant for the transition towards long-term sustainability has opened up new channels and ongoing flows of thoughtful hope and action that continue beyond this thesis work.

To this point and as a way of bringing this work into the present moment, I would like to mention a curated conference session that I participated in during the *3rd International Conference on Anticipation* in Oslo in October 2019 (Raymond et al., 2019). In presenting key elements of my thesis work as part of a group of five design educators and researchers, our talk titled "Design, relational ontologies and futurescaping" drew interest from our audience. One such curious person, Keri Facer, Professor in Climate Change Leadership at the University of Uppsala, and an author whose work I have cited frequently in this thesis, engaged with me in question time and after the session.

Prof Facer was moved enough to include a mention of some of the work in this thesis in a keynote address she made a week later at the Beyond Oil Conference (2019) in Bergen with the title 'Beyond Oil; Of timescapes, relations and monsters'. In illustrating her assertion that 'thinking beyond' requires a radical break in who we are and that 'radical novelty' is both possible and reciprocally will 'radically transform us in the process', Facer chose to reference the boundary-crossing instance of our work where we travelled with our students and a giant

unfinished fish dubbed Fiscilla that was "made and remade by the students, designers, artists, [and] communities that the fish encountered as it made its way along, gathering stories" (Facer, 2019). The point that she was making was that thinking beyond the present requires inviting the 'strange into the present', putting 'latent forces into dialogue', a mode of 'colliding thinking and worlds' through 'promiscuous alliances' that unsettle and provoke. In her words, the fish "becomes a monster that redeems – a fish that talks, that tells tales in a desert of what is happening… weav[ing] a spell of the possibility of water in a barren landscape. Monsters can open up new worlds to us. When we think *Beyond Oil*, we might want to remember them too".

6.4.2 Education-based research and research-based education

This reference to our design educational exploratory pedagogies at CPUT point to collaboration with the Oslo School of Architecture and Design (AHO) and shared interests and practices in furthering education that is sustainable, responsible and future-oriented. Experimentation and exploration have been central to these pursuits with colleagues at AHO in research, in particular, accentuating the importance of interplays between education-based research and research-based education.

Facer (2019), in her articulation above, echoes what is a core aspect of this thesis: that in seeking innovative ways to transition away from unsustainable design we must go beyond the given and overly habitual modes of educating young designers, and explore radically imaginative and generative modes of knowing, doing and being with our students and others in the living contexts within which we are interdependent. In this ontologically relational mode of designerly thinking and acting and making, we participate in and co-evolve the generative and agentive literacies of ecological knowing. Dispositions of long-term sustainable design awareness emerge, tempered by ecological literacies and knowing that materialise as "a matter of part of the world making itself intelligible to another part" (Barad 2007, p. 185).

Through such a pedagogical approach we collaborate in the generation of alternative and innovative possibilities that in turn make us differently. This study has been an exploration into a pedagogical praxis of experimentation that echoes the question, "what ideas come when we aren't constrained by the assumption that we are now, as humans, what we will always be?" (Facer, 2019). In these small yet significant ways, we can make the transition from the Anthropocene into the Ecocene (Armstrong, 2017).

In this, we as design educator-researchers and students, venture together into new spaces of design possibility. These are spatiotemporal modes of attentiveness and questioning, where diffracting-in-action might sustain relations that are emergent within, and through, the reciprocal process of the world and its actors become intelligible to one another.

REFERENCES

AfrikaBurn. (2019). *What is AfrikaBurn?* Retrieved from http://www.afrikaburn.com/about/what-is-afrikaburn

Akama, Y., & Yee, J. (2016). Seeking stronger plurality: Intimacy and integrity in designing for social innovation. In C. Kung, E. Lam, & Y. Lee (Eds.), *Open Design for E-very-thing: Cumulus 2016 Conference Proceedings* (pp. 173–180). Hong Kong: Hong Kong Design Institute.

Alvesson, M. (2011). *Interpreting interviews*. London: Sage.

Arendt, H. (2006). *Between past and future* (rev. ed.). New York, NY: Penguin Classics.

Armstrong, R. (2017). From Hell to Babel: Creating value in the ecocene. *Journal of Biourbanism*, *5*(1–2), 187–199.

Ayres, C., & Bissell, D. (2018). Casing. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods* [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

Badat, S. (2016, June 28). *Deciphering the South African higher education protests of 2015–16*. The Andrew W. Melon Foundation. Retrieved from https://mellon.org/resources/shared-experiences-blog/south-africa-protests/

Barad, K. (2003). Posthumanist performativity: Toward an understanding of how matter comes to matter. *Signs: Journal of Women in Culture and Society*, *28*(3), 801–831.

Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Durham, NC: Duke University Press.

Barad, K. (2011). Nature's queer performativity. *Qui Parle*, *19*(2), 121–158. doi.org/10.5250/quiparle.19.2.0121

Barad, K. (2014). Diffracting diffraction: Cutting together-apart. *Parallax*, *20*(3), 168–187. doi.org/10.1080/13534645.2014.927623

Barnes, V., & Gachago, D. (2015). Digital storytelling and authentic learning: A case study in industrial design. In J. Condy (Ed.), *Engaging 21st century students through Digital Storytelling* (pp. 47– 62). Stellenbosch: Sun Press.

Barnett, R. (2012). Learning for an unknown future. *Higher Education Research & Development*, *31*(1), 65–77. doi.org/10.1080/07294360.2012.642841

Barnett, R., & Coate, K. (2005). *Engaging the curriculum in higher education*. Maidenhead: Open University Press.

Bateson, G. (1972). *Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution, and epistemology*. San Francisco, CA: Chandler.

Baumgartner, L. (2001). An update on transformational learning. *New Directions for Adult & Continuing Education*, *89*, 15–24. doi.org/10.1002/ace.4

Bench, H. (2018). Arranging (*enchaînement*). In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods* [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

Benyus, J. (2002). *Biomimicry: Innovation Inspired by Nature*. New York, NY: Harper Perrennial.

Berger, J. (2004). Dancing on the threshold of meaning: Recognizing and understanding the growing edge. *Journal of Transformative Education*, *2*(4), 336–351. doi.org/10.1177/1541344604267697

Bester, M. (2012). Curriculum 2020 project. Internal unpublished Cape Peninsula University of Technology report.

Better Living Challenge. (2019). *Better Living Challenge*. The Craft and Design Institute. Retrieved from https://betterlivingchallenge.co.za/about/

Beyes, T., & Michels, C. (2011). The production of educational space: Heterotopia and the business university. *Management Learning*, *42*(5), 521–536. doi.org/10.1177/1350507611400001

Beyond Oil. (2019). *Beyond Oil: 2019: Deep and Rapid Transformations – keynote presentations* (Beyond Oil Conference). Retrieved from https://www.uib.no/en/cet/130727/beyond-oil-2019-deep-and-rapid-transformations-keynote-presentations

Bhorat, H. (2015, September 30). *FactCheck: Is South Africa the most unequal society in the world?* Retrieved from http://theconversation.com/factcheck-is-south-africa-the-most-unequal-society-in-the-world-48334

Bickford, D., & Wright, D. (2006). Community: The hidden context for learning. In D. G. Oblinger (Ed.), *Learning spaces*. Washington, DC: Educause eBook. Retrieved from https://www.educause.edu/ir/library/pdf/PUB7102d.pdf

Binder, T., De Michelis, G., Ehn, P., Jacucci, G., Linde, P., & Wagner, I. (Eds.). (2011). *Design things*. Cambridge, MA: MIT Press.

Biomimicry 3.8. (2016). *Biomimicry DesignLens: Essential elements*. Biomimicry 3.8. Retrieved from https://biomimicry.net/the-buzz/resources/designlens-essential-elements/

BiomimicrySA. (2019). *Design thinking & biomimicry thinking masterclass, Cape Town*. BiomimicrySA. Retrieved from https://www.biomimicrysa.co.za/training-biomimicry/2019/10/11/design-thinking-amp-biomimicry-masterclass-cape-town

BiomimicrySA. (n.d.). *Our projects*. BiomimicrySA. Retrieved from https://www.biomimicrysa.co.za/our-projects

Björgvinsson, E., Ehn, P., & Hillgren, P. (2012). Agonistic participatory design: Working with marginalised social movements. *CoDesign*, *8*(2–3), 127–144. doi.org/10.1080/15710882.2012.672577

Blaschke, L. (2012). Heutagogy and Lifelong Learning: A Review of Heutagogical Practice and Self-Determined Learning. The *International Review of Research in Open and Distance Learning*, 13(1), 56–71. doi.org/10.19173/irrodl.v13i1.1076

Bleecker, J. (2009, March 17). *Design fiction: A short essay on design, science, fact and fiction from Julian Bleeker*. Retrieved from http://www.core77.com//posts/12906/Design-Fiction-A-Short-Essay-on-Design-Science-Fact-and-Fiction-from-Julian-Bleeker

Boehnert, J. (2013). Ecological literacy in design education: A foundation for sustainable design. Paper presented at the 2nd DRS // CUMULUS 2013 International Conference for Design Education Researchers, Oslo, Norway.

Boehnert, J. (2014). Design vs. the design industry. *Design Philosophy Papers*, *12*(2), 119–136. doi.org/10.2752/144871314X14159818597513

Boehnert, J. (2018). *Design, ecology, politics: Towards the ecocene* [Kindle]. London: Bloomsbury Academic. Retrieved from https://www.amazon.com/Design-Ecology-Politics-Towards-Ecocene-ebook/dp/B0797BG15B

Bonsiepe, G. (2011). Reflections on a manifesto for design education 2011. In A. Bennett, & O. Vulpinari (Eds.), *Icograda design education manifesto 2011* (pp. 50–53). Montreal: Icograda.

Botes, H. (2018). Educating citizen designers at South African Universities of Technology. In E. Costandius, & H. Botes (Eds.), *Educating citizen designers in South Africa* (pp. 23–41). Stellenbosch: Sun Press.

Boud, D. (2001). Using journal writing to enhance reflective practice. *New Directions for Adult & Continuing Education*, *90*, 9–18. doi.org/10.1002/ace.16

Bozalek, V., & Boughey, C. (2012). (Mis)framing higher education in South Africa. *Social Policy & Administration*, *46*(6), 688–703. doi.org/10.1111/j.1467-9515.2012.00863.x

Bozalek, V., & Zembylas, M. (2016). Diffraction or reflection? Sketching the contours of two methodologies in educational research. *International Journal of Qualitative Studies in Education*, *30*(2), 111–127. doi.org/10.1080/09518398.2016.1201166

Bozalek, V., McMillan, W., Marshall, D., November, M., Daniels, A., & Sylvester, T. (2014). Analysing the professional development of teaching and learning from a political ethics of care perspective. *Teaching in Higher Education*, *19*(5), 447–458. doi.org/10.1080/13562517.2014.880681

Braidotti, R. (2006). *Transpositions: On nomadic ethics*. Cambridge: Polity Press.

Braidotti, R. (2013). *The posthuman*. Cambridge: Polity Press.
Braidotti, R. (2014). Writing as a Nomadic Subject. *Comparative Critical Studies*, 11(2–3), 163–184. doi.org/10.3366/ccs.2014.0122
Braidotti, R. (2018). A Theoretical Framework for the Critical Posthumanities. *Theory, Culture & Society*, *36*(6), 31–61. doi.org/10.1177/0263276418771486
Brassett, J. (2017). Creating different modes of existence. Towards an ontological ethics of design. Paper presented at the IASDR 2017 Conference, Cincinnati, OH. doi.org/10.7945/C2JT3R
Brassett, J., & Marenko, B. (2015). Introduction. In B. Marenko, & J. Brassett (Eds.), *Deleuze and design* (pp. 1–30). Edinburgh: Edinburgh University Press.
Breunig, M. (2005). Turning experiential education and critical pedagogy theory into praxis. *Journal of Experiential Education*, *28*(2), 106–122. doi.org/10.1177/105382590502800205
Bruce Mau. (2019). *Profile*. Retrieved from https://www.designindaba.com/profiles/bruce-mau
Bruun, H., Hukkinen, J., Huutoniemi, K., & Klein, J. (2005). *Promoting interdisciplinary research: The case of the Academy of Finland*. Helsinki: Edita. Retrieved from https://core.ac.uk/download/pdf/157585961.pdf
Buchanan, R. (1985). Declaration by design: Rhetoric, argument, and demonstration in design practice. *Design Issues*, *2*(1), 4–22. doi.org/10.2307/1511524
Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, *8*(2), 5–21. doi.org/10.2307/1511637
Buchanan, R. (2000). Human dignity and human rights: Toward a human-centered framework for design. *Proceedings of the Design Education Forum of South Africa, Cape Town*, 34 pp. Retrieved from http://www.defsa.org.za/sites/default/files/downloads/2000conference/09.%20Keynote%20Dr%20Richard%20Buchanan.pdf
Burns, C., Dishman, E., Verplank, W., & Lassiter, B. (1994). Actors, hairdos & videotape – Informance design. In C. Plaisant (Ed.), *CHI '94 Conference Companion on Human Factors in Computing Systems, Boston, MA* (pp. 119–120). New York, NY: ACM. Retrieved from http://dl.acm.org/citation.cfm?id=260102
Burns, H. (2015). Transformative sustainability pedagogy: Learning from ecological systems and indigenous wisdom. *Journal of Transformative Education*, *13*(3), 259–276. doi.org/10.1177/1541344615584683
Campbell, A., & Brown, I. (2018). A potential difference model for educating critical designers: The case study of the Beegin Appropriate Technology Beekeeping System. In E. Costandius, & H. Botes (Eds.), *Educating citizen designers in South Africa* (pp. 85–104). Stellenbosch: Sun Press.
Cape Peninsula University of Technology. (2012). *Research, technology innovation and partnerships 10-year blueprint*. Retrieved from http://www.cput.ac.za/storage/research/RTI_Blueprint_2013_WEB.pdf
Cape Peninsula University of Technology. (n.d.a). *History of the Cape Peninsula University of Technology*. Cape Peninsula University of Technology. Retrieved from http://www.cput.ac.za/about/history
Cape Peninsula University of Technology. (n.d.b). *Service learning*. Cape Peninsula University of Technology. Retrieved from http://www.cput.ac.za/services/ccewil/learning
Cape Town History and Heritage. (2008). *District Six*. Roddy Bray's Guide to Cape Town. Retrieved from http://www.capetown.at/heritage/city/district%206.htm
Capeto, R. (2011). The new public sphere and the design field. In A. Bennett, & O. Vulpinari (Eds.), *Icograda design education manifesto 2011* (pp. 54–57). Montreal: Icograda.
Carayannis, E., & Campbell, D. (2012). *Mode 3 knowledge production in quadruple helix innovation systems: 21st-century democracy, innovation, and entrepreneurship for development*. New York, NY: Springer. Retrieved from http://link.springer.com/10.1007/978-1-4614-2062-0
Carless, D., & Boud, D. (2018). The development of student feedback literacy: Enabling uptake of feedback. *Assessment & Evaluation in Higher Education*, *43*(8), 1315–1325. doi.org/10.1080/02602938.2018.1463354
Cartedo. (2019). Welcome to Cartedo! Retrieved from http://www.cartedo.com/sign_in

Celi, M., & Formia, E. (2015). Advanced Design Practices for Sharing Futures: a Focus on Design Fiction. In L. Valentine, B. Borja de Mozota, J. Nelson, S. Merter, & P. Atkinson (Eds.), *Proceedings of the 11th International Conference of the European Academy of Design, Paris, France*. Retrieved from https://ead.yasar.edu.tr/wp-content/uploads/2017/02/03-AD-practice-x-sharing-futures-upload.pdf?csrt=2148187219619721618

Ceschin, F., & Gaziulusoy, I. (2016). Evolution of design for sustainability: From product design to design for system innovations and transitions. *Design Studies*, *47*, 118–163. doi.org/10.1016/j.destud.2016.09.002

Ceschin, F., & Gaziulusoy, I. (2019). *Design for sustainability: A multi-level framework from products to socio-technical systems*. London: Routledge. Retrieved from https://www.taylorfrancis.com/books/9780429456510

City of Cape Town. (2014). *World Design Capital Cape Town 2014*. City of Cape Town. Retrieved from http://www.capetown.gov.za/en/wdc2014/Pages/default.aspx

Cope, B., & Kalantzis, M. (2009). "Multiliteracies": New literacies, new learning. *Pedagogies: An International Journal*, *4*(3), 164–195. https://doi.org/10.1080/15544800903076044

Cope, B., & Kalantzis, M. (Eds.). (2017). *E-Learning ecologies*. New York, NY: Routledge.

Costandius, E., & Bitzer, E. (2015). *Engaging higher education curricula: A critical citizenship perspective*. Stellenbosch: Sun Press.

Costandius, E., & Botes, H. (Eds.). (2018). *Educating citizen designers in South Africa*. Stellenbosch: Sun Press.

Cranton, P. (2016). *Understanding and promoting transformative learning: A guide to theory and practice* (3rd ed.). Sterling, VA: Stylus.

Cresswell, T. (2010). Towards a politics of mobility. *Environment and Planning D: Society and Space*, *28*(1), 17–31. doi.org/10.1068/d11407

Creswell, J. (2003). *Research design: Qualitative, quantitative, and mixed method approaches* (2nd ed.). Thousand Oaks, CA: Sage.

Creswell, J. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage.

Crichton, S. (2014). Leapfrogging pedagogy: A design approach to making change in challenging contexts. *Electronic Journal of E-Learning*, *12*(1), 3–13.

Cross, N. (2001). Designerly ways of knowing: Design discipline versus design science. *Design Issues*, *17*(3), 49–55. doi.org/10.1162/074793601750357196

Cross, N. (2006). *Designerly ways of knowing*. London: Springer.

Fundani. (n.d.). *Curriculum development*. Cape Peninsula University of Technology. Retrieved from http://www.cput.ac.za/services/fundani/curriculum

Davis, M. (2011). Relevance in a complex world – Icograda design education manifesto. In A. Bennett, & O. Vulpinari (Eds.), *Icograda design education manifesto 2011* (pp. 72–75). Montreal: Icograda.

Davis, M. (2016). "Normal science" and the changing practices of design and design education. *Visible Language: The Journal of Visual Communication Research* , *50*(1), 6–23.

Dawney, L. (2018). Diffracting. In C. Lury, R. Fensham, A Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods* [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

De Corte, E. (2011). Constructive, self-regulated, situated, and collaborative learning: An approach for the acquisition of adaptive competence. *Journal of Education*, *192*(2/3), 33–47. doi.org/10.1177/0022057412192002-307

DEFSA (Design Educators Forum of SA). (2000). *Reshaping South Africa by Design*. DEFSA International Conference. Retrieved from: https://www.defsa.org.za/2000-defsa-conference

DEFSA (Design Educators Forum of SA). (2019). *Designed Futures*. DEFSA International Conference. Retrieved from: https://www.defsa.org.za/2019-international-defsa

Deleuze, G., & Guattari, F. (1987). *A thousand plateaus: Capitalism and schizophrenia*. Minneapolis, MN: University of Minnesota Press.

Den Heyer, K., & Abbott, L. (2011). Reverberating echoes: Challenging teacher candidates to tell and learn from entwined narrations of Canadian history. *Curriculum Inquiry*, *41*(5), 610–635. doi.org/10.1111/j.1467-873X.2011.00567.x

Denzin, N. (2017). Critical qualitative inquiry. *Qualitative Inquiry*, *23*(1), 8–16. doi.org/10.1177/1077800416681864

DesignBRICS. (2019). designBRICS. designBRICS Network. Retrieved from https://www.designbrics.net

DESIS Network. (2016). *Desis Network Design for Social Innovation and Sustainability website*. DESIS NETWORK. Retrieved from https://www.desisnetwork.org/

Dewey, J. (2007). *Experience and education*. New York, NY: Simon & Schuster.

Dirkx, J., & Dang, N. (2009). From laborer to learner: The experiences of former factory workers in a developmental education program. *Adult Education Research Conference 2009 Proceedings, Chicago, IL* (pp. 107–112). Manhattan, KS: New Prairie Press. Retrieved from https://newprairiepress.org/aerc/2009/papers/19

Dong, A. (2007). The enactment of design through language. *Design Studies*, *28*(1), 5–21. doi.org/10.1016/j.destud.2006.07.001

DRAS. (2008). Design Research Agenda for Sustainability: An open and collaborative program. Draft 1 – 12.07.08. In E. Cipolla, & P. Peruccio (Eds.), *Changing the Change Proceedings: Design, Visions, Proposals and Tools, Turin, Italy* (pp 38–42). Turin: Allemandi Conference Press. Retrieved from https://www.allemandi.com/university/ctc.pdf

DRS. (2018). *DRS 2018 conference announcement*. Design Research Society. Retrieved from http://www.drs2018limerick.org/conference/drs-2018

Dubberly, H. (2017). Connecting things: Broadening design to include systems, platforms, and product-service ecologies. In L. Atzmon, & P. Boradkar (Eds.), *Encountering things: Design and theories of things* (pp. 153–166) [Google Books]. London: Bloomsbury. Retrieved from https://books.google.co.za/books?redir_esc=y&id=3Os1DwAAQBAJ&q=

Dunne, A., & Raby, F. (2013). Speculative everything: Design, fiction, and social dreaming [book announcement]. Retrieved from https://mitpress.mit.edu/books/speculative-everything

Du Plessis, C., & Brandon, P. (2015). An ecological worldview as basis for a regenerative sustainability paradigm for the built environment. *Journal of Cleaner Production*, *109*, 53–61. doi.org/10.1016/j.jclepro.2014.09.098

Edwards, A. (2007). Relational agency in professional practice: A CHAT analysis. *Actio: An International Journal of Human Activity Theory*, *1*, 1–17.

Ehn, P. (1998). Manifesto for a digital Bauhaus. *Digital Creativity*, *9*(4), 207–217. doi.org/10.1080/14626269808567128

Ehrenfeld, J. (2008). *Sustainability by design: A subversive strategy for transforming our consumer culture*. New Haven, CT: Yale University Press.

Eikeland, O. (2012). Symbiotic learning systems: Reorganizing and integrating learning efforts and responsibilities between higher educational institutions (HEIs) and work places. *Journal of the Knowledge Economy*, *4*(1), 98–118. doi.org/10.1007/s13132-012-0123-6

Ellsworth, E. (2005). *Places of learning: Media, architecture, pedagogy*. New York, NY: RoutledgeFalmer.

Erstad, O. (2014). The expanded classroom – Spatial relations in classroom practices using ICT. *Nordic Journal of Digital Literacy*, *9*(1), 8–22.

Erstad, O., Gilje, Ø., Sefton-Green, J., & Vasbø, K. (2009). Exploring 'learning lives': Community, identity, literacy and meaning. *Literacy*, *43*(2), 100–106. doi.org/10.1111/j.1741-4369.2009.00518.x

Escobar, A. (2016). Thinking-feeling with the Earth: Territorial struggles and the ontological dimension of the epistemologies of the South. *AIBR: Revista de Antropología Iberoamericana*, *11*(1), 11–32. doi.org/10.11156/aibr.110102e

Escobar, A. (2017). Response: Design for/by [and *from*] the 'global South.' *Design Philosophy Papers*, *15*(1), 39–49. doi.org/10.1080/14487136.2017.1301016

Exhibition AHO Gallery. (n.d.). *Artefacts from the pluriverse – Shaping sustainable futures | Arkitektur- og designhøgskolen i Oslo*. [Exhibition, AHO Gallery, 8–16 October 2019]. Retrieved from https://aho.no/no/kalender/exhibition-aho-gallery-artefacts-pluriverse-shaping-sustainable-futures

Facer, K. (2011). *Learning futures: Education, technology and social change*. London: Routledge.

Facer, K. (2019). *Beyond oil: Of timescapes, new frontiers and monsters*. Keynote address presented at the Beyond Oil: Deep & Rapid Transformations Conference, Bergen, Norway. Retrieved from https://www.uib.no/en/cet/130727/beyond-oil-2019-deep-and-rapid-transformations-keynote-presentations

Farías, I., & Sánchez Criado, T. (2018). Re-learning design: Pedagogical experiments with STS in design studio courses. *Revista Diseña*, *2018*(12), 14–29. doi.org/10.7764/disena.12.14-29

Fendler, R. (2013). Becoming-learner: Coordinates for mapping the space and subject of nomadic pedagogy. *Qualitative Inquiry*, *19*(10), 786–793. doi.org/10.1177/1077800413503797

Fenn, T., & Hobbs, J. (2018). Nurturing critical citizen designers: Applying strategic models for reflective practice. In E. Costandius, & H. Botes (Eds.), *Educating citizen designers in South Africa* (pp. 141–160). Stellenbosch: Sun Press.

Fensham, R., & Heller-Nicholas, A. (2018). Making and assembling. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods* [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

Findeli, A. (2001). Rethinking design education for the 21st century: Theoretical, methodological, and ethical discussion. *Design Issues*, *17*(1), 5–17. doi.org/10.1162/07479360152103796

Forlano, L. (2017). Posthumanism and design. *She Ji: The Journal of Design, Economics, and Innovation*, *3*(1), 16–29. doi.org/10.1016/j.sheji.2017.08.001

Foster, J. (2008). *The sustainability mirage: Illusion and reality in the coming war on climate change*. London: Earthscan.

Frascara, J. (Ed.). (2002). *Design and the social sciences: Making connections*. London: Taylor & Francis.

Frayling, C. (1993/1994). Research in art and design. *Royal College of Art Research Papers, 1*(1), 1-5. Royal College of Art, London. Retrieved from http://researchonline.rca.ac.uk/384/3/frayling_research_in_art_and_design_1993.pdf

Freire, P. (1992/2014). *Pedagogy of hope: Reliving Pedagogy of the oppressed*. London: Bloomsbury.

Friedman, K. (2012). Models of design: Envisioning a future design education. *Visible Language*, *46*(1/2), 132–153.

Fry, T. (2009). *Design futuring: Sustainability, ethics and new practice*. London: Bloomsbury.

Fry, T. (2012). *Becoming Human by Design*. London: Berg.

Fry, T. (2017). Design for/by "The Global South". *Design Philosophy Papers*, *15*(1), 3–37. doi.org/10.1080/14487136.2017.1303242

Fry, T., & Willis, A.-M. (2017). Design and the Global South. *Design Philosophy Papers*, *15*(1), 1–2. doi.org/10.1080/14487136.2017.1307537

Fuad-Luke, A. (2009). *Design activism: Beautiful strangeness for a sustainable world*. London: Earthscan.

Fullan, M., & Scott, G. (2014). *New pedagogies for deep learning Whitepaper: Education Plus: The world will be led by people you can count on, including you!* Seattle, WA: Collaborative Impact SPC. Retrieved from http://www.michaelfullan.ca/wp-content/uploads/2014/09/Education-Plus-A-Whitepaper-July-2014-1.pdf

Futerman, R., Grant-Broom, A., & Snaddon, B. (2012). Developing locally attuned and responsible curricula. *Paradigms: Journal for Research and Innovation in Teaching and Learning at CPUT*, *2012*(17), 27–35. Retrieved from http://www.cput.ac.za/files/images_folder/units/fundani/documents/Paradigms%20Issue%2017.pdf

Gachago, D., Morkel, J., Hitge, L., van Zyl, I., & Ivala, E. (2017). Developing eLearning champions: a design thinking approach. *International Journal of Educational Technology in Higher Education*. 14(30). doi.org/10.1186/s41239-017-0068-8

Gadamer, H. (1975). *Truth and method* (2nd rev. ed.). New York, NY: Continuum.

Gale, K., & Wyatt, J. (2009). *Between the Two: A Nomadic Inquiry into Collaborative Writing and Subjectivity*. Newcastle upon Tyne, UK: Cambridge Scholars Publishing.

Garraway, J. (2013). Introduction: Future studies and scenarios in developing degrees. *Paradigms: Journal for Research and Innovation in Teaching and Learning at CPUT, 2013*(18), 3–6. Retrieved from https://www.cput.ac.za/storage/services/fundani/paradigms_journal_18.pdf

Gee, J. (2008). A sociocultural perspective on opportunity to learn. In P. Moss, D. Pullin, J. Gee, E. Haertel, & L. Young (Eds.), *Assessment, equity, and opportunity to learn* (pp. 76–108). Cambridge: Cambridge University Press. Retrieved from http://ebooks.cambridge.org/ref/id/CBO9780511802157A013

Gibson, M., & Owens, K. (2015). Making meaning happen between 'us' and 'them': Strategies for bridging gaps in understanding between researchers who possess design knowledge and those working in disciplines outside design. In P. Rodgers, & J. Yee (Eds.), *The Routledge companion to design research* (pp. 386–399). London: Routledge.

Gornick, N., & Grout, I. (2008). A dialogue on the future of design education. In E. Cipolla, & P. Peruccio (Eds.), *Changing the Change Proceedings: Design, Visions, Proposals and Tools, Turin, Italy* (pp 740–754). Turin: Allemandi Conference Press. Retrieved from https://www.allemandi.com/university/ctc.pdf

Gray, B. (2018). 'Socially responsibilised' designers: The evils of entrepreneurship ideology in citizenship education. In In E. Costandius, & H. Botes (Eds.), *Educating citizen designers in South Africa* (pp. 105–120). Stellenbosch: Sun Press.

Gray, C. (2013). Informal peer critique and the negotiation of habitus in a design studio. Paper presented at the 2nd DRS // CUMULUS 2013 International Conference for Design Education Researchers, Oslo, Norway.

Gray van Heerden, C. (2017). *The slightest gesture*: Deligny, the ritornello and subjectivity in socially just pedagogical praxis. *Education as Change*, *21*(2), 6–24. doi.org/10.17159/1947-9417/2017/2009

Grimmett, P., & Halvorson, M. (2010). From understanding to creating curriculum: The case for the co-evolution of re-conceptualized design with re-conceptualized curriculum. *Curriculum Inquiry*, *40*(2), 241–262. doi.org/10.1111/j.1467-873X.2010.00480.x

Gürsoy, B. (2016). Why is making important for the culture of design? In S. Chien, S. Choo, & M. Schnabel (Eds.), *Living Systems and Micro-Utopias: Towards Continuous Designing: Proceedings of the 21st International Conference of the Association for Computer-Aided Architectural Design Research in Asia (CAADRIA 2016), Melbourne, Australia* (pp. 851–860). Hong Kong: CAADRIA.

Gutiérrez, K., Engeström, Y., & Sannino, A. (2016). Expanding educational research and interventionist methodologies. *Cognition and Instruction*, *34*(3), 275–284. doi.org/10.1080/07370008.2016.1183347

Haraway, D. (1997). *Modest_witness@second_millenium. FemaleMan©_meets_OncoMouse™*. New York, NY: Routledge.

Haraway, D. (2016). *Staying with the trouble: Making kin in the Chthulucene*. Durham, NC: Duke University Press.

Heape, C. (2015). Today's students, tomorrow's practitioners. In R. vande Zande, E. Bohemia, & I. Degranes (Eds.), *Proceedings of the 3rd International Conference for Design Education Researchers*, *Chicago, IL* (Vol. 4, pp.1362–1380). Helsinki: Aalto University. doi.org/10.13140/RG.2.1.2642.5440

Heidegger, M. (1996). *Being and time*. Albany, NY: State University of New York Press.
Heller, S. (2005). *The education of a graphic designer* (2nd ed.). New York, NY: Allworth.
HESA (Higher Education South Africa) (2010, March). *Sector Position Paper on the Report of the Ministerial Committee on Transformation and Social Cohesion and the Elimination of Discrimination in South Africa's Public Higher Education Institutions*. Pretoria: HESA. Retrieved from http://www.usaf.ac.za/wp-content/uploads/2017/07/2010_HESA_Position-Paper-on-Transformation-Soudien-Report.pdf
Higgins, M., & Madden, B. (2018). (Not Idling at) the Flâneur in Indigenous Education: Towards Being and Becoming Community. In R. Irwin & L. Cutcher (Eds.), *The Flâneur and Education Research: A Metaphor for Knowing, Being Ethical and New Data Production* (pp. 1–28). New York: Palgrave Pivot.
Hill, R. (2012). Civic engagement and environmental literacy. *New Directions for Adult & Continuing Education*, *2012*(135), 41–50. doi.org/10.1002/ace.20025
Holbrook, T., & Pourchier, N. (2014). Collage as analysis: Remixing in the crisis of doubt. *Qualitative Inquiry*, *20*(6), 754–763. doi.org/10.1177/1077800414530260
Holden, E., Linnerud, K., & Banister, D. (2016). The imperatives of sustainable development. *Sustainable Development*, *25*(3), 213–226. doi.org/10.1002/sd.1647
Holliday, A. (2007). *Doing and writing qualitative research* (2nd ed.). London: Sage.
Hooker, G. (2017). *Genius of place*. The Biomimicry Institute. Retrieved from: https://asknature.org/collections/genius-of-place/
Hokanson, B. (2012). The design critique as a model for distributed learning. In L. Moller, & J. Huett (Eds.), *The Next Generation of Distance Education* (pp. 71–84). New York: SpringerHull, G., & Katz, M. (2006). Crafting an agentive self: Case studies of digital storytelling. *Research in the Teaching of English*, *41*(1), 43–81.
Hultman, K., & Lenz Taguchi, H. (2010). Challenging anthropocentric analysis of visual data: A relational materialist methodological approach to educational research. *International Journal of Qualitative Studies in Education*, *23*(5), 525–542. doi.org/10.1080/09518398.2010.500628
Hunt, J. (2011). Icograda design education manifesto. In A. Bennett, & O. Vulpinari (Eds.), *Icograda design education manifesto 2011* (pp. 86–89). Montreal: Icograda.
Ingold, T. (2011). *Being alive: Essays on movement, knowledge and description*. London: Routledge.
Ingold, T. (2018). *Anthropology and/as education* [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Anthropology-as-Education-Tim-Ingold-ebook-dp-B075DGNSBC/dp/B075DGNSBC/ref=mt_kindle?_encoding=UTF8&me=&qid=
Irwin, T. (2012). Wicked problems and the relationship triad. In S. Harding (Ed.), *Grow small, think beautiful: ideas for a sustainable world from Schumacher College* (pp. 163–226). Edinburgh: Floris.
Irwin, T. (2015). Transition design: A proposal for a new area of design practice, study, and research. *Design and Culture*, *7*(2), 229–246. doi.org/10.1080/17547075.2015.1051829
Irwin, T., & Baxter, S. (2008). The dynamical view of natural form. In C. Brebbia (Ed.), *Design and nature IV: Comparing design in nature with science and engineering* (pp. 129–138). Southampton: WIT Press.
Irwin, T., Kossoff, G., & Tonkinwise, C. (2015). Transition Design Provocation. *Design Philosophy Papers*, *13*(1), 1–2. doi.org/10.1080/14487136.2015.1085688
Jackson, N. (2013). The concept of learning ecologies. In *Lifewide learning, education & personal development* [e-book]. Retrieved from http://www.lifewideebook.co.uk/uploads/1/0/8/4/10842717/chapter_a5.pdf
Jackson, N. (2016). *Exploring learning ecologies*. Milton Keynes: Chalk Mountain.
Jansen, J. (2018, June). Viewpoints: The future prospects of South African universities. *Viewpoints* (Centre for Development and Enterprise), *2018*(1), 1–7. Retrieved from https://www.cde.org.za/wp-content/uploads/2018/06/Viewpoints-The-future-prospects-of-South-African-Universities-Jonathan-Jansen.pdf

Jardine, D. (2006). "Under the tough old stars": Meditations on pedagogical hyperactivity and the mood of environmental education. In D. Jardine, S. Friesen, & P. Clifford (Eds.), *Curriculum in abundance* (pp. 179–184). Mahwah, N.J: Lawrence Erlbaum.

Jellis, T. (2018). Suspending. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods* [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

Jewitt, C. (2012). An introduction to using video for research. National Centre for Research Methods Working Paper 03/12. Southampton: NCRM. Retrieved from http://eprints.ncrm.ac.uk/2259/4/NCRM_workingpaper_0312.pdf

Johnson, L., & Morris, P. (2010). Towards a framework for critical citizenship education. *The Curriculum Journal*, *21*(1), 77–96. doi.org/DOI:10.1080/09585170903560444

Jones, D. (2015). Reflection-in-action and motivated reasoning. In R. vande Zande, E. Bohemia, & I. Degranes (Eds.), *Proceedings of the 3rd International Conference for Design Education Researchers, Chicago, IL* (Vol. 4, pp. 1559–1615). Helsinki: Aalto University.

Kaiser, Z., & Nash, K. (2015). [Un]Learning x design from the ground, up. In R. vande Zande, E. Bohemia, & I. Degranes (Eds.), *Proceedings of the 3rd International Conference for Design Education Researchers, Chicago, IL* (Vol. 4, pp.1616–1627). Helsinki: Aalto University.

Kellner, D. (1998). Multiple literacies and critical pedagogy in a multicultural society. *Educational Theory*, *48*(1), 103–122. doi.org/10.1111/j.1741-5446.1998.00103.x

Kelly, A. (2004). Design research in education: Yes, but is it methodological? *Journal of the Learning Sciences*, *13*(1), 115–128. doi.org/10.1207/s15327809jls1301_6

Kempton, W. (2019). *Unpacking making: A product design critique on emergent uses of additive manufacturing.* (Unpublished doctoral thesis). Oslo, Oslo School of Architecture and Design. Retrieved from https://aho.brage.unit.no/aho-xmlui/handle/11250/2597236

Kennedy, E., Fecheyr-Lippens, D., Hsiung, B., Niewiarowski, P., & Kolodziej, M. (2015). Biomimicry: A path to sustainable innovation. *Design Issues*, *31*(3), 66–73. https://doi.org/10.1162/DESI_a_00339

Killi, S., & Morrison, A. (2015). Just-in-time teaching, just-in-need learning: Designing towards optimized pedagogical outcomes. *Universal Journal of Educational* Research, 3(10), 742–750. doi: 10.13189/ujer.2015.031013

Kimbell, L. (2012). Rethinking design thinking: Part II. *Design and Culture*, *4*(2), 129–148. doi.org/10.2752/175470812X13281948975413

Kolko, J. (2009). Abductive thinking and sensemaking: The drivers of design synthesis. *Design Issues*, *26*(1), 15–28. doi.org/10.1162/desi.2010.26.1.15

Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J., & Wensveen, S. (2012). *Design research through practice: From the lab, field, and showroom*. Waltham, MA: Morgan Kaufmann.

Kossoff, G. (2015). Holism and the reconstitution of everyday life: A framework for transition to a sustainable society. *Design Philosophy Papers*, *13*(1), 25–38. doi.org/10.1080/14487136.2015.1085688

Kossoff, G., Irwin, T., & Willis, A.-M. (2015). Transition design. *Design Philosophy Papers*, *13*(1), 1–2. doi.org/10.1080/14487136.2015.1085681

Kumar, V. (2012). *101 design methods: A structured approach for driving innovation in your organization*. Hoboken, NJ: Wiley.

Kuntz, A. (2015). *The Responsible Methodologist: Inquiry, Truth-Telling, and Social Justice*. London: Routledge.

Kuntz, A., & Presnall, M. (2012). Wandering the Tactical: From Interview to Intraview. *Qualitative Inquiry, 18*(9), 732-744. doi.org/10.1177/1077800412453016

Lammes, S. (2018). Engaging and distributing. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research*

methods [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

Lather, P. (1991). *Getting smart: Feminist research and pedagogy with/in the postmodern*. New York, NY: Routledge.

Latour, B. (2018). *Down to earth: Politics in the new climatic regime*. Cambridge: Polity Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lawson, B. (2005). *How designers think: The design process demystified* (4th ed.). Amsterdam: Architectural Press.

Lawson, C., & Poggio, N. (2015). From engagement to impact in design education. In R. vande Zande, E. Bohemia, & I. Degranes (Eds.), *Proceedings of the 3rd International Conference for Design Education Researchers*, *Chicago, IL* (Vol. 2, pp. 518–534). Helsinki: Aalto University. doi.org/10.13140/RG.2.1.2642.5440

Le Roux, K., & Costandius, E. (2013). The viability of social design as an agent for positive change in a South African context: Mural painting in Enkanini, Western Cape. *Image & Text: A Journal for Design, 21*(1), 106–120.

Leander, K., Phillips, N., & Taylor, K. (2010). The changing social spaces of learning: Mapping new mobilities. *Review of Research in Education* (Vol. 34, pp. 329–394). Washington, DC: American Educational Research Association.

Leibowitz, B. (Ed.). (2012). *Higher education for the public good: Views from the South*. Stellenbosch: Sun Media.

Leibowitz, B., & Bozalek, V. (2016). The scholarship of teaching and learning from a social justice perspective. *Teaching in Higher Education*, *21*(2), 109–122. doi.org/10.1080/13562517.2015.1115971

Leibowitz, B., & Bozalek, V. (2018). Towards a Slow scholarship of teaching and learning in the South. *Teaching in Higher Education*, *23*(8), 981–994. doi.org/10.1080/13562517.2018.1452730

Leibowitz, B., Bozalek, V., Carolissen, R., Nicholls, L., Rohleder, P., & Swartz, L. (2010). Bringing the social into pedagogy: Unsafe learning in an uncertain world. *Teaching in Higher Education*, *15*(2), 123–133. doi.org/10.1080/13562511003619953

Lemke, J. (1997). Cognition, context, and learning: A social semiotic perspective. In D. Kirshner., & J. Whitson (Eds.), *Situated cognition: Social, semiotic, and psychological perspectives* (pp. 37–56). Mahwah, N.J: Lawrence Erlbaum.

Lemke, J. (2000). Across the scales of time: Artifacts, activities, and meanings in ecosocial systems. *Mind, Culture, and Activity*, *7*(4), 273–290. doi.org/10.1207/S15327884MCA0704_03

Lemke, J. (2002). Becoming the village: Education across lives. In G. Wells, & G. Claxton (Eds.), *Learning for life in the 21st century* (pp. 34–45). Oxford: Blackwell. doi.org/10.1002/9780470753545.ch3

Lemke, J. (2013). Feeling and meaning in the social ecology of learning: Lessons from play and games. In M. Baker, J. Andriessen, & S. Järvelä (Eds.), *Affective learning together: Social and emotional dimensions of collaborative learning* (pp. 71–94). London: Routledge.

LeNS International. (n.d.). *About*. Retrieved from http://www.lens-international.org/about

Leong, B., & Lee, B. 2014. Learning the unlearned. In C. Vezzoli, C. Kohtala, & A. Srinivasan (Eds.), *Product-service system design for sustainability* (pp. 471–488). Sheffield: Greenleaf.

Lerner, F. (2005). Foundations for design education: Continuing the Bauhaus *Vorkurs* vision. *Studies in Art Education*, *46*(3), 211–226. doi.org/10.1080/00393541.2005.11650075

Lock, S. (2013). Anachronistic intervention: Performative collaborative design in the wild. *CoDesign*, *9*(1), 17–36. doi.org/10.1080/15710882.2012.755550

Luke, A. (2012). Critical literacy: Foundational notes. *Theory Into Practice*, *51*(1), 4–11. doi.org/10.1080/00405841.2012.636324

Lury, C. (2018). Introduction. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods* [Kindle].

London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

Lury, C., & Wakeford, N. (Eds.). (2012). *Inventive methods: The happening of the social*. London: Routledge.

Mainsah, H. (2014). Pedagogy of critical design literacies for fast-changing futures. In A. Breytenbach, & K. Pope (Eds.), *Design with the Other 90%: Cumulus Johannesburg Conference Proceedings* (pp. 292–297). Johannesburg: Cumulus. Retrieved from https://www.cumulusassociation.org/wp-content/uploads/2015/09/CumulusJoburgProceedings_Sep14.pdf

Mainsah, H., & Morrison, A. (2014). Participatory design through a cultural lens: Insights from postcolonial theory. *PDC '14: Proceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium Papers, and Keynote Abstracts, Windhoek, Namibia* (Volume 2, pp. 83–86). New York, NY: ACM. doi.org/10.1145/2662155.2662195

Malcolm, J., & Sanchez Ruano, D. (2015). Using nature to inspire design values, issues & ethics. In R. vande Zande, E. Bohemia, & I. Degranes (Eds.), *Proceedings of the 3rd International Conference for Design Education Researchers*, *Chicago, IL* (Vol. 3, pp. 923–939). Helsinki: Aalto University. doi.org/10.13140/RG.2.1.2642.5440

Maldonado, T. (1972). *Design, nature, and revolution: Toward a critical ecology*. New York, NY: Harper & Row.

Maniates, M. (2017). Suddenly more than academic: Higher education for a post-growth world. In E. Assadourian, & L. Mastny (Eds.), *EarthEd: Rethinking education on a changing planet* [Adobe digital edition] (pp. 215-228). Washington, DC: Island Press. Retrieved from https://www.ebooks.com/en-za/95910902/earthed-state-of-the-world/the-worldwatch-institute/?_c=1

Manzini, E. (2008). New design knowledge: Introduction to the conference. In E. Cipolla, & P. Peruccio (Eds.), *Changing the Change Proceedings: Design, Visions, Proposals and Tools, Turin, Italy* (pp. 38–42). Turin: Allemandi Conference Press. Retrieved from https://www.allemandi.com/university/ctc.pdf

Manzini, E. (2009). New design knowledge. *Design Studies*, *30*(1), 4–12. doi.org/10.1016/j.destud.2008.10.001

Manzini, E. (2014). Design in a changing, connected world. *Strategic Design Research Journal*, *7*(2), 95–99. doi.org/10.4013/sdrj.2014.72.06

Manzini, E., & Cullars, J. (1992, Autumn). Prometheus of the everyday: The ecology of the artificial and the designer's responsibility. *Design Issues*, *9*(1), 5–20. doi.org/10.2307/1511595

Marenko, B., & Brassett, J. (Eds.). (2015). *Deleuze and design*. Edinburgh: Edinburgh University Press.

Margolin, V. (2007). Design, the future and the human spirit. *Design Issues*, *23*(3), 4–15. doi.org/10.1162/desi.2007.23.3.4

Markussen, T., & Knutz, E. (2013). The poetics of design fiction. *DPPI '13: Proceedings of the 6th International Conference on Designing Pleasurable Products and Interfaces*, *Newcastle upon Tyne, UK* (pp. 231–240). New York, NY: ACM. Retrieved from http://dl.acm.org/citation.cfm?id=2513531

Marres, N. (2012). *Material participation: Technology, the environment and everyday publics*. Basingstoke: Palgrave Macmillan.

Mathews, F. (2011). Towards a deeper philosophy of biomimicry. *Organization & Environment*, *24*(4), 364–387. doi.org/10.1177/1086026611425689

Maturana, H. (1999, September). In conversation: Heinz von Foerster and Humberto Maturana. *Patterns*, 4–5. Retrieved from http://www.asc-cybernetics.org/Patterns/PATTERNS%201999%2009.pdf

Mazzei, L. (2014). Beyond an easy sense: A diffractive analysis. *Qualitative Inquiry*, *20*(6), 742–746. doi.org/10.1177/1077800414530257

Mbembe, A. (2016). *Decolonizing knowledge and the question of the archive. Keynote address*. Combined Conference of ICED and HELTASA: Ethics, Care and Quality in Educational Development, Cape Town. Retrieved from https://www.youtube.com/watch?v=qLEEEyn4Hi0

McCullagh, K. (2010). Is It Time to Rethink the T-Shaped Designer? Retrieved from https://www.core77.com/posts/17426/Is-It-Time-to-Rethink-the-T-Shaped-Designer

McFarlane, C. (2011). *Learning the city: Knowledge and translocal assemblage*. Chichester: Wiley.

Mead, T., & Jeanrenaud, S. (2017). The elephant in the room: Biomimetics and sustainability? *Bioinspired, Biomimetic and Nanobiomaterials*, *6*(2), 113–121. https://doi.org/10.1680/jbibn.16.00012

Meadows, D. (1999). *Leverage points: Places to intervene in a system*. Retrieved from http://www.donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/

Melioranski, R. (2019). Transdisciplinary collaboration as a new phenomenon in the Estonian design field. *Cumulus Conference Proceedings: Around the Campfire – Resilience and Intelligence, Rovaniemi, Finland* (pp. 246–258). Aalto: Cumulus. Retrieved from https://www.cumulusassociation.org/cumulus-conference-proceedings-rovaniemi-2019-around-the-campfire-resilience-and-intelligence/

Meyer, J., Land, R., & Baillie, C. (Eds.). (2010). *Threshold concepts and transformational learning*. Rotterdam: Sense.

Mezirow, J. (1990). *How critical reflection triggers transformative learning*. San Francisco, CA: Jossey-Bass.

Miller, R. (2007). Futures literacy: A hybrid strategic scenario method. *Futures*, *39*(4), 341–362. doi.org/10.1016/j.futures.2006.12.001

Miller, R. (Ed.). (2018). *Transforming the future: Anticipation in the 21st century*. London: Routledge. doi.org/10.4324/9781351048002

Minty, Z. (2017, December 14). *The missed opportunity: World Design Capital 2014*. Creative City South. Retrieved from https://creativecitysouth.org/blog-1/2017/12/13/missed-opportunity-wdc14

Moon, J. (2006). *Learning journals: A handbook for reflective practice and professional development* (2nd ed.) London: Routledge.

Morrison, A., & Sevaldson, B. (2010). 'Getting going' – Research by design. *FORMakademisk*, *3*(1). doi.org/10.7577/formakademisk.136

Morrison, A., Erstad, O., Liestøl, G., Pinfold, N., Snaddon, B., Hemmersam, P., & Grant-Broom, A. (2019). Investigating agentive urban learning: An assembly of situated experiences for sustainable futures. *Oxford Review of Education*, *45*(2), 204–223. doi.org/10.1080/03054985.2018.1556627

Morrison, A., Mainsah, H., & Rygh, K. (2019). Sharp edges, blunt objects, clean slices. Exploring design research methods. *The Design Journal*, *22*(Supl.1), 2267–2273. doi.org/10.1080/14606925.2019.1595025

Mott, C., Zupan, S., Debbane, A.-M. (2015). Making Space for Critical Pedagogy in the Neoliberal University: Struggles and Possibilities. *ACME: An International E-Journal for Critical Geographies, 14*(4), 1260–1282. Retrieved from https://www.researchgate.net/publication/288824927_Making_Space_for_Critical_Pedagogy_in_the_Neoliberal_University_Struggles_and_Possibilities

Motala, S. (2018). *Critical posthumanism in geomatics education: A storytelling intervention*. (Unpublished doctoral thesis). University of the Western Cape, Bellville, South Africa.

Murris, K., & Bozalek, V. (2019). Diffracting diffractive readings of texts as methodology: Some propositions. *Educational Philosophy and Theory*, *51*(14), 1504–1517. doi.org/10.1080/00131857.2019.1570843

Narayanan, G. (2010). Enactive design. *LeNS Conference, Bangalore, India* (Vol. 1, pp 19–24). Retrieved from www.lens.polimi.it

National Commission on Higher Education. (1996). *Report: A framework for transformation*. Pretoria: The Commission. Retrieved from https://www.che.ac.za/media_and_publications/other-stakeholder-s-publications/nche-report-framework-transformation-1996

Nespor, J. (1997). *Tangled up in school: Politics, space, bodies, signs in the educational process*. Mahwah, N.J: Lawrence Erlbaum.

Nespor, J. (2013). *Knowledge in Motion: Space, Time and Curriculum in Undergraduate Physics and Management*. London: Routledge.

Ng'ambi, D., Brown, C., Bozalek, V., Gachago, D., & Wood, D. (2016). Technology enhanced teaching and learning in South African higher education – A rearview of a 20 year journey. British Journal of Educational Technology, 47(5), 843–858. doi.org/10.1111/bjet.12485

Norrish, J., Williams, P., O'Connor, M., & Robinson, J. (2013). An applied framework for positive education. *International Journal of Wellbeing*, *3*(2), 147–161. doi:10.5502/ijw.v3i2.2

Nussbaum, B. (2010). Is humanitarian design the new imperialism? Retrieved from https://www.fastcompany.com/1661859/is-humanitarian-design-the-new-imperialism

Oblinger, D. (Ed.). (2006). *Learning spaces*. Boulder, CO: Educause.

Open Design Afrika. (n.d.). *About*. Open Design Afrika. Retrieved from http://opendesignafrika.org/

Orr, D. (1992). *Ecological Literacy: Education and the Transition to a Postmodern World*. New York: State University of New York Press.

Orr, D. (2004). *Earth in mind: On education, environment, and the human prospect* (10th anniversary ed.). Washington, DC: Island Press.

Orr, S., & Shreeve, A. (2018). *Art and design pedagogy in higher education: Knowledge, values and ambiguity in the creative curriculum* [Google Books]. London: Routledge. Retrieved from https://play.google.com/books/reader?id=GRIwDwAAQBAJ&printsec=frontcover&pg=GBS.PT19

Osmond, J., & Turner, A. (2010). The threshold concept journey in design: From identification to application. In J. Meyer, R. Land, & C. Baillie (Eds.),*Threshold concepts and transformational learning* (pp. 347–364). Rotterdam: Sense.

Papanek, V. (1985). *Design for the real world: Human ecology and social change* (2nd ed.). London: Thames & Hudson.

Parisi, L. (2013). Speculation: A method for the unattainable. In C. Lury, & N. Wakeford (Eds.), *Inventive methods: The happening of the social* (pp. 232–244). London: Routledge. Retrieved from http://research.gold.ac.uk/12707/

Parr, A. (2010). *The Deleuze Dictionary Revised Edition*. Edinburgh: Edinburgh University Press.

Pedgley, O. (2007). Capturing and analysing own design activity. *Design Studies*, *28*(5), 463–483. doi.org/10.1016/j.destud.2007.02.004

Perold-Bull, K. (2018). Design and its education in 'post' South African society: A way forward. In E. Costandius, & H. Botes (Eds.), *Educating citizen designers in South Africa* (pp. 187–197). Stellenbosch: Sun Press.

Perod-Bull, K., & Costandius, E. (2019). Post-qualitative design research: Negotiating serendipity and risking the colonised self. *CriSTaL: Critical Studies in Teaching & Learning*, *7*(1), 42–63. doi.org/10.14426/cristal.v7i1.171

Perold, R., & Delport, H. (2018). Exploring live and design-build projects as educational spaces to foster critical citizenship. In E. Costandius, & H. Botes (Eds.), *Educating citizen designers in South Africa* (pp. 43–63). Stellenbosch: Sun Press.

Poggenpohl, S. (2002). Design moves: Approximating a desired future with users. In J. Frascara (Ed.), *Design and the social sciences: Making connections* (pp. 66–82). London: Taylor & Francis.

Poggenpohl, S. (2009). Time for change: Building a design discipline. In S. Poggenpohl, & K. Sato (Eds.), *Design integrations: Research and collaboration* (pp. 3–22). Chicago, IL: University of Chicago Press.

Ragin, C. (2018). Casing. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods* [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

Raymond, C., Snaddon, B., Chisin, A., Morrison, A., Steggell, A., & Di Ruvo, M. (2019). Curated session: Design, relational ontologies and futurescaping [Abstract]. *Anticipation 2019 Conference, Oslo, Norway*. Retrieved from http://anticipationconference.org/wp-content/uploads/2019/10/Anticipation_2019_paper_141.pdf

Raworth, K. (2012). A safe and just space for humanity: Can we live within the doughnut? Oxfam Discussion Paper. Oxford: Oxfam. Retrieved from https://www-cdn.oxfam.org/s3fs-public/file_attachments/dp-a-safe-and-just-space-for-humanity-130212-en_5.pdf

Reason, P. (1998). Political, epistemological, ecological and spiritual dimensions of participation. *Studies in Cultures, Organizations and Societies*, *4*(2), 147–167. doi.org/10.1080/10245289808523509

Reason, P., & Bradbury, H. (Eds.). (2008). *The Sage handbook of action research: Participative inquiry and practice* (2nd ed.). London: Sage.

Richardson, L., & St. Pierre, E. A. (2005) Writing: A method of enquiry. In N. Denzin, & Y. Lincoln (Eds.), *The Sage handbook of qualitative research* (3rd ed., pp. 959-978). Thousand Oaks, CA: Sage.

Rittel, H., & Webber, M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155–169. doi.org/10.1007/BF01405730

Rochfort, D. (2002). Making connections: Design and the social sciences. In J. Frascara (Ed.), *Design and the social sciences: Making connections* (pp. 158–166). London: Taylor & Francis.

Ryan, N. (2016). 2025: Forecasting Futures. In C. Kung, E. Lam, & Y. Lee (Eds.), *Open Design for E-very-thing: Cumulus 2016 Conference Proceedings* (pp. 118–120). Hong Kong: Hong Kong Design Institute.

Sachdev, G. (2014). New ways of educating: Articulating experience. In C. Vezzoli, C. Kohtala, & A. Srinivasan (Eds.), *Product-service system design for sustainability* (pp. 422–440). Sheffield: Greenleaf. Retrieved from https://www.researchgate.net/publication/260831608_Product-Service_System_Design_for_Sustainability

Sanders, E. (2002). From user-centered to participatory design approaches. In J. Frascara (Ed.), *Design and the social sciences: Making connections* (pp. 1–8). London: Taylor & Francis.

SANGONeT. (2011, July 24). *SA designers empower non-profit campaigns*. SANGONeT. Retrieved from http://www.ngopulse.org/press-release/sa-designers-empower-non-profit-campaigns

Sauthoff, M. (2004). Walking the tightrope: Comments on graphic design in South Africa. *Design Issues*, *20*(2), 34–50. doi: 10.1162/074793604871329

Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In R. Sawyer (Ed.), *Cambridge handbook of the learning sciences* (pp. 97–118). Cambridge: Cambridge University Press.

Scarry, E. (1985). *The body in pain: The making and unmaking of the world*. Oxford: Oxford University Press.

Schleppegrell, M., & Bowman, B. (1995). Problem-posing: A tool for curriculum renewal. *ELT Journal*, *49*(4), 297–306. doi.org/10.1093/elt/49.4.297

Schrank, A. (2006). Case-Based Research. In E. Perecman, & S. Curran (Eds.), *A Handbook for Social Science Field Research* (pp. 21–38). Thousand Oaks, CA: Sage.

Schön, D. (1983). *The reflective practitioner: How professionals think in action*. New York, NY: Basic Books.

Schön, D. (1988). Toward a marriage of artistry & applied science in the architectural design studio. *Journal of Architectural Education*, *41*(4), 4–10. doi.org/10.1080/10464883.1988.10758496

Schön, D. (1992). Designing as reflective conversation with the materials of a design situation. *Research in Engineering Design*, *3*(3), 131–147. doi.org/10.1007/BF01580516

Senge, P. (2006). *The fifth discipline: The art & practice of the learning organization* (rev. ed.). New York, NY: Doubleday.

Shai, K. (2017). South African state capture: A symbiotic affair between business and state going bad(?). *Insight on Africa*, *9*(1), 62–75. doi.org/10.1177/0975087816674584

Shawer, S., Gilmore, D., & Banks-Joseph, S. (2008). Student cognitive and affective development in the context of classroom-level curriculum development. *Journal of the Scholarship of Teaching and Learning*, *8*(1), 1–28.

Shay, S. (2004). The Assessment of Complex Performance: A Socially Situated Interpretive Act. *Harvard Educational Review*, 74(3), 307–329. doi.org/10.17763/haer.74.3.wq16l67103324520

Shedroff, N. (2009). *Design is the problem: The future of design must be sustainable*. New York, NY: Rosenfeld Media.

Sheridan, M., & Rowsell, J. (2010). *Design literacies: Learning and innovation in the digital age*. London: Routledge.

Shreeve, A. (2015). Signature pedagogies in design. In M. Tovey (Ed.), *Design pedagogy: Developments in art and design education* (pp. 83–94). Farnham: Gower.

Simon, H. (1996). *The sciences of the artificial* (3rd ed.). Cambridge, MA: MIT Press.

Smith, M. (2011). What is Praxis? Retrieved from https://infed.org/mobi/what-is-praxis/

Snaddon, B. (2019). Design pedagogy for sustainability: Developing qualities of transformative agentive learning. In A. Ambrosio, & C. Vezzoli (Eds.), *Proceedings of the 3rd LeNS World Distributed Conference, Milano, Mexico City, Beijing, Bangalore, Curitiba, Cape Town.* (Vol. 4, pp. 1271–1275). Milan: Edizioni PoliDesign. Retrieved from http://www.lensconference3.org/images/program/VOLUME4.pdf

Snaddon, B., & Chisin, A. (2017). Futures oriented design pedagogy: Performing a space of powerful possibility. In *Proceedings of the 7th Nordic Design Research Conference NORDES 17: Design + Power*, *Oslo, Norway*. Retrieved from www.nordes.org

Snaddon, B., Morrison, A., & Grant-Broom, A. (2017). Learning spaces for sustainable futures: Encounters between design and rhetoric in shaping nomadic pedagogy. *Kairos–A Journal of Rhetoric, Technology, and Pedagogy*, *22*(1). Retrieved from http://kairos.technorhetoric.net/22.1/topoi/snaddon-et-al/index.html?path=contexts/cape-town.html

Snaddon, B., Morrison, A., Hemmersam, P., Grant Broom, A., & Erstad, O. (2019). Investigating design-based learning ecologies. *Artifact: Journal of Design Practice*, *6*(1&2), 2.1–2.30. doi.org/10.1386/art_00006_1

Soudien, C., Michaels, W., Mthembi-Mahanyele, S., Nkomo, M., Nyanda, G., Nyoka, N., … Villa-Vincencio, C. (2008). *Report of the Ministerial Committee on Transformation and Social Cohesion and the Elimination of Discrimination in Public Higher Education Institutions*. Pretoria: Department of Education. Retrieved from https://www.ukzn.ac.za/wp-content/miscFiles/publications/ReportonHEandTransformation.pdf

South African Government. (2020). *National Development Plan 2030*. Pretoria: National Planning Committee. Retrieved from https://www.gov.za/issues/national-development-plan-2030

South African Qualifications Authority. (2000). *The national qualifications framework and curriculum development*. Pretoria: SAQA. Retrieved from http://www.saqa.org.za/docs/pol/2000/curriculum_dev.pdf

Staszowski, E., & Leirner, P. (2008). Visions and possibilities of a transsociation between design and anthropology: A method for a glocally driven product-system innovation. In E. Cipolla, & P. Peruccio (Eds.), *Changing the Change Proceedings: Design, Visions, Proposals and Tools, Turin, Italy* (pp 1427–1439). Turin: Allemandi Conference Press. Retrieved from https://www.allemandi.com/university/ctc.pdf

Steffen, W., Persson, Å., Deutsch, L., Zalasiewicz, J., Williams, M., Richardson, K., … Svedin, U. (2011). The anthropocene: From global change to planetary stewardship. *Ambio*, *40*(7), 739–761. doi.org/10.1007/s13280-011-0185-x

Steinke, P. & Fitch, P. (2007). Assessing Service-Learning. *Research & Practice in Assessment*, 1(2), 24–29. Retrieved from http://www.rpajournal.com/dev/wp-content/uploads/2012/05/A32.pdf

Sterling, S. (2009). Ecological intelligence. In A. Stibbe (Ed.), *The handbook of sustainability literacy: Skills for a changing world* (pp. 77–83). Totnes: Green Books.

Sterling, S. (2010). Learning for resilience, or the resilient learner? Towards a necessary reconciliation in a paradigm of sustainable education. *Environmental Education Research*, *16*(5–6), 511–528. doi.org/10.1080/13504622.2010.505427

Sterling, S., Dawson, J., & Warwick, P. (2018). Transforming sustainability education at the creative edge of the mainstream: A case study of Schumacher College. *Journal of Transformative Education*, *16*(4), 323–343. doi.org/10.1177/1541344618784375

Stewart, K. & Gachago, D. (2016). Being human today: A digital storytelling pedagogy for transcontinental border crossing: Being human today. *British Journal of Educational Technology*, 47(3), 528–542. doi.org/10.1111/bjet.12450

St. Pierre, E. (2014). A Brief and Personal History of Post Qualitative Research: Toward "Post Inquiry." *Journal of Curriculum Theorizing*, 30(2), 2–19.

Swanborn, P. (2010). *Case Study Rsearch: What, Why and How?* London: Sage.

Swartz, B., Gachago, D., & Belford, C. (2018). To care or not to care – reflections on the ethics of blended learning in times of disruption. *South African Journal of Higher Education*, 32(6), 49–64. doi.org/10.20853/32-6-2659

Taylor, P., & Fransman, J. (2004). Learning and teaching participation: Exploring the role of higher learning institutions as agents of development and social change. Working Paper Series, 219. Brighton: IDS.

Tham, M. (2019). Dirty design (or a bloody mess): In celebration of life affirming design. In K. Fletcher, L. St. Pierre, & M. Tham (Eds.), *Design and nature* (Kindle, pp. 135–143). Retrieved from https://www.amazon.com/Design-Nature-Partnership-Kate-Fletcher/dp/0815362749

Tham, M., & Jones, H. (2008). Metadesign tools: Designing the seeds for shared processes of change. In E. Cipolla, & P. Peruccio (Eds.), *Changing the Change Proceedings: Design, Visions, Proposals and Tools, Turin, Italy* (pp 1491–1506). Turin: Allemandi Conference Press. Retrieved from https://www.allemandi.com/university/ctc.pdf

The Craft and Design Institute. (n.d.). *Design support*. The Craft and Design Institute. Retrieved from https://www.thecdi.org.za/page/Design_Support?&dgpcrpg=1&dgpcrsrt=13a

The Ten-Year Plan for Science and Technology. (n.d.). Retrieved from https://www.dst.gov.za/index.php/resource-center/strategies-and-reports/143-the-ten-year-plan-for-science-and-technology

Thiele, K. (2014). *Ethos* of diffraction: New paradigms for a (post)humanist ethics. *Parallax*, *20*(3), 202–216. doi.org/10.1080/13534645.2014.927627

Tironi, M. (2018). Dissenting. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods* [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

Tonkinwise, C. (2013). Design thinking as a radical form of disruptive innovation. In J. Yee, E. Jefferies, & L. Tan (Eds.), *Design transitions. Inspiring stories. Global viewpoints. How design is changing* (pp. 216–219). Amsterdam: BIS Publishers.

Tonkinwise, C. (2015). Design for Transitions – from and to what? *Design Philosophy Papers*, *13*(1), 85–92. doi.org/10.1080/14487136.2015.1085688

Tovey, M. (2015). *Design pedagogy: Developments in art and design education*. Farnham: Gower.

Tracy, S. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative Inquiry*, *16*(10), 837–851. doi.org/10.1177/1077800410383121

Tronto, J. (1993). *Moral boundaries: A political argument for an ethic of care*. New York, NY: Routledge.

Tronto, J. (2013). *Caring democracy: Markets, equality, and justice*. New York, NY: New York University Press.

Tunstall, D. (2011). Respectful design: A proposed journey of design. In A. Bennett, & O. Vulpinari (Eds.), *Icograda design education manifesto 2011* (pp. 132–135). Montreal: Icograda.

Tunstall, E. (2013). Decolonizing design innovation: Design anthropology, critical anthropology and indigenous knowledge. In W. Dunn, T. Otto, & R. Smith (Eds.), *Design anthropology: Theory and practice* (pp. 232–250). London: Bloomsbury.

Turner, V. (1974). Liminal to liminoid, in play, flow, and ritual: An essay in comparative symbology. *Rice University Studies*, *60*(3), 53–92. Retrieved from https://scholarship.rice.edu/handle/1911/63159

Turner, V. (1982). *From ritual to theatre: The human seriousness of play*. Baltimore, MA: Performing Arts Journal Publications.

United Nations Department for Economic and Social Affairs. (2019). *The sustainable development goals report 2019*. United Nations. Retrieved from https://unstats.un.org/sdgs/report/2019/

United Nations Development Programme. (2018a). *Human development indices and indicators: 2018 statistical update*. Retrieved from http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf

United Nations Development Programme. (2018b). *Human development reports*. Retrieved from http://hdr.undp.org/en/composite/IHDI

United Nations. (1987). *Report of the World Commission on Environment and Development: Our common future*. New York, NY: UN. Retrieved from https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

United Nations. (2015). *The millennium development goals report*. New York, NY: UN. Retrieved from https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf

Uprichard, E. (2018). Capturing and composing: Doing the epistemic and the ontic together. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael, & E. Uprichard (Eds.), *Routledge handbook of interdisciplinary research methods* [Kindle]. London: Routledge. Retrieved from https://www.amazon.com/Routledge-Handbook-Interdisciplinary-International-Handbooks-ebook/dp/B07F9XWQSW

Varela, F., Thompson, E., & Rosch, E. (1993). *The embodied mind: Cognitive science and human experience*. Cambridge, MA: MIT Press.

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wahl, D., & Baxter, S. (2008). The designer's role in facilitating sustainable solutions. *Design Issues*, *24*(2), 72–83. doi.org/10.1162/desi.2008.24.2.72

Wenger-Trayner, E., & Wenger-Trayner, B. (2015). Learning in a landscape of practice: A framework. In E. Wenger-Trayner, M. Fenton o'Creevy, S. Hutchinson, C. Kubiak, & B. Wenger-Trayner (Eds.), *Learning in landscapes of practice: Boundaries, identity, and knowledgeability in practice-based learning* (pp. 13–30). London: Routledge.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge: Cambridge University Press.

Wensveen, S., & Matthews, B. (2015). Prototypes and prototyping in design research. In P. Rodgers, & J. Yee (Eds.), *The Routledge companion to design research* (pp. 262–276). London: Routledge.

Wertsch, J. (1994). The primacy of mediated action in sociocultural studies. *Mind, Culture, and Activity*, *1*(4), 202–208.

White, D. (2016). Metaphors, hybridity, failure and work: A sympathetic appraisal of transitional design. *Design Philosophy Papers*, *13*(1), 39–50. doi.org/10.1080/14487136.2015.1085694

Willis, A.-M. (2006). Ontological designing. *Design Philosophy Papers*, *4*(2), 69–92. doi.org/10.2752/144871306X13966268131514

Winnicott, D. (1989). *Playing and reality*. New York, NY: Routledge.

Wood, J. (2008). A fractal framework for metadesign. In E. Cipolla, & P. Peruccio (Eds.), *Changing the Change Proceedings: Design, Visions, Proposals and Tools, Turin, Italy* (pp 1698–1705). Turin: Allemandi Conference Press. Retrieved from https://www.allemandi.com/university/ctc.pdf

Yee, J., & Bremner, C. (2011). Methodological Bricolage – What does it tell us about Design? In *Proceedings of the Doctoral Education in Design Conference* (pp. 181–190). Hong Kong: Hong Kong Plytechnic University. Retrieved from http://nrl.northumbria.ac.uk/8863/1/DesignWithoutDiscipline-final.pdf

Yee, J., Jefferies, E., & Tan, L. (Eds.). (2013). *Design transitions. Inspiring stories. Global viewpoints. How design is changing*. Amsterdam: BIS Publishers.

Yee, J., Raijmakers, B., & Ichikawa, F. (2019). Transformative learning as impact in social innovation. *Design and Culture*, *11*(1), 109–132. doi.org/10.1080/17547075.2019.1567984

Zembylas, M., Bozalek, V., & Shefer, T. (2014). Tronto's notion of *privileged irresponsibility* and the reconceptualisation of care: Implications for critical pedagogies of emotion in higher education. *Gender and Education*, *26*(3), 200–214. doi.org/10.1080/09540253.2014.901718

Zimmerman, J., Stolterman, E., & Forlizzi, J. (2010). An analysis and critique of *Research through Design*: Towards a formalization of a research approach. In *Proceedings of DIS'10: 8th ACM Conference on Designing Interactive Systems, Aarhus, Denmark* (pp. 310–319). New York, NY: ACM. doi.org/10.1145/1858171.1858228

PUBLICATION 1
LEARNING SPACES FOR SUSTAINABLE FUTURES: ENCOUNTERS BETWEEN DESIGN AND RHETORIC IN SHAPING NOMADIC PEDAGOGY

Snaddon, B., Morrison, A. & Grant-Broom, A. (2017). Learning Spaces for Sustainable Futures: Encounters between design and rhetoric in shaping nomadic pedagogy. Published in *Kairos–A Journal of Rhetoric, Technology, and Pedagogy, 22*(1). Available at: http://kairos.technorhetoric.net/22.1/topoi/snaddon-et-al/index.html

Learning Spaces for Sustainable Futures: Encounters Between Design and Rhetoric in Shaping Nomadic Pedagogy

Bruce Snaddon
Cape Peninsula University of Technology
Andrew Morrison
Oslo School of Architecture and Design
Andrea Grant Broom
Cape Peninsula University of Technology

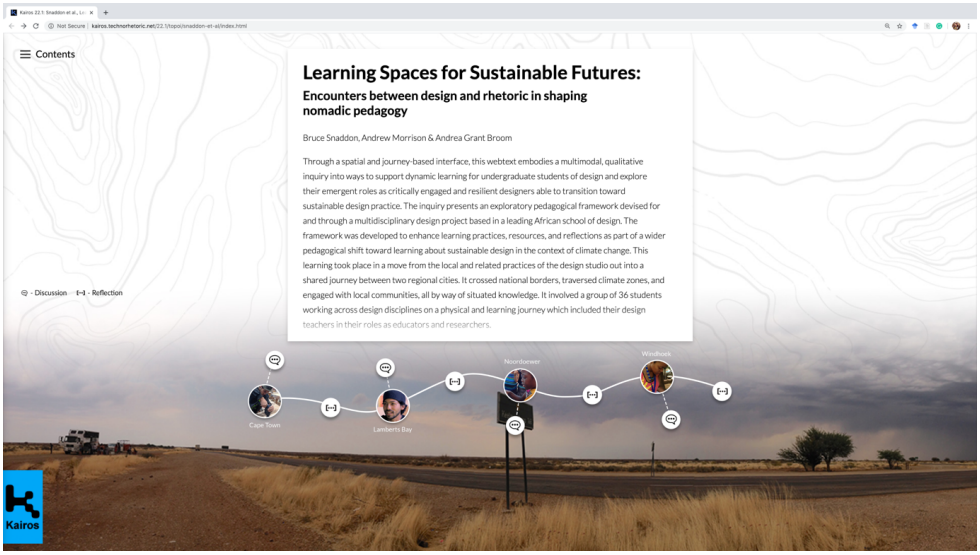
This publication is available online as an interactive webtext. It was published in *Kairos–A Journal of Rhetoric, Technology, and Pedagogy* which is one of the oldest continually-published, peer-reviewed academic journals on the World Wide Web.

Through a spatial and journey-based interface, this webtext embodies a multimodal, qualitative inquiry into ways to support dynamic learning for undergraduate design students as they explore their emergent roles as critically engaged and resilient designers transitioning toward sustainable design practice.

The inquiry presents an exploratory pedagogical framework devised for and through a multidisciplinary design project based in the Design Faculty at CPUT, Cape Town South Africa. The framework was developed to enhance learning practices, resources, and reflections as part of a wider pedagogical shift toward learning about sustainable design in the context of climate change. This learning took place in a move from the local and related practices of the design studio out into a shared journey between two regional cities. It crossed national borders and climate zones, and engaged with front-line communities affected by climate change, all by way of situated and experiential knowledge creation. It involved a group of 36 students working across design disciplines on a physical and learning journey which included their design teachers in their roles as educators and researchers. The journey became pedagogical and pedagogy became the journey, together creating a space that transformed agentive selves in lived relations to others (Ellsworth, 2005).

Overall, the exploration drew together conceptual, productive, and experiential design learning and design multiliteracies, along with approaches to situated and emergent reflection and knowledge building. The webtext is centred around stages and key events in the journey across a landscape. Methodologically, it takes up a diversity of modes of making, documenting, and reflecting on this shared learning journey, including photography, interviews, participant observation, and a documentary film. This is conveyed through a spatial rhetoric that is designed to evince and allow access to different thematics and elements in the interface so that readers—students, educators, researchers—may differentially traverse the multimodal account of the learning journey. Pivotal moments are pointed to during the learning process which were found to have effectively altered students' dispositions and cultivated attributes of thoughtfulness, self-awareness, resilience, adaptability, and self-reliance. These are moments that effectively connect design students more confidently to the process of building their learning identities consistent with the skills and agency desired for knowing and acting in a transitioning world. A discussion is

offered around the possibilities of enacting a renewal of design curriculum through pedagogy that is responsive to the speculative, locative, and performative elements found in the experimental project under analysis.



Publication 1, Learning Spaces for Sustainable Futures: Encounters between design and rhetoric in shaping nomadic pedagogy is published in *Kairos–A Journal of Rhetoric, Technology, and Pedagogy*, 22(1), and is available at: http://kairos.technorhetoric.net/22.1/topoi/snaddon-et-al/index.html

PUBLICATION 2
FUTURES ORIENTED DESIGN PEDAGOGY: PERFORMING A SPACE OF POWERFUL POSSIBILITY

Snaddon, B. & Chisin, A. (2017). Futures oriented design pedagogy: performing a space of powerful possibility. Paper presented at *NORDES Design + Power*, Oslo, Norway, 15–17 June 2017. Available at: http://www.nordes.org/nordes2017/assets/full_papers/nordes17a-sub1018-cam-i26_SNADDON_v2.pdf

FUTURES ORIENTED DESIGN PEDAGOGY: PERFORMING A SPACE OF POWERFUL POSSIBILITY

THEME: ENGAGEMENTS, RELATIONS

BRUCE SNADDON

CAPE PENINSULA UNIVERSITY OF TECHNOLOGY

BOX 652, CAPE TOWN, 8000

BRUCE.SNADDON@AHO.NO

ALETTIA CHISIN

CAPE PENINSULA UNIVERSITY OF TECHNOLOGY

BOX 652, CAPE TOWN, 8000

CHISINA@CPUT.AC.ZA

ABSTRACT

Where is the futuring power in performative design pedagogy? How do we, as educators and researchers, engage with pedagogical approaches in design learning that are flexible and responsive to changing times? These are questions we ask relating to an experimental teaching project that took students into a space for learning possibilities within the context of a creative desert festival. Our pedagogical impulse had been to firstly relocate design students and educators into a space where the environmental extremes would be experientially immersive, so as to bring their social ecology in step with the environmental ecology. Secondly, it had been to situate the design learning activity within a sociocultural microcosm over a week, where embodied, performative engagement with all participants would provide feedback and give momentum to the groups praxis – through lived reflection in, and on their actions. We refer to performance in design pedagogy as imaginative meaning-making performatively produced. Our findings suggest that pedagogy that is enabling of performative event spaces in radically different settings, can expose and empower ontological relations between design students and their co-created world and hopefully prepare them to become power-ful actors in design futuring.

Keywords: Learning spaces, design pedagogy and power relations, deterritorialisation, performativity, sustainable futures, climate change.

Introduction

Once a year if you drive northeast of Cape Town out into the arid Karoo semi-desert you will come across a festival called *Afrikaburn* that hosts a creative community of people who have chosen to live for a week in the austere beauty and extreme climate of the Tankwa. Entering a public, cultural and performative space that celebrates difference, everyday lives are suspended and are oriented to principles for participation that demand a culture of respect, sharing and a zero environmental impact. One can “experience a different world where creativity, self-reliance, self-expression and communal effort are championed. Ice is the only commodity for sale and everything needed for survival, including tents food and water has to be brought in. The festival aims to be radically inclusive and accessible, bringing a community of participants together who create art, costume, performance, theme camps, music, mutant vehicles, and burning structures (Afrikaburn, “What is Afrikaburn”, n.d.).

This is the public performative festival space that we, a group of design educators, researchers, and students, chose to explore for its pedagogical potential in exploring relations between design and power. Our paper presents this as a second part of an experimental

Figure 1: The festival playa, a space for performative possibility.

design project with the quest of investigating and offering designerly ways of scaling up climate change awareness. The travelling group to *Afrikaburn* 2015 consisted of five design educators, 20 Industrial Design Bachelors students and 40 Extended Curriculum Programme (ECP) Architecture and Interior Design students, all from the Cape Peninsula University of Technology (CPUT) in Cape Town, South Africa. A choreographer assisted with the performative naissance of *We Are Water*, the co-created installation piece designed as a site-specific event by this group for *Afrikaburn*. Central to this was Fiscilla, the fictive story gatherer in the shape of a physical fish, who had accompanied us on a journey from Cape Town to Namibia six months earlier (Snaddon et al. 2016, in press). She had functioned as a mediating design artifact (Morrison & Chisin, 2017), used as a means of gathering stories from water stressed communities and destined to be an interactive installation at a *Participatory Design Conference* in Windhoek, Namibia. As a continuation of this, she now shifted shape to become the centrepiece of an ecological message portraying the indispensable role of water for the survival of all species.

FOCUS AND METHODS

In this paper we draw on conceptual research perspectives from sustainable futures oriented design, performative design pedagogy, and power relations in design learning. These we connect to the following aspects of learning – *ontological* enactment of learning

within enabling *heterotopian* spaces, and mutual *agency*. Consequently, the main question is: What role can performative design pedagogy play in creating dynamic learning spaces that are futures oriented? We present this research as participatory action design educators and researchers who took part in the event, but also as research colleagues working and writing together through a qualitative enquiry process. This constituted a living enquiry where social processes were given time to develop as exploratory pedagogy that is democratically and publicly productive of knowledge building, exchange and critique (Koskinen et al., 2011; von Busch, 2015). In moving beyond the studio environment we explored the pedagogical possibilities for participatory sustainable design in the culturally defined yet egalitarian space of *Afrikaburn*, seeking ways to empower ontological agency away from the dominant logic of design for economic growth (Tham, 2014:331).

Figure 2: Documentary film aided processes of reflection and analysis in this research. Here students engage with other festival participants through playful use of water-like fabric.

In pursuing such perspectives, the data we assembled consists of a documentary film, photographic imagery, field notes, and transcribed interview reflections during workshops held post the event. Analysis involving a variety of modalities has elicited a multivocal and reflective dialogue of a cross section of participating staff and students, indicative of the diversity of the group in terms of gender, culture, race, level of study, and design discipline (Tracy, 2010). The documentary video aided the process of elicitation to stimulate recall and as a basis for reflection and conceptualisation (Jewitt, 2009). In a discursive and performative process of thinking our way through "data, theory, words, images, and lived experiences" (Holbrook & Pourchier, 2014:755), we have conceptualised and themed the analysis around the emergent phases of the event. In so doing, this offers an analytical method that is evocative of the methodological approach of the event: to design, develop, implement, document, observe and investigate relations in a performative pedagogy. Research writing done in this way provides thick description of the phenomena so that the resultant text can be evocative and convincing enough for other educators as "a tipping point towards new capabilities to act" (von Busch, 2015:232). As such, this research is a means of understanding, for ourselves and others, the potentials of performatively experimental design pedagogy that disrupts the status quo in order to engender power-ful agentive selves through collaborative exploration.

CONCEPTUAL PERSPECTIVES

Conceptually, we position this design pedagogy using the following perspectives on sustainability in design education, performativity and power relations inherent in design learning.

DESIGN EDUCATION FOR SUSTAINABLE FUTURES

The design industry - embedded in capitalist epistemological, ontological, and ideological assumptions - is in conflict with design practice viewed as a socially beneficial activity engaged with creating a better world for all (Boehnert, 2014). A more urgent focus is required orienting pedagogies towards "being-for-uncertainty", as preparation for students entering an increasingly fast paced and connected world in an era of material limits (Barnett, 2014:232; Manzini, 1992). Wider framing of design as problem exploration in the creation of products, services and systems, has challenged design schools with already full programmes resulting from a curriculum-by-accrual approach (Davis, 2013).

Calls for design education to respond to uncertain sociocultural, economic and political times, are not new. These accentuate graduate dispositions of thoughtfulness, carefulness, humility, receptiveness, resilience, courage and stillness (Barnett, 2014). Many cite the need for change based on the potential for further damage to the environment if we do not acknowledge our human place as a subsystem within the vast ecological system of nature (Buchanan, 1985; Manzini, 1992; Margolin, 2007). Fry strongly critiques liberal democracy and blind anthropocentrism as constructs that de-future by encouraging assumptions "that humanity advances simply by increasing productive and consumptive capacity" (2009:93). Inciting designers to redirect their practice in an act of futuring that is born of 'commonality in difference', he emphasises that creating sustain-ability can only come about if pursued in socioculturally plural ways (ibid). Irwin (2012: 2) draws attention to wicked problems such as climate change, water scarcity and poverty as having the same intrinsic principles as living systems, and that they are comprised of countless relational strands between "people, the environment and the things that people make and do – a relationship triad". 'Respectful design' is proposed by Tunstall (2013:245) as an alternative way of being for design education, "something akin to the creation of preferred courses of action based on the intrinsic worth of all human, animal,

mineral, fauna and flora and the treatment of them with dignity and regard".
These are matters concerning how we construct and enact our design pedagogies when they are futuring of structures, processes and enactments in the present that project designers' and researchers' agency towards the future.

PERFORMATIVITY AND DESIGN LEARNING

Concerning design learning, educators performing as facilitators of knowledge creation can be likened to theatre directors whose major goal is to "devise a performance by making it emerge with minimum control, and being ready to take advantage of the unexpected" (Binder, 2011:114). If the concept of performance taken in its broadest logic, entails "the production of a subject through the performance, then design practice and the designed work is the effect of a performance" (Dong, 2007:1). Performative design pedagogy can therefore be described as imaginative meaning making performatively produced.
Designers need to be highly honed observers that "understand performance: improvisation, character, expressiveness and self-awareness" (Tonkinwise, 2013:219). To the notion of improvisational performance, Binder et al. (2011) highlight the importance of the interpretive and participatory process that brings about a completion of the collective endeavour. Completion is emergent as offerings within the space such as actions, symbols and artefacts that are reacted to by all present. These authors propose that meaning, as experience for someone, is never fully complete until it is intelligibly communicated or expressed to others, and that culture can be seen as an ensemble of such expressions.
Drawing on techniques from the arts, and performative approaches to collaborative design, performativity in design education can open up dialogue in ways that are imaginary, playful, and disruptive of hierarchy (Lock, 2013). Ehn (2008:93) questions "how the object of design is made into a public thing and open[ed] to controversies among participants" inside and outside of the project. The term 'spect-actor', coined by Boal (2002) refers to active spectators in audience participation within improvised performances where solutions to certain sociocultural, ethical and moral problems can be co-created.

POWER RELATIONS IN DESIGN LEARNING

Acknowledging relations of power within ontological ways of being and becoming is key to this study on learning and pedagogy. This resonates with notions of nomadicity in pedagogy, defined by "a double movement where learning practices are displaced (becoming mobile) and where learning itself is its own form of displacement (i.e., a change in one's worldview)" (Fendler, 2013:788). The nomadic metaphor within educational discourse on learning mobilities (ibid:792) enriches conceptions of displacement or deterritorialisation as it is performed by students. Movement in learning is well conceptualised by Deleuze and Guattari who describe territorialities as being "shot through with lines of flight testifying to the presence within them of movements of deterritorialization and reterritorialization" (2005:55). We understand these lines of flight as threshold crossing opportunities for students as they negotiate and enact their becoming, as they "enter into unfamiliar territory, in a process of discovery" (Fendler, 2013:787).

Teaching according to Heidegger is "to let learn" (1976:15), a view that augments Freire's argument for democratized education allowing for a "dialogical relationship" between both educators and students that ensures content is situated within people's "reading of the world" (Freire, 2004:280). Reading and re-reading how and what is taught becomes pertinent here. How might we open up learning spaces for "multiple ways of storying the past related to the nation-state or any community" (Den Heyer, 2011:611)? In developing design pedagogies that offer space for students to learn about how to negotiate power, change and design as co-creative knowledge production in the future we point to Mainsah's (2014) concept of 'critical design literacy'. Design educators, he argues, do not place enough attention on the value system inherent in design approaches – they need to develop students' capacity to "be creative and transformative subjects and not just objects of domination and manipulation" (ibid, 2014:296).
Speaking to the exigency of the common and of sharing, Mbembe (2016) makes the point that "we humans are not as special as we once thought", we are not as disentangled from other species as we once imagined. This takes on the modern knowledge project and its focus on the human, and proposes a decentering of the human through sharing not only *agency*, but also the capacity to *know* with nonhuman entities, organic as well as technical. Here we link to the fish, Fiscilla, and her mediating influence as a diagetic artifact that brokered shared and emergent meaning making.
"Powerful learning arises from weaving between different knowledge processes in an explicit and purposeful way" according to multiliteracy scholars Cope and Kallantzis (2009:187). They describe the micro dynamics of meaning making as processes of "negotiating discourse differences" (2009: 166). These differences lie within the hegemony of hidden framing of *who* generates innovation along with its underlying values (Tunstall, 2013). Diethelm warns of the colonising metaphor of design intervention and how little thought is given to its "metaphoric bloodline of knowledge as power" (2016:169). This connects with Mainsah's notion of critical design literacy and how performing this approach will demand educators to skillfully negotiate the tools, attitudes and values of any given context with their students, and "depend upon students' and teachers' everyday relations of power, their lived problems and struggles" (2014:296).

The event we analyse here has to do with a staged artifact that was part art object and part interactive installation. It is therefore relevant to consider views on the topic of art as they pertain to locating design pedagogy within a wider creative, public, cultural festival event that is expressive, affective and performative. For we are caught up in the hegemony of the spatio-temporal register we find ourselves in, "we only see what we have already seen" (O'Sullivan, 2001:127). Art's function, in this view, is to switch our register, transforming (if only temporarily) our sense of self and world view. Performative design pedagogy, as transformative and potential scoping of future practices, may thus be seen as expressive enactments and use of designed things to mobilise current stasis and publicly co-create shared meaning that is responsive to the culture of the heterotopic space (Snaddon et al. 2016, in press). Agency, in this view is mutually generated through deterritorialising moves that are exploratory and performative. Conceptions of decentering, revealing and bringing forth are axial to the argument of this paper, and we now proceed to apply these in the analysis of the experimental event.

ANALYSIS

WHAT WE THOUGHT AND BROUGHT

Preparatory to relocating to *Afrikaburn*, studio processes echoing given disciplinary differences and expectations had shaped the students conceptual designs. Workshops had been held to encourage inter-disciplinary crossovers between industrial design and architecture, but expectations of staff and students in these two domains remained unreconciled. Fiscilla the fish and the concept *We are Water*, developed by the industrial design students differed from the cultural African icons conceptualised by the junior ECP architecture students. On arrival at *Afrikaburn*, an underlying power dynamic crystallised in the first day or two. Partly because of the layout of the campsite, senior students situated to one side of the support vehicle and junior students on the other, this spatial 'divide' seemed to encourage a social divide. Some expressed dissatisfaction with this and became distracted by the festival activities while others participated more actively. One junior student said "…with us being cooped up in our ECP mindset, they [senior students] kind of took over the project, but it wasn't as bad as I thought it would be… it was OK giving them the platform to lead" (Khanyiso:2017). In adapting to their role as mentors to the juniors, senior students shared their knowledge about construction and power tool operation – "as soon as they realized what they could learn from us and what we could learn from them, things started moving quite quickly" (Mikhail:2017). More than mentoring, this also presented an opportunity for project management of building logistics and the social skills inherent in such an exercise.

No grading, no taps, no money – these were some of the characteristics of the event space that presented both

Figure 3: Concepts and sketches brought by the multidisciplinary team into the arid desert.

constraints and opportunities. With less competitiveness amongst the students there was no "platform to be better or for other people to be worse, you just brought what you had and that was enough" (Lizanne:2017). Our aim in taking students out into a challenging space was to consciously disrupt and democratize the space of learning so as to liberate ourselves (staff and students) from the constraints of studio practice where; competitiveness, grading and separation between staff and students can create tense divides. The radical shift from the norm prompted one student to remark on the sense of freedom (Lizanne:2017), "We were working with a concept and not a specific plan – we weren't told, you do this and… check it off the list, you developed your list as you go."

MAKING DO

"It's interesting to say we are water in the desert" (Devan:2017), a place where "… there were no taps" (Iska:2017). The anomalous nature of the message being presented in such a context bound by very real water constraints was part of the pedagogical rationale for being there. What remained to be seen was how the experience would pan out in the moment. Making do and working with multiple materialities in the social space as well as the physical started to affect the relational dynamic within the group. The choreographer in our facilitation team expressed what she saw as "on-site teamwork, on-site management and on-site thinking" and how "everything changed from that very

first meeting where we sat down and spoke about how everything wasn't as we expected" (Danielle:2017).
A student remarking on how the group drew on its diversity to mutually negotiate in a more generous way said "If you put [students] in such a different environment they open up their network and they start sharing information which otherwise would have been kept to themselves" (Lizanne:2017).
You've spent four years with these people and you've got to know them in a certain way, and then you put them in this completely different environment and they open up to you in this weird caring, empathic way, that you aren't used to (ibid).
These explorations of power and authority so central to performativity became evident as the group negotiated limits and possibilities for viable courses of action through re-iterative performances (Dong, 2007). An example of this is the consternation when faced with the reality of the old wooden palettes we had to work with. Realising previously conceived ideas would not be possible using this material a frenetic work session ensued to salvage usable wood. A design Masters

Figure 4: On site adaptations to original concepts, and Fiscilla suspended as part of the We are Water installation.

student, who had managed to move more nomadically between the two groups came forward and said, "Lets try something out" (Corbin:2017). Conscious of the gathered crowd of students and staff he sketched out in the dust a simple wave profile requiring the least amount of material and nails to construct – then using the sketch he laid out planks and nailed them together. He remembers thinking "I have to make this work" (ibid) as he lifted the shape and found it held together – a second one was made and a prototype for a three dimensional wave shape containing a seat was born.

This process whereby someone came forward and performed within the problem space, enacting a solution in front of the assembled group appears to have been a seminal moment when the social dynamic of the event shifted. The moment had been fraught with tension, the 'stand off' between design and architecture staff compared by a student to a "clash of the titans" (ibid). True to design's process consisting of heuristic iterations this became a stepping stone out of a difficult problem space, where making do and performing a conversation with the materials of the situation (both things and people) provided a way out and a way into what followed (Schön, 1992).

LETTING GO

Letting go of habitual modes of being with one another as design students and adapting towards finding fit within the learning space became increasingly evident after initial acclimatisation. Participants not only found their place within the teamwork but also became aware of their own emergent agentive selves, one saying how it "triggered another inner self that I didn't know about…" (Khanyiso:2017). Through deterritorialising moves born of the challenging situation, students nomadically reterritorialised in a give and take mode of learning.
Guided by the task at hand the groups diffused through social osmosis, one student remarking that the process of figuring out who would do what as involving "bumping heads" and "…dancing around a bit [before] we fell into our positions. Another noted how this performative dance in the radically different context mobilized the collective imaginary of the group while sharply delineating constraints. Mobilities of opening out, feeling the constraints, and again reopening that are typical of the design process became lived and embodied as students felt their way forward (Binder, 2011).
But the public festival space presented opportunity for wider participation. One student noted that in not putting their intention into words, and simply using a piece of shimmering water-like fabric, they engaged with other festival participants in a playful conversation. By introducing something unfamiliar to the desert setting, they played with a familiar element in a liminal recombination. In liminality this sort of ludic play is inherent in the "work of the collectivity in performing symbolic actions" (Turner, 1982:32). This marks a shift from internal performative processes to the inclusion of other 'spect-actors' from the festival playa (Boal, 2002). This decentering was pivotal, as suddenly the festival offering had taken on a new life as it started to draw attention to itself. The conversation had started.
Another performative factor was the activity of body and face painting, which one student described as becoming "a second being because you're painted up and masked… you can just be whatever avatar you had on that day" (Corbin:2017). Fiscilla too was dressed with colourful scales to breathe new life into her persona. This embodying of the moment changed

according to the disposition of the group and the type of contact with the festival community as the staged space became more inviting for interaction. One student remarked how other festival performers gifted their time and adapted their performance around the theme of water. A water bar also attracted people while costumed and painted students passionately advocated the importance of water and the consequences of a lack of water security.

Figure 5: Students played with their identities as they explored performative possibilities within the public festival space.

Factors mentioned here, as well as others helped the transition from oppositional discourse to co-operative discourse, from atomised individual inputs to collective endeavours. Students noticed the lack of coercion to contribute and that participation had to be willingly offered. The festival theme *GIFT* found expression in these incidental and more deliberate actions. Initial narratives of "your fish" (Fiscilla), and "our concepts" (developed back in the studio) gave way to "our installation" and "our burn" as Fiscilla eventually went up in flames in the tradition of *Afrikaburn*.

Figure 6: The final burn drew thousands of festival participants at sunset. Here, a student oversees Fiscilla's rite of passage in a poignant moment of letting go and gifting the message that we are all water.

Reflecting on the final performative act of burning Fiscilla, students commented on how this cathartic spectacle heightened revelations of inner self and agency (Corbin:2017; Lizanne:2017; Khanyiso:2017). One remarked on the eeriness moments before the burn, where he experienced a mental playback of his learning experience and how he'd found so many "elements and traces about [his] role as a designer to contribute to society in a more constructive way" (Corbin:2017). All student alumni interviewed post the event commented on how they now apply knowledge gained through the experience of flexibly solving problems on the spot, and value co-created generously through openly performed expressions of intent.

DISCUSSION AND CONCLUSION

Students co-designed and experienced their creative offering as invested fellow community members, in two related ways: 1) to actively cultivate their "response-ability" through an enlarged sense of inter-connection between self and others, including the environment (Haraway, 2016; Braidotti, 2013), and 2) to engage deeply with the sociocultural and physical materiality of design. In de-coupling from a consumer-centric mode of designing, we experienced a certain spatio-temporal shift beyond workaday activities (OSullivan, 2001). This shift, accentuated by contextual resource constraints emphasised the ontological quality of learning in design that gives credence to the biographies of all participants – personal ontological lenses magnified epistemological depth. This heightened awareness of emergent, discursive value negotiation through the design process, as a means of translating value into tangible experience for all (Tunstall, 2013). The following three propositions and their associated implications highlight the main take out of this research.

1. *Immersion in a radically different environment opens out learning as experience that empowers students' agentive selves in relation to others, both human and non-human.* Through immersive engagement in the context of the event space, the requirements of the project emerged as roles became defined through a process of self-organization and dialogue inclusive of people, materials and the environment. Implications are that consideration given to the embedded and emergent knowledge within an extreme project location can reveal to all participants diverse knowledge that is generative of unexpected outcomes. This draws on concepts of a pedagogical kinetics and the performative enactment of meaning making in an eventful space, where students are freed up from the hegemony of design solutioning for a consumerist world (Fendler, 2013; Tonkinwise, 2013). We propose this conceptual framework as a deterritorialising move that empowers knowledge creation for stakeholders in such a setting, and specifically in this case, the ability for design students to experience the generosity in sharing and creating *with* rather than merely *for* a distant audience.

The question remains whether these results are achievable only in these extreme conditions – how do we create learning spaces with similarly nomadic qualities when we aren't able to physically travel? The following propositions probe this question further.

2. *Performativity understood as meaning making in the moment enables learning that is more fluid and open to momentary feedback loops that guide the process in a more responsive manner to contextual requirements.* Being exposed to the apparent freedoms of the creative space, students quickly had to define the parameters of their activity – by acknowledging their skill sets and the requirements of the situation they found their fit. They did this actively by 'dancing around' one another (4:2017) to sense abilities, interests and passions amongst themselves, and other festival participants. Making meaning publicly through "collective creative action" (Binder et al. 2011:115) is what this event was about. Expressions in the form of performance and design aided the process of co-creating actions responsive to the culture of the event space. This implies that reflection in the form of performed expression of ability and interest within the activities of making, verbalizing and playful improvisation makes learning immediately explicit and apparent to students. Results of these learning performances can be immediately applied in the next moment in a feedback loop that completes a cycle of meaning making for a student.

Pedagogical enabling of spaces conducive to learning that is dynamic and nomadically explorative, requires a firm but light touch. It is about finding strategies to make things happen without over prescribing, and about adapting to the spatio-temporal register that is emergent if learning is allowed to happen in its own space and at its own pace (Binder, 2011: OSullivan, 2001).

3. *Deterritorialisation of power relations to democratise pedagogy, counters hegemonic value imposition external to the context*. Freed from normative, processes based on prejudged outcomes, students evolved appropriate means of deciding what value they deemed worthy of the space and context. The performative dance enacted by participants which animated hidden relations of power within the multi-disciplinary group, pointed towards a mode of being that was appropriate to the context and values of the community festival. Implications are that for pedagogy aimed at enabling redirective practice (Fry, 2009), consideration needs to be given to how to disrupt the norm if we are indeed to radically redirect our educational practice to allow students to become designers who are deeply aware of contingency in designing and its outcomes. This can be a painful process and requires being up front about what to expect from a deterritorialising process, which is the very disruption that allows learning to take place (Fendler, 2013:792). The ability to harness opportune scenarios by being open to the unexpected remains paramount.

To conclude, we return to the original intent of this exploratory pedagogy grounded in scaling up climate change awareness. We argue in this paper that by doing an immersive performative pedagogy around the issue of climate change and by addressing the climate of the pedagogy itself we can come up with enactments and performativities that directly address, but aren't directed by hegemonic hierarchies that defuture. In performing this co-created process, all players as participants themselves, act in the moment as it unfolds in iterative ways that involve making, thinking, doing and being to develop a futures oriented design pedagogy. We see that the connection between design and power is one that is concerned with ways to shape and enact means to sustainable futures. This may also offer approaches to design pedagogies that reveal the power and potential of changing climates of knowledge building together.

REFERENCES

Afrikaburn. What is AfrikaBurn? [WWW Document], n.d. . AfrikaBurn. URL http://www.afrikaburn.com/about/what-is-afrikaburn (Accessed 4.3.17).

Barnett, R. (2014). *Thinking and Rethinking the University: The selected works of Ronald Barnett*. Abingdon: Routledge.

Binder, T., De Michelis, G., Ehn, P., Jacucci, G., Linde, P. & Wagner, I. (2011). Design Things.. Cambridge: The MIT Press.

Boal, A. (2002). *Games for Actors and Non-Actors*. London: Routledge.

Boehnert, J. (2014). Design vs. the design industry. *Design Philosophy Papers*, *12*(2), 119-136. http://doi.org/10.2752/144871314X14159818597513 (Accessed 8.3.16).

Braidotti, R. (2013). *The Posthuman*. Cambridge, UK: Polity Press.

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, *8*(2), 5-21.

Cope, B., Kalantzis, M., (2009). "Multiliteracies": New literacies, new learning. *Pedagogies: An International Journal, 4*, 164-195.

Deleuze, G., Guattari, F., (2005). A thousand plateaus: capitalism and schizophrenia. University of Minnesota Press, Minneapolis. (Original work published 1987)

Den Heyer, K. & Abbott, L. (2011). Reverberating echoes: Challenging teacher candidates to tell and learn from entwined narrations of Canadian history. *Curriculum Inquiry*, *41*, 610-635. doi:10.1111/j.1467-873X.2011.00567.x

Diethelm, J., (2016). De-colonizing design thinking. *She Ji: The Journal of Design, Economics, and Innovation*, 2, 166-172. doi:10.1016/j.sheji.2016.08.001

Dong, A. (2007). The enactment of design through language. *Design Studies*, *28*(1), 5-21.

Ehn, P. (2008). Proceedings of the tenth anniversary Conference on Participatory Design: 2008, Bloomington, Indiana, October 01-04, 2008. ACM Press, New York, NY.

Fendler, R. (2013). Becoming-learner: Coordinates for mapping the space and subject of nomadic pedagogy. Qualitative Inquiry 19, 786–793.

Freire, P. (2004). *Pedagogy of Hope: Reliving Pedagogy of the Oppressed*. (R. Barr, Trans.). London: Bloomsbury Academic.
Fry, T. (2009). *Design Futuring: Sustainability, ethics and new practice* (English Ed edition). Oxford: Bloomsbury.
Haraway, D. (2016). *Staying with the Trouble: Making kin in the Chthulucene. Experimental futures: technological lives, scientific arts, anthropological voices*. Durham: Duke University Press.
Heidegger, M. (1976). *What Is Called Thinking?* New York: HarperCollins. (Original work published 1954)
Holbrook, T., Pourchier, N.M., (2014). Collage as Analysis Remixing in the Crisis of Doubt. *Qualitative Inquiry,* 20, 754-763.
Irwin, T. (2012). Wicked problems and the relationship triad. In *'Grow Small, Think Beautiful: Ideas for a Sustainable World from Schumacher College'*. Edinburgh: Floris Books.
Jewitt, C. (2009). The Routledge Handbook of Multimodal Analysis. London:Routledge.
Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J. & Wensveen, S., (2011). *Design Research Through Practice: From the lab, field, and showroom*. Oxford: Elsevier.
Mainsah, H. (2014). *Pedagogy of critical design literacies for fast-changing futures*. Presented at the Cumulus Johannesburg Conference, Johannesburg. http://www.cumulusjohannesburg.co.za/files/9014/1810/9492/CumulusJoburgProceedings_Sep14.pdf (Accessed 3.11.15).
Manzini, E., & Cullars, J. (1992). Prometheus of the everyday: The ecology of the artificial and the designer's responsibility. *Design Issues*, *9*(1), 5-20. http://doi.org/10.2307/1511595 (Accessed 22.1.16).
Margolin, V. (2007). Design, the future and the human spirit. *Design Issues*, *23*(3), 4-15.
Mbembe, A. (2016). Decolonizing knowledge and the question of the archive. HELTASA conference. Retrieved from http://heltasa.org.za/heltasaiced-conference-2016/ (Accessed 18.3.17).
Morrison, A. & Chisin, A. (2017). Design fiction, culture and climate change: weaving together personas, collaboration and fabulous futures. In *Design for Next. Conference Proceedings of EAD 2017*. Rome: 12.04.2017–14.04.2017. Available: http://www.designfornext.org
O'Sullivan, S. (2001). The aesthetics of affect: Thinking art beyond representation. *Angelaki*, *6*(3), 125-135.
Schön, D.A., (1992). Designing as reflective conversation with the materials of a design situation. *Research in Engineering Design*, 3, 131-147. doi:10.1007/BF01580516
Snaddon, B., Morrison, A., & Grant Broom, A. (forthcoming August 2017). Learning spaces for sustainable futures: Encounters between design and rhetoric in shaping nomadic pedagogy. *Kairos*. Available at: http://kairos.technorhetoric.net/
Tham, M. (2014). Off-centre – a call for humble lessons for design. How can metadesign perspectives support education in design for sustainability? In *Cumulus Johannesburg Conference, Johannesburg*. http://www.cumulusjohannesburg.co.za/files/9014/1810/9492/CumulusJoburgProceedings_Sep14.pdf (Accessed 22.3.17).
Tonkinwise, C. (2013). Design away. *Design Philosophy Politics.* http://www.academia.edu/download/31454059/Design_Away_DRAFT.pdf (Accessed 14.3.17).
Tunstall, E., (2013). Decolonizing Design Innovation: Design anthropology, critical anthropology and indigenous knowledge. Design anthropology: theory and practice 232–250.
Turner, V. (1982). From ritual to theatre: the human seriousness of play. Performing Arts Journal Publications.
von Busch, O. (2015). Hacktivism as design research method. In (Eds). Rodgers, P. & Yee, J. *The Routledge Companion to Design Research*. New York: Routledge. 226-235.

PUBLICATION 3
INVESTIGATING AGENTIVE URBAN LEARNING: AN ASSEMBLY OF SITUATED EXPERIENCES FOR SUSTAINABLE FUTURES

Morrison, A., Erstad, O., Liestøl, G., Pinfold, N., Snaddon, B., Hemmersam, P., & Grant-Broom, A. (2019). Investigating agentive urban learning: An assembly of situated experiences for sustainable futures. *Oxford Review of Education*, *45*(2), pp. 204–223. Available at: https://doi.org/10.1080/03054985.2018.1556627

OXFORD REVIEW OF EDUCATION
2019, VOL. 45, NO. 2, 204–223
https://doi.org/10.1080/03054985.2018.1556627

Routledge
Taylor & Francis Group

Investigating agentive urban learning: an assembly of situated experiences for sustainable futures

Andrew Morrison[a], Ola Erstad[b], Gunnar Liestøl[b], Nicholas Pinfold[c], Bruce Snaddon[c], Peter Hemmersam[a] and Andrea Grant-Broom[c]

[a]The Oslo School of Architecture and Design (AHO), Norway; [b]University of Oslo, Norway; [c]Cape Peninsula University of Technology (CPUT), Cape Town, South Africa

ABSTRACT

In this article we explore the dynamic between the pedagogical and the urban, attending to 'agentive urban learning'. By this we mean processes by which young people build agency in the urban context, in using the resources of the city to develop their own agency, and of developing agency to act within the city. By agency, we refer to the capacity to imagine and act to create individual and collective futures. Our interest is how young people develop such agentive urban learning themselves and how it might be enhanced pedagogically at school and university. Three case studies explore different facets—the first how young people themselves develop this agency in situated settings and the tools that they use to reflect upon the future; the second how digital tools might be used to enhance students' understanding of the city as a site of change, in this instance, climate change; and the third how such agency might be developed collectively in partnership with other city dwellers. We conclude that a diversity of students' engagement in urban contexts of learning offers ways from which to further investigate how identity, setting, and stakeholder relationships matter as part of potentially sustainable agentive learning futures.

KEYWORDS

Agentive urban learning; learning lives; situated simulation; identity; community

1. Introduction

In this article we explore the dynamic between conceptions of education and contextual issues within cities, paying particular attention to what we call 'agentive urban learning'. This is understood as those processes by which young people build agency in the urban context: using the resources of the city to develop their own agency and developing their agency to act within and on the city. By working with the concept of agency, we refer to young people's capacity to imagine and act to create their own and collective futures; and by drawing attention to this as an urban practice, we are paying particular attention to how agency may be realised through transformations and practices that happen in places (Rasmussen, 2012), mediated and supported by the physical and digital infrastructures of the city (Liestøl & Morrison, 2014).

The concept of agentive urban learning as a trans-disciplinary idea brings together and assembles (e.g. McFarlane, 2011) insights from design, pedagogy, urban studies, and

CONTACT Andrew Morrison andrew.morrison@aho.no

critical pedagogy. It draws on a range of theoretical resources, for example, Edwards and Mackenzie (2008) on agency in learning; Facer (2011) and Osberg (2010) on educational futures; Bringle, Phillips, and Hudson (2004) on service-learning; Freire (2005) on critical pedagogy; Sanders and Stappers (2008) on co-design as well as Haaspasari and Salama (2009) on transformative pedagogy. These diverse insights draw attention to questions of power, of ethics, to the relationship between learning and the future, and the processes of developing identity and belonging.

In an age of claims for 'smart cities' (e.g. Marvin, Luque-Ayala, & McFarlane, 2016), dominated by discourses of infrastructural and technical determinism, it is ever more important that the connections between agency and urban learning are better understood; and that the roles of educators, designers, and researchers in facilitating agentive urban learning are explored.

To that end, this article draws together insights from our own collaborative, experimental work as educators, designers, and researchers who have been working with this broad concept of agentive urban learning. Here we make connections within and across two cities and countries across three case studies. These three cases from Norway and South Africa are research projects in which we have sought to understand and to support students' experiential and interpretative experience of agentive learning in the city. The projects have involved upper secondary school, undergraduate, and master's students, as well as stakeholders within a range of urban communities and expert participants.

Our core intention in this paper is to explore how a pedagogy of agentive learning may be theorised and realised in a range of urban settings. In particular, we want to discuss how students' agency can be enabled to flourish in the context of learning in, with, from, and through the city and how such learning can be supported by their own digital resources and reflections, by intentional interventions and mediations, and by collective pedagogic practices in the city.

Overall, this article seeks to provide an emergent space for discussing linkages and relations between learning and studies of the city in relation to questions of agency, pedagogy, and mediational tools. First, we explore the conceptual bases of the idea of agentive urban learning before, second, discussing the methodologies we employ to study and provoke such learning in our own work. Third, we discuss the three cases that are prompts for our analysis before finally reflecting on our understanding of the significance of agentive urban learning in both educational and urban studies.

2. Conceptual concerns: learning and agentive selves in urban settings

The traditions of critical pedagogy and co-design that we draw upon in this paper lead us to view agentive urban learning as an activity of making and shaping that is dialogical, participative, questioning, and reflexive. In the context of the contemporary city, however, it is crucial that learners' agency is not seen as essentialised or individualised but as embedded in context and deeply tied to social practices and structures of meaning making.

Socio-cultural theories of learning, in particular, draw attention to processes of negotiation, meaning making, and learning in which young people come to operate as 'agentive selves' in *situated* cultural practices (Gutierrez & Rogoff, 2003; Hull & Katz, 2006; Lave & Wenger, 1991; Rajala, Hilppö, Lipponen, & Kumpulainen, 2013). Such cultural practices are increasingly

understood as dynamic, distributed across space and time (Erstad & Sefton-Green, 2013; Morrison, Aspen, & Westvang, 2013), and, with the advent of mobile and social media, have taken on a distributed, location based, and self-directed character, offering 'new mobilities' (Leander, Phillips, & Taylor, 2010). In such contexts, communities of cultural and technological diversity represent different opportunities and barriers for participation, engagement, and transformation for young people in processes of re-imaging the urban (Amin & Thrift, 2002) and learning to 'see like a city' (Amin & Thrift, 2017).

Young people's realisation of their own agency through these processes may draw on a mix of media, narrative, fact, and affect as part of the dynamic process of co-constructing identity, interests, and knowledge. How they give body and voice to their views can be seen as much in action as reflection, demonstrated in practices that bring together multiple activities in a form of 'cosmopolitan' practice (Hull & Stornaiuolo, 2010; Stornaiuolo, Hull, & Hall, 2017).

Such agency, however, can also be realised via educational interventions, through the design of curriculum and learning activities and events that are a part of an experimental and 'change laboratory' mode of providing means and conditions to facilitate learning activities and outcomes (Haapasaari, Engeström, & Kerosuo, 2016). Such interventions need, however, to pay attention to the distinctive features of learning in the city.

Here, we draw on recent work in urbanism that draws attention to the city as an imperfect and messy setting, infused with the daily agency of its dwellers (Hou, Spencer, Way, & Yocom, 2015), to the city as a site of potential 'learning pathways', defined as '… physical, social, urban, virtual and deterritorial spaces and places where structured and unstructured modes of learning, social interactions and re-presentation of knowledge is orchestrated largely in a self-organized manner' (Bannerjee, 2010, p. 7). In particular, we draw on a recognition of the city as a contested set of assemblages that need to be disambiguated to 'expose, evaluate and democratise the politics of knowing cities by placing learning explicitly at the heart of the urban debate' (McFarlane, 2011, p. 75).

This conceptual framework draws our attention, therefore, to the lived and negotiated experience of learning in the city, to its mediation and distribution via digital tools, to contested and stratified contexts in which young people will be operating. It focuses our attention as pedagogues and designers on the question of how these tools and settings can be mobilised to engage young people in thinking critically and constructively ahead of the world before them. In other words, in developing agentive urban learning we are interested in developing an 'anticipatory pedagogy' that focuses on how urban futures are being imagined and made (Facer, 2011).

Attending to agentive urban learning also means paying attention to how participants and stakeholders are included in processes of urban change at a time when interests of urban developers, planners, and policy makers may align closely in market and profit (see also Manchester & Cope, 2019 this Special Issue). How young people may become more active and productive in articulating their own agency with wider communities may become particularly important in escaping historical constraints and shaping different futures (e.g. Costandius & Botes, 2018).

The overarching term, *agentive urban learning*, therefore, encompasses the dynamic between young people's learning and lived experience and the contexts of cities with wider notions of dwelling and active, participative citizenship.

3. Methods: researching agentive urban learning from multiple perspectives

This paper reports on three case studies drawn from a wider body of work that focuses on design-centred pedagogy and students' agency. The cases have been chosen to highlight three different aspects of what may be central to agentive urban learning: first, to accentuate the forms of agentive urban learning visible as students move through the city and transition from home and school; second, to discuss the potential of locative media to support the development of students' engagement with change in their city; and third; to explore the potential of students to engage actively with city planners and planning decisions in partnership with communities and as active citizens.

Qualitative in character, our research works with methods drawn (Kelly, Lesh, & Baek, 2008) from several disciplines: media, design, urbanism, and education. These methods move between co-creation and innovation, site specific studies, and studio and post-field reflections. They include: close collaborative and interventionist work (e.g. Gutiérrez, Engeström, & Sannino, 2016) with urban youth in their contexts of mediated meaning making; digital design and foresight methods (Fuller & Loogma, 2009) in a social constructivist approach to shaping prospective inquiry; and consultations with stakeholders in urban community settings. Methodologically, we have employed ethnographic, exploratory inquiry and action research perspectives.

In Case 1 we use ethnography as our 'logic of inquiry' (Green, Skukauskaite, & Baker, 2012) to describe how teenagers in Oslo express their 'agentive selves' through exploring the dynamics between their own identities and the specific urban settings in which they are living (Erstad, 2013). The case is drawn from a longitudinal ethnography that traces the lives of 60 students over two years moving from home, to school, to personal activities (Erstad, Gilje, Sefton-Green, & Arnseth, 2016). The study is based in Groruddalen, a valley in north eastern Oslo characterised by its mix of industry and its historically working-class community, which has, in the past decade, become a suburb with one of the largest immigrant populations in the country, encompassing a diversity of origins and languages. In the case here, we focus particularly on the experiences and insights of two students with very different ethnic backgrounds whose own photographs and explanations point to key issues for them in negotiating their identity. The data comprise fieldnotes, interviews with all informants four times over a two-year period, and data collected by the informants themselves about their own lives such as diaries of 'a week in my life'. We also had access to students' mobile phone photos, some of their social media activity, and annotated maps of how they moved around the community, as well as short explanations of places that have specific significance in their upbringing.

Case 2 takes an interventionist approach, experimenting with digital media to explore how students can engage with simulations to reflect on their own and their communities' potential futures in a particular site in the city. This experimentation drew on a body of applied methods on digital 'situated simulations' (Liestøl, 2009, 2011) in conjunction with designers, experts, educators, and students (e.g. Liestøl & Morrison, 2013; Liestøl, Rasmussen, & Stenarson, 2011). We drew on methodologies from design fiction, foresight studies, and futures literacies. The emergence of design fiction as a broad and mixed category of foresight, conjectural settings, and projected scenarios provides a framework from within which to develop a situated simulation cast in the future (e.g. Liestøl, Morrison, & Stenarson, 2015; Morrison, 2018). These simulations connect notions of future

change with participants' local settings. This is needed if students are to anticipate, approximate, and aspire to futures that might be realised through stance and actions that differ from 'business as usual' today. The case involved a class of 28 high-school students (9th grade, aged 14–15) from a central part of western, largely middle-class, Oslo. The case was part of a wider collaborative research and learning project negotiated between the school and the University of Oslo in the same suburb. A week-long fieldwork activity in autumn 2014 was co-designed between three researchers and one teacher as part of a science class. The school, suburb, and the Oslo Opera, the site of the experimentation, are three short metro stops apart and a familiar part of students' lives. The on-site experiment was split into three related activities: (1) general classroom teaching about climate change; (2) a field trip to the Opera roof to test a situated simulation application; and (3) group presentation back at school a week later.

In Case 3 educational and participatory action research methodologies were adopted to create dialogues between students, educators, and community members in relation to urban planning activities and processes in Cape Town. The case refers to a wider 3-year service learning project that develops education and community partnerships around learning outcomes that broaden a student's disciplinary knowledge and sense of civic responsibility in response to the needs of a specific community (Amin & Cirolia, 2017; Bringle et al., 2004; Lazarus, Erasmus, Hendricks, Nduna, & Slamat, 2008). This project drew 35 undergraduate students and members of a poor, informally housed urban community into a space requiring the building of trust and negotiation around issues of privilege. The student cohort consisted of 13 females and 22 males, many coming from beyond Cape Town's environs. Having started their tertiary education after school, the average age was 18 years old. Students' home languages included English, Afrikaans, and IsiXhosa. The service-learning component of the semester course involved 20 hours of community engagement. Students spent one day a week (approximately three hours a day) with the community over a period of eight weeks. Such courses are a key strategic part of university community partnerships in the western Cape.

None of the students had grown up in an informal settlement and were mostly from a more prosperous, formal urban background. The settlement was characterised by being built without planning permission, using found materials, and structured outside of building and safety codes, with water only accessible at central points. The informal settlement is thought to house 90 households (approximately 450 residents). The main purpose of the collaboration was mapping and enumeration that was negotiated between the course leader and community committee members through a non-profit Community Resource Centre (CORC). Students were invited to keep a record of the engagement through diaries. Pedagogically, active engagement with communities seeks to verify knowledge through actual experience and by facing issues in context, not all connected to given outcomes.

Taken together the three cases point to a number of key aspects that may be included in a wider view of agentive urban learning: students' personal identity building in specific urban locations, their reflective uses of tools and technologies in understanding the changing climate of the city, to learning through collaborative processes of working with the needs and views of a variety of community stakeholders.

4. Understanding agentive learning through three case studies

4.1. Case 1: identity and agency in urban settings

In our first case we explore how identity negotiation plays a part in developing late teen and young adults' agentic selves as they negotiate key transitions between home and school, between schools, and from schooling to working life or higher education. In particular, we focus on how two 18-year-olds, one boy and one girl, go about constructing their identities as part of community life in one specific area of the city of Oslo.

Drawing on material from a larger body of qualitative data gathered and reported elsewhere (Erstad et al., 2016) these two examples have been selected out of a corpus of 60 young people who participated in a two-year fieldwork. These two participants shared experiences of growing up in this part of the city and going to the same school, but also differ in their cultural backgrounds and how they use community resources to develop a sense of self and in their interpretation of how these spaces within the larger city have significance for their identity formation.

The first example, of Khalida, an 18-year-old girl born in Morocco, concerns her reflections on her identity within this particular part of the city. Figures 1a–c show three photos Khalida took as part of documenting what mattered to her in her daily learning and her longer-term aspirations in the city. She explained that the first image shows the upper secondary school that she had dreamt about being able to enter when she was a very young girl and that she finally entered when she was 16. Figure 1b shows the sports areas close to where she lives where she meets friends. In an accompanying text Khalida explained that sport occupies a large part of her life and is important for how she sets herself goals to succeed in school subjects. Figure 1c presents a photo she took inside the public library in her community. She observed that the library:

> has had enormous significance in my growing up. Here I have borrowed books and it is thanks to those books and what they have introduced me to that I am the person I am today. I went there 3 times a week. The library was the door to a new world.

In this respect, Khalida is not unusual. Many of our interviewees in this study took similar photos and wrote explanations of how these spaces had specific meanings in growing up in this community. The qualities that were emphasised in these important places by our informants were mainly about strong connections with families and friends. Even though many of them had plans to move out of the area, either to other parts of the city or internationally, they all had strong ties to their local community and the spaces they referred to as important to them growing up.

However, Khalida was also an example of how several girls growing up in her neighbourhood saw their own futures within this specific area of the city. In an interview she explained how she had decided to become a teacher, and that she had plans to work in a school within her own community:

> I then got a teacher that gave us games and things like that and she was really patient with me. So I thought, [I could] give back sort of … So I thought if I become a teacher, I can give back. Since I am sure there are children that are in the same situation as me, [children] that thought the same as I did: 'No hope to succeed at all'. To give them back that hope! (Interview, girl, 18 years old)

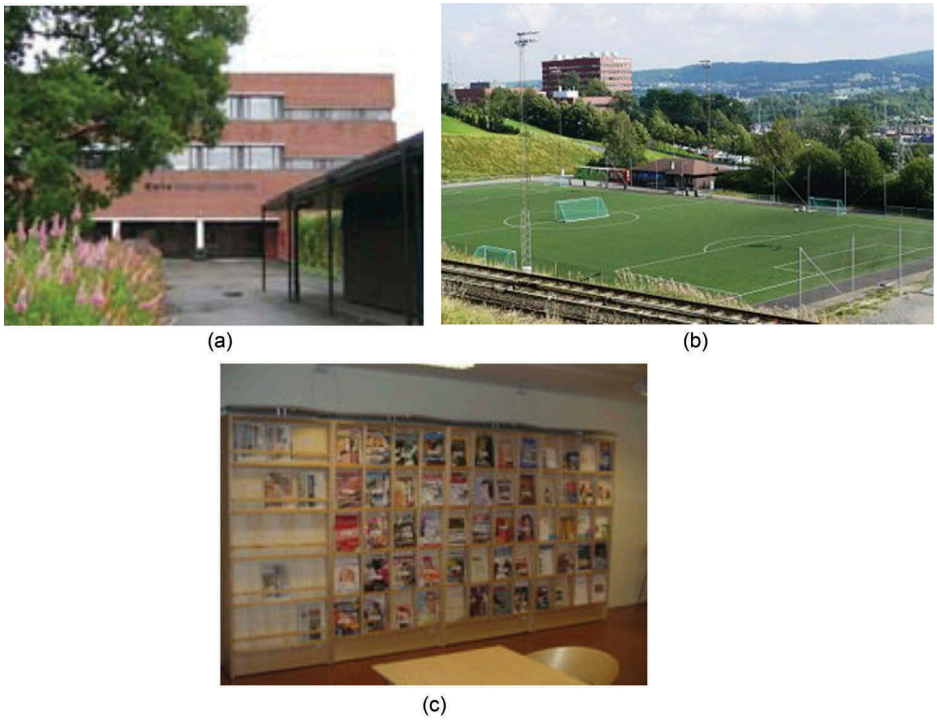


Figure 1. Mobile phone photos by Khaida of significant places in her own neighbourhood. She said that she took these photos because they represent: (a) the upper secondary school she dreamt about entering when she was young; (b) the sports field where she met friends; and (c) the public library where she could borrow books and do homework.

Khalida reflects back on her own education in primary school when she experienced a very patient teacher who introduced alternative methods to help her reading and writing. Khalida then expresses what some researchers describe as a 'debt of gratitude' (Leirvik, 2014, p. 7), often referring to some sort of gratitude to specific people that means something specific for them, but also to the community itself. By becoming a teacher Khalida frames her future role in the city as drawing on her own experiences to help other young people with multicultural backgrounds who struggle to shape their own identity. She reflects on her own future identity and her own role in her community, as a way of providing opportunities for young people in the same community.

The second example, of Mathias, concerns an 18-year-old boy of Samí background and closely connected to his family and arctic traditions, who has grown up in the same neighbourhood as Khalida. Mathias represents one of the ways that students have themselves gone about 'mapping' their own daily urban experiences as young people, through a form of common 'auto-photography' practice on social media such as Instagram.

In Figures 2a–c Mathias took photos to show where he lives with his mother and others of a graffiti artist friend making a new painting on a wall with permission from the local community. Mathias also provided an annotated map that shows how he moves mostly within a small radius within the community, between home, school,

Figure 2. Mobile phone photos by Mathias of (a) the apartment block where he grew up with his mother, and (b) a graffiti artist friend, working on a wall in his neighbourhood. His map (c) shows the route from home to school (bold), places where he meets friends (black oblongs), and places where he makes music and does sports (circles, crosses).

different leisure activities, and meeting friends. In interviews Mathias explained how these places had formed him as a person and how he became engaged in rap-music and graffiti through his friend's network, sometimes also travelling to other parts of the city. Of special importance was the local youth club where he met friends, recorded his music, and started performing on stage. After a while Mathias performed at youth clubs in other parts of Groruddalen. He also became part of a larger network of rappers in the area. In one of the interviews he explained:

> I was probably not the smartest at school, but what I did with music that was what I could do, and there was no one that could do that better than me at that time. I felt like, this is my thing. (Interview, Barnsley upper secondary school, 2012)

Mathias showed us the stage at the youth club where he had begun his performances as a rap artist. He proudly recounted how several hundred young people were cheering him on while he was performing. All this seemed to strengthen a certain kind of identity

for him, building not just personal self-confidence, but an awareness of his role in acting widely in the social world of his peers:

> It is fun. It is probably the strongest and coolest experiences I have had, when you are on stage and there is strong pressure [trøkk] from the audience and stuff. There is not a lot that is stronger than that. (Interview, youth club, 2012)

In a fieldnote when visiting the youth club with Mathias we wrote that 'When showing me the recording studio and the performing stage it becomes apparent that this place has meant a lot for him in his teenage years, where he could express important interests that he could not express in school' (Fieldnote, youth club, 2012). However, as part of Media and Communication studies in upper secondary school Mathias takes advantage of his experiences from this youth club as part of a school project about his two graffiti artist friends, where the importance of this youth club for several youngsters in the community becomes apparent. For Mathias the youth club and rapping offered a way to be a person, to create an identity based on the confidence that he was good at something.

In these examples, we can see that students' identity and agency emerges in interaction with the city and specific local characteristics. They move through the valley, access its social and cultural facilities, and engage in shared meaning making that is important in their development of a sense of who they can be and their sites of potential agency within the city.

4.2. Case 2: situated simulation and urban climate change

In this case we explore how digital technologies can be used as pedagogic devices to enable young people to make connections between the past, present, and future and to reflect on what this means for their understanding of the city, how it may change, and their role in these changes. While Case 1 is descriptive of what young people already do to make connections and build agency, this case shifts to a focus on how these processes might be enhanced to enable young people to think creatively about both the city and their individual and collective agency, and the sorts of digital tools that might be useful to do so.

The example is drawn from a larger project *Oslo Opera 2222* in which the overarching focus is on climate futures and the city some 200 years beyond today (Liestøl et al., 2015; Smørdal, Liestøl, & Erstad, 2016). Here, we used a 'situated simulation' to prompt reflection amongst a group of 9th graders (14–15-year-olds) about climate futures and the city. Situated simulation is a form of Indirect Augmented Reality that allows users to make connections between the past, present, and future by way of digital overlays on the present drawn from past events and future scenarios. The focus on climate change for the simulation combined with the physical location of the Oslo Opera Building (which has a plaza sloping directly into the city Fiord) was seen as a means of drawing students in the city of Oslo into a discussion of the results of rising sea levels and temperatures.

This AR simulation, in various stages of its development within an ongoing research project, has been tested both with a small group of media students as well as a class of 9th graders. The 'trial' with 9th graders was split into three related activities: (1) general

classroom teaching about climate change; (2) a field trip to the Opera roof to test the application; and (3) group presentation back at school a week later.

The assignment was to use the sitsim AR app as a means to document the future effects of climate change in downtown Oslo. Students used smart phones and tablets using GPS technology. Clues and questions were posted in the app about action and events between 2015 and 2222. In particular, certain features were included to encourage learning that connected the student's embodied experience of being in place with their explorations of a potential future scenario for that place. These included: flag-like hypertext links with names (e.g. the appearance of a flower from the Mediterranean in the 2222 scenario) that were placed inside the virtual environment and distributed spatially so that they can be 'found' by children as they move around; these links allowed students to add written input, audio and photo, and links to online information. At the same time, students were organised in small groups of between three and five and each student in the same group could see an avatar with the name of collaborating students. Chat and commentary functions allowed collaborative communication within a group (Smørdal et al., 2016, p. 31). This made it possible to easily locate group members on a crowed Opera roof and to connect with each other during the process.

Based on features in the app students wrote each other messages, recorded audio, wrote notes, took now/then pictures, and placed hypertext nodes inside the environments. These nodes asked questions about possible futures and offered clues, including, for example: why there were exotic plants growing on the site, why very tall although abandoned skyscrapers appeared in the city centre, and what a flickering artificial light in the distance might indicate.

When back in the classroom each student group had 10 minutes for a plenary presentation giving their interpretation of what had happened to Oslo and its people during the period 2015–2222. In these presentations they used the app to document their problem solving, added links, composed snapshots combining the present and future scenarios. This was video recorded and students answered a questionnaire about the overall learning process. One pair found the futuristic visualisation a little boring (some iPads had problems with the electronic compass and orientation) and that the graphics could have been more advanced. The majority found the experience of using the app to explore the potential future of the urban space very interesting. They stressed the fact that they could see the potential future instead of 'just reading about it' (female student, 14 years), and that the experience was novel as a student said she had 'never done anything like this before' (female student [2], 14 years).

The class teacher reported that the enthusiasm among the students was unusual and that students manifested unusual creativity in contributing content to the virtual and real environment as well as their interpretation of the future history of Oslo over the next 200 years. The flickering light in the distance was interpreted by one group as a solar-powered OLED light that refused to shut down, while another group interpreted it as a camp fire because people now were again living like hunters due to the breakdown of advanced civilisation. Smørdal et al. (2016) elaborate on the situated and experiential uptake of the *Oslo 2222* sitsim application with the upper secondary school science students, documenting how the process enabled students to make added connections to curricular subjects, taking the locative aspects of the urban climate change experiment into learning activities (see Figures 3 and 4).

Figure 3. *The Opera2222* situated simulation in use on the Opera roof in Oslo displaying the year 2222 mode and a dystopic future of the same environment. (A video demo of the sitsim in use can be found at *www.sitsim.no*.)

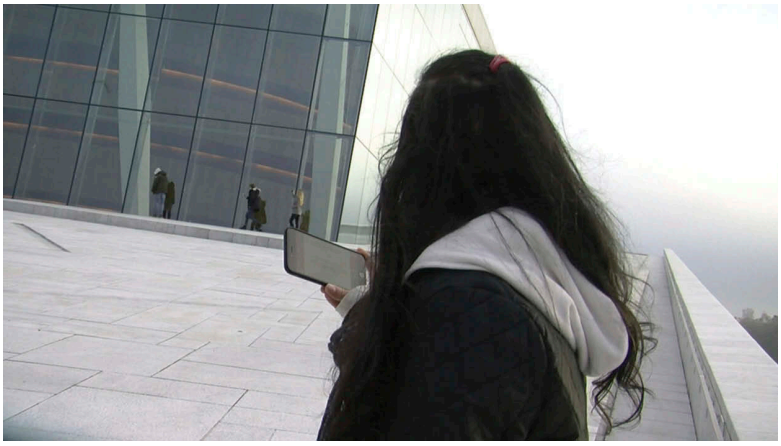


Figure 4. A student's participative point of view in accessing and writing into the sitsim app of a future climate change scenario in 2222, Oslo Opera 2017.

Overall our goal was to involve students—themselves active users of mobile technologies in their own daily lives in and out of formal school settings—in engaging individually and collectively in investigating aspects of the context within which they are moving. This movement occurs physically in the present and on location and digitally in either the past or future, through virtual overlays. The design was geared towards students' active participation at the venue. Their additions into the digital environment provided specific views from their own experience of shifts between a mediated dystopian future and the physical materiality

and seeming comfort of the present. Using locative tools, students' authoring within the sitsim app extended beyond the typical school trip. It provided them with their own inputs and annotations for discussion back in the school so that they were further able to reflect together on the effects of climate change on their own known city centre and the need for wider engaged critical debate as part of their own immediate learning.

4.3. Case 3: learning together in an urban community

While Case 1 focuses on individual agentive urban learning and Case 2 focuses on a digital intervention to promote the processes of ideation that may support individual and collective agency, our final case explores how, over a sustained period, young people can be supported to engage in a practice of collective agentic urban learning inspired by traditions of critical pedagogy.

Case 3 examines a three-year project conducted as part of undergraduate coursework within the Department of Town and Regional Planning (TRP) at Cape Peninsular University of Technology. Grounded in a service learning approach, this practice-based teaching and learning model is intended to broaden a student's disciplinary knowledge and sense of civic responsibility and is informed by community-led rather than top-down urban development in post-apartheid South Africa. The pilot project was established in 2013, focusing on an informal settlement on the urban fringe of Cape Town.

'Problem-posing education' (Freire, 2005, p. 12) in socio-cultural settings brings students face-to-face with social and political factors at play. Engagement with these nested and situational problems helps develop agentive learning for students. In South Africa these problems manifest as deeply layered, complex, and interlinked social, cultural, and economic issues. For people living in informal settlements, the indeterminacy of the problems they face appears to be insurmountable, creating a sense of hopelessness. Frustration in not knowing where to start the process of improving the situation often causes violent protest actions (see also Robin 2019 et al., this Special Issue). As this project developed over three years there was time for critical reflection on how its phases were unfolding, and for learning to be applied within the context of the emergent needs of community and of students. Reflection as a core part of learning in the case of this project was facilitated through student journaling of their experience and how the long-term aims of the project were being served.

The Flamingo Crescent community in Cape Town is comprised of homeless people who live together informally. They are generally unemployed or earn extremely low wages. Local government agreed to implement a basic in-situ services upgrade which includes sewerage, electricity, fresh water, and grey water drainage. This type of upgrade is referred to as re-blocking and involves the cooperation of community members in dismantling their dwellings (shacks) and rebuilding them in a structured layout. Although social capital does exist within the community there is a need to inform/educate residents of their right to space and to convince them they are not being evicted. Only once this is done can re-blocking commence.

The task of the TRP students was to enumerate and geographically document each structure by drawing a map. In so doing the students were able to inform/educate residents regarding the re-blocking process as well as inform the local planning

department. As part of the activity, undergraduate TRP students are taught Computer Aided Design and the principles of Global Positioning Systems (GPS) as a means 'to assist in the analyses of complex space and social issues for urban and regional planning projects' (Pinfold & Moodley, 2013). This socio-technical component of coursework became central with the course focus on service-learning and led to a partnership with the Flamingo Crescent community, various local NGOs, and government to co-design the upgrading of the built environment of the settlement (Pinfold & Moodley, 2013). This would in time lead to a relationship where the service-learning outcomes of engaged citizenry and experiential design learning combined synergistically with the needs of the Flamingo Crescent community. Over three years, this project would involve a total of 105 students and two educators working with a core group of community members, three local NGOs, and local government engineers.

Critical reflection during each phase of the project allowed for learning to be applied within the context of the emergent community and student needs. Reflective learning was facilitated through student journaling of their experience and how the long-term aims of the project were being served. Reflective sessions were an integral part of learning with group reflective sessions preferred over self-reflective sessions. The group sessions provided space for students to performatively reconfigure preconceptions. For example, a student who was initially judgemental about informal living, with little understanding of its wider social ramifications, ended up revising her point of view. The group reflective session with other students who looked at the settlement in a different way enabled a discursive space that opened up wider views on embedded political issues.

During this project students were able to think and talk empathically about others and the conditions in which they live. It became evident that the scale, scope, and complexity of learning during this service-learning project far outweighed information acquisition in a classroom. One of the students articulated that:

> … through a site visit and an exploration of the place, I developed a collective sense of the place that differed from my initial perceptions. My perceptions shifted from viewing the community as a static, rural geographic place to a unique and social constructed place.

Experiences brought students face to face with issues of socio-economic disparity and community aspirations of social justice (see Figures 5 and 6). A student commented that:

> going to the community [exposed me] … to bad living conditions and inadequate services … community members were also participative as they also wanted to see themselves living in better conditions.

The close collaboration with community drew students into learning the need for open mindedness and empathy for those living in marginal and informal settings. Another student wrote that 'going and spending much time with the community was good and also important to have strong relationship with the community'.

They also associated learning as situated meaning making emerging out of longer-term relationships of trust, where value systems and other socio-political undercurrents became apparent. This resonates with Winkler's (2013, p. 224) recommendation that for these sorts of projects to be beneficial to all participants, they should be 'conceptualized as longer-term projects with different cohorts of students'.

Figure 5. Students learning with the community about the urban context of Flamingo Crescent. Students show residents how to measure the perimeter of their dwellings using GPS technology and how to sketch its layout.

Figure 6. Group work on understanding possible urban design processes. A cardboard cut-out was made of each dwelling. Students and community residents together placed the cut-outs on the plan in an agreed position that would best suit service delivery.

There is also some evidence that there were benefits for the community from the project. A quantitative survey was done after this mapping exercise, with 41 of 95 informal households interviewed. Overall, 80% of respondents welcomed the university's initiative to engage with their community; 68% of the respondents worked well

with the students during the mapping process and felt they had gained some knowledge; 95% indicated they were well informed about the re-blocking process and supported it; 100% of respondents were positive about their future and felt they would be happier in the coming years. A community committee member said 'in the beginning this place was very bad but now everyone is satisfied because they have toilets, electricity and water'.

What changed for students through agentive learning in such a context was a shift in perception that fuelled their own sense of agency in relation to what they experienced. Agentive selves co-evolved through meaningful interactions during the site visits that manifested the unfolding socio-cultural dynamic in all its chaotic complexity. This immersive exposure to the everyday tangled nature of these social problems facilitated transformative and boundary-crossing learning that challenged preconceived static representations of geographical locations. The very technology of (Geographic Information System) GIS mapping used by apartheid planners was used as an emancipation tool for communities.

The case showed how learning was 'not an individual act but an interdependent relationship built on trust' (Baumgartner, 2001, p. 19). Contemporary urban planning problems in South Africa require students to deal with complexity and uncertainty, and to solve problems collaboratively, especially at community level. Students learned to focus on community advocacy and ways to lobby for better community services. In one student's words '… my involvement in the community helped me to mobilize the community so that they can be activists of their own needs and also assisting in a bottom up approach in grass rooted communities'.

5. Discussion

These cases highlight three key aspects of agentive urban learning: as students move through the city and develop their own identities through and interaction with the city; as students are supported to engage with emerging digital media to interrogate the relationship between past, present, and future; and as students engage actively with the city as learners and as active citizens in collaboration with city inhabitants. Agentive urban learning is thus comprised of many inter-related elements: the wider ecology of students' processes of meaning making that matters for their own senses of selves; the mobile media that increasingly broker links between environment, motivated interests, and change; and the concerns of groups of urban citizens within broader processes of urban development and change. By bringing together these three perspectives—concerned with identity, with ideation/anticipation, with collective practice—we hope to make visible the potentially multi-faceted nature of agentive urban learning. Methodologically these three cases also illustrate diversity in the ways researchers engage with young people in ways of negotiating learning pathways within and beyond communities and co-constructions of social futures.

In light of this, the development of students' capacities to practise agentive urban learning in schools and universities needs to: take account of students' own identity work as they make meaning moving between different cultural contexts; explore how different mediational means and tools can be used to negotiate personal and collective identity; and enable attention to how the needs of a diversity of stakeholders

engaged in processes of urban transformation at a community level might be negotiated.

Our joint view as designers, educators, and researchers has been to facilitate learning on the part of students in the context of the city and in relation to the changing character of urban living. The cases are congruent with the view that ontologically learning has shifted (e.g. Christansen & O'Brien, 2003) from the site of the classroom and studio to the city street, public arenas, malls, bedrooms, cafes, and increasingly to mobile and locative uses of social media, within and between these settings and their members. These are complex interpersonal, cultural, and communicative changes in how students enact, perform, and engage in the dynamics and venues in their urban meaning making. In these cases, the agentive in the learning has to do with learners finding their own contextual articulations (Hull & Katz, 2006; Ito et al., 2010) as responses to given societal and trans-disciplinary problematics. Students' critical reflection includes making connections (Ito et al., 2013) between their own emergent understanding and contextual experiences of learning in and through aspects of the city by way of their own productive inquiry.

Students who are learning in these ways may then themselves take the experience and knowledge gleaned from these contexts into their future making (Facer, 2011). Their experiences and reflections of learning in and through the urban environment has the potential to be extended into their continued and lifelong learning. Ideally too, and anticipatorially, it may be taken up into the wider work that it takes to build, change, and propose improved and emergent modes of sustainably designing and living in cities, today and tomorrow.

Acknowledgements

The authors would like to thank all the participants in the projects as well as the anonymous reviewers who provided invaluable feedback on this article.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

Research Council of Norway: FRISAM Grant [number ES489007] KLIMAFORSK Grant and: Cape Peninsula University of Technology (CPUT): Grant from Department of Town and Regional Planning, Faculty of Informatics and Design

Notes on contributors

Andrew Morrison, Director of the Centre for Design Research at the Oslo School of Architecture and Design(AHO), leads design research projects on Communication and Interaction Design, collaborating on service, systems, and product design. He works on design writing, fiction and criticism, and design and technology critiques. Andrew collaborates with the Institute of Urbanism and Landscape at AHO, has coordinated the AHO PhD School, has supervised and examined widely, is on the board of several international journals and previously the AHO Board. Prominent

projects include YOUrban and Future North; recent books are *Inside multimodal composition* (2010) and *Exploring digital design* (2010). Andrew was co-chair of the Design + Power NORDES 2017 Conference, a member of Anticipation 2017 Conference, and the Chair of the 2019 Anticipation Conference. He led the AHO Research Review 2014–2017 into ethnographically and mediationally unpacking discourses of research impact. Andrew has published extensively on digital media, learning, design, urbanism, and landscape. He is co-authoring books on doctoral design education and the network city, and his own on futures and design studies. Andrew has an academic background in literature, linguistics, law, digital media, and pedagogy, and a practice profile in interaction and communication design, publishing, community, and health.

Ola Erstad is Professor and Head of Department of Education, University of Oslo, Norway. He is an internationally leading researcher with a focus on digital literacy, but firmly rooted in the wider social and cultural context of learning beyond the technological aspects. His areas of expertise are learning, technology and education, and children and youth in modern society. He has led several national and international research projects and is part of several international networks and committees. Ola is vice-chair of a COST Action and is a board member of several international journals. In 2016 he was elected as Chair of the Scientific Advisory Committee of Science Europe. Recent publications are *Learning identities, education and community* (Erstad, Gilje, & Sefton-Green, Cambridge University Press, 2016), and *Learning beyond the school. International perspectives on the schooled society* (Routledge, 2019).

Gunnar Liestøl is Professor at the Department of Media and Communication, University of Oslo. He has authored and edited numerous books and articles on rhetoric, narrativity, and digital design, among them *Digital media revisited* (The MIT Press, 2003, with A. Morrison & T. Rasmussen). He has a long track record of digital design for various platforms, starting with early hypermedia systems for museums, cd, and the Web, such as the award-winning *Interactive Kon-Tiki* (1995). Gunnar focuses on combining practical and theoretical experiments based in and informed by humanistic disciplines. He is currently directing the SitsimLab project exploring the storytelling, locative media, and indirect augmented reality for simulation of past and future environments in situ, <www.sitsim.no>. Several of these AR simulations are available for free download, such as the Roman Forum, Ancient Phalasarna, Omaha Beach, and Old Narva.

Nicholas Pinfold, a lecturer at the Cape Peninsula University of Technology, has a Master degree in Urban and Regional Planning—MURP (University of the Free State), B Honours—Spatial Planning (University of the Free State), and Bachelor of Technology—B.Tech Surveying (Cape Peninsula University of Technology). His research interests are indigenous knowledge systems and alternative teaching methods. His career as a land surveyor (engineering) began with local authorities in the Witwatersrand, Free State, and Cape Province (South Africa) in the 1980s and then as a private practitioner in the early 1990s. Nicholas spent 3 years in the United Kingdom (London and North Yorkshire) working on various civil engineering projects. In 1995 he joined the Ministry of Lands Resettlement and Rehabilitation in Namibia in the position of Chief Surveyor and returned to South Africa in 1998 and worked for a private land surveying firm in Cape Town until 2008. His professional affiliations are in the categories of Geographic Information Science GISc Practitioner and Professional Engineering Surveyor—South African Geomatics Council (SAGC).

Bruce Snaddon, a senior design lecturer and researcher at the Cape Peninsula University of Technology, has an MPhil Education (UCT) and is currently a PhD fellow at the Oslo School of Architecture and Design. His research interest is transformative design pedagogy that addresses sustainable design futures. He has recently published on the dynamics of experimental off-campus learning spaces that enable dispositional shifts in design students. Bruce worked in the design and advertising industry in Cape Town and the UK until 1995 before pursuing a teaching career. He has served on a number of boards including Cape Town's 2014 World Design Capital implementation company, several academic institutions, and chaired the Cape Town Design Network between 2013 and 2015.

Peter Hemmersam (PhD, MNAL) is an architect and Professor in Urban Design at the Institute for Urbanism and Landscape at the Oslo School of Architecture and Design where he heads the Oslo Centre for Urban and Landscape Studies. His research interests include city centre retail design and place-making, digital cities, periurban landscapes, and Arctic urbanism and landscapes. Ongoing research includes the project Displacement, Placemaking and Wellbeing in the City and a book on Arctic urbanism. Recent publications include: Hemmersam, P., Harboe, L., & Morrison, A., Building the brief. Developing a place specific urban practice, in E. Lorentsen & K. A. Torp (Eds), *Formation. Architectural education in a Nordic perspective* (Nordic Baltic Academy of Architecture, 2018); Larsen, J. K. & Hemmersam, P. (Eds), *Future north. The changing Arctic landscapes* (Routledge, 2018); Larsen, J. K. & Hemmersam, P., Landscapes on hold. The Norwegian and Russian Barents Sea coast in the new north, in Maier, K. & Ray, S. (Eds), *Critical norths: space, theory, nature* (University of Alaska Press, 2017); Hemmersam, P., Arctic architectures, *Polar Record*, *52*(4) (2016).

Andrea Grant-Broom is an independent design consultant and has a background in art direction, communication strategy, and new product development. With an additional 20 years as a communication design educator at the Faculty of Informatics and Design at the Cape Peninsula University of Technology, her great interest is in creating and facilitating design-in-practice environments which often include biomimetic methodology. Content development, innovative curriculum practices, experience design, communication strategies, and operational coordination within the sustainability and social innovation space are her dominant activities. Over the past 7 years, due to engagement with a range of universities in South Africa and internationally, and including corporate partners, she has been able to connect design students with globally competitive sustainability projects and to pursue her research interests.

References

Amin, A., & Cirolia, L. (2017). Politics/matter: Governing cape town's informal settlements. *Urban Studies*, *55*(2), 274–295.

Amin, A., & Thrift, N. (2002). *Reimaginging the urban*. Oxford: Polity.

Amin, A., & Thrift, N. (2017). *Seeing like a city*. Cambridge: Polity.

Bannerjee, I. (2010, June). Educational urbanism. Urban, virtual and de-territorial imaginaries of emerging educational spaces. In M. Schrenk, V. Popovich, D. Engelke, & P. Elisei (Eds.), *REAL CORP 2010 Proceedings* (pp. 1–16). Vienna: REAL CORP. Retrieved from *https://publik.tuwien.ac.at/files/PubDat_193027.pdf*

Baumgartner, L. (2001). An update on transformational learning. *New Directions for Adult and Continuing Education*, *Spring*(89), 15–24.

Bringle, R., Phillips, M., & Hudson, M. (2004). *The measure of service learning: Research scales to assess student experiences*. Washington, DC: American Psychological Association.

Christansen, P., & O'Brien, M. (Eds.). (2003). *Children in the city: Home, neighbourhood and community*. London: RoutledgeFalmer.

Costandius, E., & Botes, H. (2018). *Educating citizen designers in South Africa*. SUN PreSS. online.

Edwards, A., & Mackenzie, L. (2008). Identity shifts in informal learning trajectories. In B. van Oers, W. Wardekker, E. Elbers, & R. van der Veer (Eds.), *The transformation of learning* (pp. 163–181). Cambridge: Cambridge University Press.

Erstad, O. (2013). *Digital learning lives: Trajectories, literacies, and schooling*. New York: Peter Lang.

Erstad, O., Gilje, Ø., Sefton-Green, J., & Arnseth, H. C. (2016). *Learning identities, education and community. Young lives in the cosmopolitan city*. Cambridge: Cambridge University Press.

Erstad, O., & Sefton-Green, J. (2013). *Identity, community, and learning lives in the digital age*. Cambridge: Cambridge Univeristy Press.

Facer, K. (2011). *Learning futures: Education, technology and social change*. London: Routledge.

Freire, P. (2005). *Pedagogy of the oppressed*. (30th anniversary edn). New York: Continuum.

Fuller, T., & Loogma, K. (2009). Constructing futures: A social constructionist perspective on foresight methodology. *Futures*, *41*(2), 71–79.

Green, J., Skukauskaite, A., & Baker, W. (2012). Ethnography as epistemology: An introduction to educational ethnography. In J. Arthur, M. J. Warring, R. Coe, & L. Hedges (Eds.), *Research methodologies and method in education* (pp. 309–321). London: Sage.

Gutiérrez, K., Engeström, Y., & Sannino, A. (2016). Expanding educational research and interventionist methodologies. *Cognition and Instruction*, *3*(34), 275–284.

Gutierrez, K., & Rogoff, B. (2003). Cultural ways of learning: Individual traits or repertoires of practice. *Educational Researcher*, *32*(5), 19–25.

Haapasaari, A., Engeström, Y., & Kerosuo, H. (2016). The emergence of learners' transformative agency in a change laboratory intervention. *Journal of Education and Work*, *29*(2), 232–262.

Hou, J., Spencer, B., Way, T., & Yocom, K. (Eds.) (2015). *Now urbanism: The future city is here*. Abingdon: Routledge. (Kindle Edition).

Hull, G., & Katz, M. (2006). Crafting an agentive self: Case studies of digital storytelling. *Research in the Teaching of English*, *41*(1), 43–81.

Hull, G., & Stornaiuolo, A. (2010). Literate arts in a global world: Reframing social networking as cosmopolitan practice. *Journal of Adolescent & Adult Literacy*, *54*(2), 85–97.

Ito, M., Baumer, S., Bittanti, M., Boyd, D., Cody, R., Herr-Stephenson, B., & Tripp, L. (2010). *Hanging out, messing around, geeking out: Living and learning with new media*. Cambridge: The MIT Press.

Ito, M., Gutiérrez, K., Livingstone, S., Penuel, B., Rhodes, J., Salen, K., … Watkins, S. G. (2013). *Connected learning: An agenda for research and design*. Irvine, CA: Digital Media and Learning Research Hub.

Kelly, A., Lesh, R., & Baek, J. (Eds.) (2008). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York: Routledge.

Lave, J., & Wenger, E. (1991). *Situated learning*. New York: Cambridge University Press.

Lazarus, J., Erasmus, M., Hendricks, D., Nduna, J., & Slamat, J. (2008). Embedding community engagement in South African higher education. *Education, Citizenship and Social Justice*, *3*(1), 57–83.

Leander, K., Phillips, N. C., & Taylor, K. H. (2010). The changing social spaces of learning: Mapping new mobilities. *Review of Research in Education*, *34*(1), 329–394.

Leirvik, M. (2014). *Mer enn klasse: betydningen av 'etnisk capital' og 'subkulturell capital' for utdanningsatferd blant etterkommere av innvandrere*. (*More than class. The meaning of 'ethnic capital' and 'subcultural capital' for educational behaviour among descendants of immigrants*) Doctoral thesis. Oslo: Department of Sociology and Human Geography, University of Oslo.

Liestøl, G. (2009). Augmented reality and digital genre design – Situated simulations on the iPhone. In R. Grasset, C. DiSalvo, J. Pair, & J. Bolter. (Eds.), *IEEE International Symposium on Mixed and Augmented Reality—Arts, Media and Humanities, 2009* (pp. 29–34). Orlando: IEEE.

Liestøl, G. (2011). Situated simulations between virtual reality and mobile augmented reality: Designing a narrative space. In B. Furth (Ed.), *Handbook of augmented reality* (pp. 309–319). New York: Springer.

Liestøl, G., & Morrison, A. (2013). Views, alignment and incongruity in indirect augmented reality'. In M. Billinghurst & B. Thomas (Eds.), *Proceedings of ISMAR 2013, IEEE International Symposium on Mixed and Augmented Reality—Arts, Media and Humanities* (pp. 23–28). Adelaide: IEEE.

Liestøl, G., & Morrison, A. (2014). The power of place and perspective: Sensory media and situated simulations in urban design. In A. de Souza & M. Sheller (Eds.), *Local and mobile: Linking mobilities, mobile communication and locative media* (pp. 207–222). New York: Routledge.

Liestøl, G., Morrison, A., & Stenarson, T. (2015). Visualization of climate change in situ. In J. Shaw, H. Thwaites, & S. Kenerdine. (Eds.), Proceedings of the *2014 International Conference on Virtual Systems and Multimedia (VSMM)* (pp. 251–256). Hong Kong: IEEE.

Liestøl, G., Rasmussen, T., & Stenarson, T. (2011). Mobile innovation: Designing & evaluating situated simulations. *Digital Creativity*, *22*(3), 172–184.

Marvin, S., Luque-Ayala, A., & McFarlane, C. (Eds.) (2016). *Smart urbanism*. London: Routledge.

Manchester, H., & Cope, G. (2019). Learning to be a smart citizen. *Oxford Review of Education*, *45*(1).

McFarlane, C. (2011). *Learning the city: Knowledge and translocal assemblage*. Chichester: Wiley-Blackwell.
Morrison, A. (2018). Future north, nuture forth: Design fiction, anticipation and Arctic futures. In J. Kampevold Larsen & P. Hemmersam (Eds.), *Future north. The changing arctic landscapes* (pp. 119–143). London: Routledge.
Morrison, A., Aspen, J., & Westvang, E. (2013, April). Making the mobile and networked city visible by design. In U. Johansson, L. S. Holm, M. Nyström, M. Soila-Wadman, R. Cooper, & P. Atkinson (Eds.), *Proceedings of Crafting the Future, 10th European Academy of Design Conference*.Gothenburg/Lancaster: The European Academy of Design. Retrieved from*http://www.trippus.se/web/presentation/web.aspx?evid=qTCRaT4TJ70WGtClyjpKRA==&ecid=vajn7H5hFUL31Hr+Q9enuw==&ln=eng&emid=3JGsoZYZLLLPljnQTw8HmA==&view=infopage&template=desktop*
Osberg, D. (2010). Taking care of the future? In D. Osberg & G. Biesta (Eds.), *Complexity theory and the politics of education* (pp. 153–166). Rotterdam: Sense Publishers.
Pinfold, N., & Moodley, R. (2013). The importance of service-learning and community engagement within the GIS pedagogy of the town and regional planning department (CPUT). In *Africa geo-spatial forum* Retrieved from https://www.geospatialworld.net/.
Rajala, A., Hilppö, J., Lipponen, L., & Kumpulainen, K. (2013). Expanding the chronotopes of schooling for the promotion of students' agency. In O. Erstad & J. Sefton-Green (Eds.), *Identity, community, and learning lives in the digital age* (pp. 107–125). Cambridge: Cambridge University Press.
Rasmussen, I. (2012). Trajectories of participation: Temporality and learning. In N. Seel (Ed.), *Encyclopedia of the science of learning* (pp. 3334–3337). n.p.: Springer US.
Robin, E., Chazal, C., Acuto, M. & Carrero, R. (2019). (Un)learning the city through crisis: lessons from Cape Town. *Oxford Review of Education*, *45*(1).
Salama, A. (2009). *Transformative pedagogy in architecture and urbanism*. Solingen: UMBAU Forlag.
Sanders, E., & Stappers, P. (2008). Co-creation and the new landscapes of design. *Codesign*, *4*(1), 5–18.
Smørdal, O., Liestøl, G., & Erstad, O. (2016). Exploring situated knowledge building using mobile augmented reality. *Qwerty*, *11*(1), 26–43.
Stornaiuolo, A., Hull, G., & Hall, M. (2017). Cosmopolitan practices, networks, and flows of literacies. In K. Mills, A. Stornaiuolo, A. Smith, & J. Zacher Pandya (Eds.), *Handbook of writing, literacies, and education in digital cultures* (pp. 13–25). New York: Routledge.
Winkler, T. (2013). At the coalface: Community–university engagements and planning education. *Journal of Planning Education and Research*, *33*(2), 215–227.

PUBLICATION 4
INVESTIGATING DESIGN-BASED LEARNING ECOLOGIES

Snaddon, B., Morrison, A., Hemmersam, P., Grant Broom, A. and Erstad, O. (2019), Investigating design-based learning ecologies. *Artifact: Journal of Design Practice*, 6:1&2, pp. 2.1–2.30. https://doi.org/10.1386/art_00006_1

Artifact: Journal of Design Practice
Volume 6 Numbers 1 & 2
 doi: 10.1386/art_00002_1

BRUCE SNADDON
Cape Peninsula University of Technology

ANDREW MORRISON
Oslo School of Architecture and Design

PETER HEMMERSAM
Oslo School of Architecture and Design

ANDREA GRANT BROOM
Cape Peninsula University of Technology and independent consultant

OLA ERSTAD
University of Oslo

Investigating design-based learning ecologies

KEYWORDS
design-based learning ecologies
relational interplay
transformative learning
futures literacies
participatory urban pedagogy
sustainability

ABSTRACT

In this article we argue that, for educators in design, urbanism and sustainability, the responsibility of connecting emergent design practice and changing societal needs into pedagogical activities demands that attention be given to ecologies of learning that explore the interplay between what is and what might be. As such, this futuring imperative brings into play a mix of modes of situated learning experience, communication and tools from design and learning to query the planned and built environment as a given, while offering alternate future visions and critiques. In this article, we argue for agile pedagogy that enables students to co-create as citizens in public spaces, through agentive multimodal construction

of their identities and modes of transformative representation. Our core research problematic is how to develop, enact and critique design-based pedagogies that may allow designer-educator-researchers and students alike to co-create learning ecologies as dynamic engagement in re-making the city. This we take up within the wider context of climate change and pressing societal and environmental needs within which design and urbanism education increasingly needs to be oriented. Our inquiry is located within a shared practice of design pedagogy across two continents, and climatic and disciplinary domains between the western cape in South Africa and the far north of Norway. The main finding of this research is that pedagogies that are enabling of and attentive to the interplay of an assemblage of relational context-sensitive modalities can be conducive to sustainable and futuring design-based urban engagements.

INTRODUCTION

As a growing global population rapidly moves to live in cities, how we approach learning in the city and from the city becomes increasingly imperative. In this article, we address the potential dynamic between the pedagogical, design and the urban through four case type contributions from South Africa and Norway. They are part of an overall argument on the conceptualization of learning futures (Facer 2011) and learning ecologies (e.g. Cope and Kalantzis 2017) that are centred in a developmental and socioculturally framed perspective on the transformative character of learning as activity (e.g. Wertsch 1998) yet reach towards more relational, assemblages of knowledge making.

The cases are located 'from Cape to Cape', that is from the southern tip of Africa to the northernmost territories of Norway. The material included is drawn from completed projects as well as joint research underway: co-creation, collaborative inquiry and shared composition of research being a key feature of the work. Including cases from such diverse socio-economic and political contexts opens up an expanded space to understand and critique the core concepts in this research.

Against such a backdrop, the development, enactment and critique of sustainably oriented pedagogies for and through design need to situate students in relation to different knowledge forms and modes of communication. In following a relationally framed concept of learning ecologies we explore an ecosystem view that considers distributed agency and resource potentials beyond the individual, and bounds of siloed territories of academia, business, government and community. Hence 'symbiotic learning' seeks mutually beneficial learning partners 'across old institutional and organizational borders' that may enliven and enact tacit processes that show up new possibilities for design action (Eikeland 2013: 114).

Overall, we offer an account of how negotiating difference matters in shaping relationally positioned transformational ecologies for learning. We have adopted a wide frame of situated, experiential and embodied cognition

within which designers, educators and researchers, together with students and civil society have explored ways of 'learning the city'. Especially for students, this has embodied new social practices of developing design-based means to co-create as citizens in public spaces, agentive multimodal construction of their identities, and modes of transformative representation (Cope and Kalantzis 2009). We approach this through the notion of 'futures literacies' (Miller 2007) in design pedagogy, but provide a more specific design focus than prevailing learning and future studies ones, gesturing towards the importance of design pedagogies for survivable and sustainable futures.

DESIGN-BASED PEDAGOGY

Inherited design educational practices

Pedagogical practices in many design schools – incorporating various domains of design, urbanism, architecture and landscape architecture – have been strongly influenced by studio-based learning (Boling et al. 2016). Located in the Bauhaus model of design education involving solution based and developmental creative productive practices (Cross 1983), these approaches are supported by close tutoring and peer learning that typically results in presentations and 'crits'. With the advent of digital media and its pervasive reach into contemporary society, much design-based education may be understood as taking place within a 'digital bauhaus' (Ehn 1998). This is a pedagogy that is increasingly related to rapidly changing economic contexts (Friedman 2012) and material world settings including digital, online and socially mediated ones.

As transdisciplinary frames of design and urbanism expand and enfold, increased attention has been given to the dynamics of learning and the types of reflection in and on action (Schön 1983) that such pedagogy may support (e.g. Salama 2009). Mewburn critiques Schön's reflective practice as being inadequate today and suggests a 'more supple theory of pedagogical action' (2010: 372) that emphasizes a performative dimension. Interested in how 'peoples, policies, tools, representations, learning environments and the rest – make possible different teaching and learning practices' (2010: 372), she proposes that design pedagogy becomes 'responsive and attentive to what is going on *as* we act' (2010: 378, original emphasis).

Snaddon et al. (2017) have suggested three inter-related concepts when co-creating design learning spaces for sustainable futures. These are that educators attend to the *locative* as the changing context of learning activities, the *nomadic* in learning as it moves out into the world and takes that experience back into universities and work practices, and the *performative* aspect of students enacting their emergent identity and agency in relation to complex real-world contexts. Attention to the *afffective* may also be added to this list and highlights that we need to be engaged in noticing and ways of paying attention to the pyschological, emotional and sensory.

Situatedness and systemic design learning

Our task as designer-educators then is to bring co-created design dispositions to the fore by engaging students, actively and productively, in taking part in the agentive shaping of their own learning futures (Morrison et al. 2019a). In both design and educational terms, these challenges are systemic and situated (e.g. Lave and Wenger 1991; Meadows 2009), yet they are for each student a

negotiation of self in a wider societal and environmental frame (Gee 2008). Students are exposed to a variety of design disciplines and abductive alignment with others beyond design in complex real-world environments (e.g. Costandius and Botes 2018). Agency goes beyond localization within individuals and considers agentive entanglements for human and non-human entities that may be generative of futuring literacies (Barad 2007; Miller 2018). Marking a shift from traditional instrumental design school pedagogies responds to Findeli's (2001) challenge that design education should be less reactive and more proactive in exploring the future profile of design professions.

Design learning ecologies

The concept of design learning ecologies resonates with how design practice is becoming enmeshed in systems and ecologies, requiring us to connect things and 'to think and act in terms of whole systems' (Dubberly 2017: 7). The dynamics of such a shift highlights the importance for students to make their own connections in 'weaving between different knowledge processes' inherent within content, context and devices in a mode of situated and lived experiential inquiry (Cope and Kalantzis 2009: 187).

Lemke (1997) speaks of 'micro-ecologies of situated activities' (1997: 5) and emphasizes that 'how we play our parts in these micro-ecologies depends not just on what the other parts do to us, and us to them, but on what these doings mean for us' (1997: 2) and how our 'identity-in-practice' (1997: 3) develops as a result. The concept of learning ecologies acknowledges such complex notions of emergence and 'because the parts are interconnected, the behaviour of every part is shaped by feedback loops' that can maintain stasis or promote growth and change in the system as a whole (1997: 27). In this, feedback loops can be forces promoting growth and change (positive feedback) and also ones that resist change (negative feedback loop) (Meadows 1999). Design-based learning ecologies are thus learning spaces where designing as doing, knowing and becoming for a student and others can be seen and understood to be relationally dynamic.

Learning as transformation

Transformative learning has its origins in emancipatory pedagogies of democratic change (e.g. Freire 1973) and ones concerning dynamic change processes in adult and life-long learning (e.g. Mezirow 1991). We understand transformative learning as also being about what propels us out of present modes of habitual and socially reinforced norms in need of critical re-imagining (Braidotti 2006). Our four case studies deal with pedagogical interventions that collaboratively (with multiple stakeholders) aspire to enable learning and yearnings for change in positive and creative ways. These are transformational not only for the individual knower in changes in their own experience but can reciprocally transform the world in which the knower lives. This notion of reciprocity resonates ecologically in how collaborative and context-sensitive learning within urban settings might be shaped.

Concerning urbanism, notions of transformative learning have been taken up for example, by the Learning Cities Network that has been concerned with fostering responsive and responsible urban stewardship to ensure sustainable and inclusive urban transformation with active citizen participation. In the context of the Learning Cities perspective supported by UNESCO, African

scholars have argued that conscientization (Freire 1973) is central to citizens' arriving at actions and adaptations in transformation of their own cities – psychologically and physically – that are connected to related governance (Biao et al. 2013). The UK Cities of Learning project was part of a wider global initiative with key features such as discovery, means and motivation oriented to 'learning as the city learns' (Painter and Shafique 2017). Changes in conceptualizing 'learning the city' (McFarlane 2011) as an 'educational urbanism' have been presented as a matter of 'tying together new spatial imaginaries of educational spaces' (Banerjee 2010: 6). McFarlane views learning the city as understanding a set of assemblages that need to be untangled to 'expose, evaluate and democratise the politics of knowing cities' and that learning is central to such urban debate (2011: 75).

Transdisciplinary perspectives on learning cities

In the recent *Seeing like a City*, Amin and Thrift (2017) argue that cities can only be partially known as they are in flux and are complex assemblages of interests, formations and perspectives. Considering urban design and theory, this has extended to seeing the city as not only a built environment, to be planned and studied, but one that is experienced from the street upwards. In the editorial to a special issue on 'learning cities' Facer and Buchczyk (2019: 155) argue that growing international agenda of this movement needs to be connected with the daily realities, lived experience and complex materialities of learning in cities to understand how a city learns.

We too see a need to recast learning and cities in regard to the dynamics of embodiment, movement and dwelling (e.g. Ingold 2011), lively infrastucturing (Amin 2014) in schools and with communities (not socio-technical 'smart city' ones), and assemblages of alternate actions and sites of engaged pedagogy and practice (Morrison et al. 2019a). Contributing to that same special issue, we illustrated how the notion and practice of agentive learning may be enacted by a diversity of participants (young migrants in Oslo or design students in Cape Town) in their critical encounters with cities.

Design and sustainable futures literacies

Such interactions may be understood in part also as 'futures literacies' (Miller 2007; Miller 2018) that are realized through mediated meaning making for exploring mobile and locative technologies for their communicative potential as resources for learning. This is an anticipatory learning perspective where spatial and temporal shifts between the present and the imagined city may be explored and conveyed to others. Urban settings are 'multiple entanglements associated with materializing the "not yet" now' (Brassett and Marenko 2015: 12) for students working in complex contexts with unfolding dynamics, relating to climate change and learning to work in sustainable design-based futures.

Recently, it has been argued that greater attention be given to exploring the prospective in unpacking relations between Futures Studies and Design (Celi and Morrison 2017). Despite transdisciplinary influences (e.g. cultural geography, multi-sited ethnography), this article accentuates the need to unpack relations between learning and cities articulated through co-designing and within design-centred inquiry.

CONDUCTING THE INQUIRY

Methodological matters

Over the past five years, our design, teaching and research has involved collaborative and individual research and education projects in and between two countries at the southern- and northern-most reaches of Africa and Europe. Methodologically, we have drawn on qualitative inquiry to investigate dynamic and situated characteristics of a perspective on design learning inclined towards dialogue, emergence and agency (Morrison et al. 2019a). Consequently, the research has included a mix of ways to conduct inquiry to connect teaching and learning, framed through a productive-critical interplay in a mode of research through design (e.g. Stappers and Giaccardi 2017). This has ranged from the formative and constructive (Koskinen et al. 2011) to the imaginary and speculative (Lury and Wakeford 2012).

Our approach to design inquiry encompassed a four-way enactment of means (crossing between distinctions and sets of inter-relations) through which design inquiry may be understood, practiced and critiqued. Based on shared interests and experiences, we have positioned this as part of connecting qualitative inquiry in the social sciences, including education, with ones enacted in design making that involve knowledge production through embodied, situated and material production. We have labelled these four aspects: research methodology, research methods, design techniques and design tools (Morrison et al. 2019b). In the four cases presented below, the investigations included co-design and participative research, working within, between and across disciplines, and studies of design learning in formal and informal places and contexts (see Table 1).

Methodologically, this has meant adopting a shared view between students and designer-researchers on the status of design and learning as a dynamic activity of finding and forming ways of knowing that are inventive and prospective (Wilkie et al. 2017) rather than ones of only solving immediate known needs.

Research methods, design techniques and tools

In terms of qualitative research, we drew together a range of methods applied in the human sciences (Kelly et al. 2008) and related studies of interdisciplinarity with a focus on processes and the dynamics of shaping knowledge (Lury et al. 2018). This extended to the interplay of digital and situated ethnographic methods (Hjorth et al. 2017) and design pedagogy located within practices of co-design and co-creation (Sanders and Stappers 2008). Participant observation, situational photography, student diaries, open discussions, semi-structured interviews and course evaluations were taken up.

A medley of design techniques and tools were applied. These allow the educator and researcher to focus on means used in making that also reveal how design is not only developed, produced and even shared but also what we may know about a context and its inhabitants and the views of member participants in case-based experiments and interventions. In the four cases these included design sketches and prototypes, fictive narrative scenarios, putative personas, visual urban 'scenography' and collages, and evidencing. These design techniques and tools were further realized on site, through collaborative learning activities as well as by ways of students' individual design production. The cases include visual mediations of this work, contrasting in

Case 1	6-week practice-based learning and participatory design action research
	Cape Town city centre
	on social and natural systems
	5 design educators, 70 multidisciplinary undergraduate and bachelors design students
Case 2	3-month emergent process connected to studio on urban design
	Longyearbyen, Svalbard
	unscripted multimodal fictive narrative on potential climate change futures
	five volunteer master's urban studies students and researcher
Case 3	Whole semester studio
	Norwegian arctic border town
	on potential urban development undergoing a shift from mining extraction
	master's urbanism students, classroom and on-site urban experience
Case 4	3-year participatory design action research dialogue
	informal urban settlement in Cape Town
	on service delivery processes
	between students, educators, local government and community members

Table 1: Summary of cases.

purpose, style and participation. The array of work is given to suggest some of the variation that may be connected in developing and enacting design-based learning ecologies.

Case-based research

The inquiry centred on case-based research which covers a range of inquiry and disciplines. It provides ways of locating specific interests and change in relation to contexts, typical and particular (Stake 1995; Shrank 2006; Swanborn 2010). Our cases are included from a wider set of heuristic case-based design teaching and research into what may be called designs for learning and learning designs (see also Morrison and Aspen 2013; Hemmersam et al. 2015; Hemmersam and Morrison 2016; Snaddon and Chisin 2017).

CASE STUDIES

Case # 1: Design, transformative learning and urban change

Project: Biomimicry in the urban fringe

This case study presents a project module 'Developing collaborative design process through a biomimicry-inspired curriculum' in a Design and Informatics Faculty at the Cape Peninsula University of Technology (CPUT), South Africa. Located in the District Six precinct within which the campus is situated, the

challenge was to use newly introduced biomimicry thinking as a lens and methodology to conceive future scenarios inspired and modelled on natural ecosystems.

The main focus was to immerse students experientially in environments where they could directly observe and reflect on contextual dynamics of urban change, and then apply this learning to a set of design challenges. The central question was how a design learning intervention could provide stakeholders in the city with innovative ideas for energy-use, social regeneration, retrofitted products and ways to green and re-imagine the economy through creative use of existing resources.

Design, learning and the city

The campus, located in District Six where apartheid era forced removals took place has had a chequered past in its relations with local community groups. Starting from when the university was built by the apartheid government on land where homes and businesses had been demolished, concerns have grown over potential gentrification of areas with historical character and established businesses.

Initiatives by CPUT executive management and staff have attempted to bridge divides by instigating projects that are inclusive of community stakeholders. A pedagogy of learning positioned as part of urban change has produced speculative student proposals that have challenged the status quo and posed difficult questions on how this area can be more inclusive and engaging for its diverse populace. Two guiding conceptual perspectives were taken up.

The first was the mobility of learning communities, enabling a view of the city as a learning resource, and the offer of students being a learning resource for the city (Wenger 1998; Rudd et al. 2006). Through the involvement of academia in local outreach activities with anticipatory processes prompting and informing innovative social upliftment initiatives, learning extended beyond the bounds of academic inquiry to involve local stakeholder networks in a situated and participatory manner.

The second conceptual perspective concerned biomimetic pedagogy as creating conditions for learning characterized by cross-fertilizing strategies for reading the new and unfamiliar, including the role of diverse agency (human and non-human) within the meaning making process. Pedagogically, this starts with an immersive, spatio-temporal shift of register that decentres and leads students away from what they have already seen in the built environment, to natural ecosystems where relational interdependency can be understood through deep observation (O'Sullivan 2001). Learning with rather than from or about nature is enabled through attending closely to evolved strategies by organisms within an ecosystem. The possibility of emulating natural forms, processes or systems can then be explored. This is essentially a transdisciplinary move that exposes students to expertise from domains other than design, bringing about collaborative learning processes characterized by openness to difference.

Growing the city

This project sought to 'fold in pedagogic moments across the urban fabric' by enabling 'learning pathways' within 'physical, social, urban, virtual and de-territorial spaces and places' (Banerjee 2010: 7). Guest talks including city

planners provided students with an enlivened sense of the intricacies of an urban visioning project with all attendant complexities. This entailed a vision for the area as a design and innovation hub, where quadruple helix activity involving academia, business, government and community could thrive (Carayannis and Campbell 2012). Walkabouts and a talk by a water activist generated a space for curious enquiry, where exposure to a wider set of mediational processes animated an emergent and shared community of practice for all participants.

Momentum gained through this initial phase built anticipation among students for an introduction to biomimicry, its embodied practice and methodology, which followed on the third day at the Kirstenbosch Botanical Garden. The aim of this was to immerse students within a living natural ecosystem before exposing them to the deeply complex challenges of the District Six precinct. Immersion in close proximity to a functioning ecosystem heightened students' observation skills and revised personal conceptual schemas. Biomimicry would become an inclusive design methodology through which multi-disciplinary groups could work towards sustainable design proposals within the urban fringe area with its highly visible poverty, pollution, decaying buildings and vacant land. Observations of 'natural champions' served as inspiration that could then be abstracted from and emulated within the built environment of District Six.

The following two points characterize aspects of ecologies for learning within this project:

1. Students found the deep observation methods of biomimicry to be beneficial to their mapping and noticing of relational activities in the urban fringe. One remarked on how the time spent on the streets revealed many 'broken systems edged alongside each other without communication […] [and that] they could benefit from one another in well-optimised relationships'. The learning experience took them into spaces where they engaged deeply with all levels of socio-economic activity in the area, through a variety of times and weathers to detect multiple layers of activity taking place. This process challenged preconceived notions by opening up students to unexpected encounters, some positive and some negative. Walking and learning the city in this way enabled students to notice patterns and relationships previously unseen, and to hear first-hand what the aspirations of historically marginalized communities might be. These communities consisted of informal traders with their unwieldy mobile stalls, homeless and jobless vagrants, a wide range of local business owners, school children cutting across the area on the way to school, and students from several private/public higher education institutions. Engagement with these different groups shifted preconceived notions of who belongs and who contributes towards an urban economy, and helped establish an ethical and valuative stance.
2. The project outcome yielded twelve proposals that were presented to an audience of stakeholders including academia, local government, Biomimicry SA, and an NGO.

The performative expression of these presentations to an audience from beyond the bounds of academia enabled learning not only for students, but also for the invited stakeholders who in turn drew inspiration that was then

shared with their networks. Students learnt that their design imaginaries, which visualized alternative scenarios based on how natural systems enhance the wellbeing of all in a balanced and symbiotic manner, could engage the attention of planners and local business. The latter realized the value of engagement with academia in serving their civic mandate and how the relationship showed up surprising possibilities unforeseen within institutionally bound practices and approaches.

One offering, titled 'Greening Harry' (Figures 1 and 2), proposed a scenario in Harrington Street that has now come to pass. The area has now transformed into the creative precinct that was envisaged and a key factor has been the work of one particular individual, a business owner who was inspired by the student work that was presented six years ago. The 'Mayor of Harrington Street' as he is known has been a catalyst in the area that has promoted open and shared practice through a ground level 'garage space' that houses a coffee shop and eatery with work space for hire. The combination of these activities with an entrance that opens onto the street (the 'Mayor's' office) has activated

Figure 1: An alleyway transformed (Images: Steven Harris).

Figure 2: The 'Mayor's' office after activating the creative community (Images: Steven Harris).

a creative design community that attracts a range of businesses and activities catering to Cape Town's creative design industry.

Many young design students and early career designers continue to use the shared workspace to meet and collaborate on joint projects. CPUT design educators have made use of the space for off-campus supervision of students during times when the campus has been forced to shut down due to #fees-mustfall student protests (Langa 2017).

Reflections

This case illustrates how agentive and performative learning in spaces and places that are socially and politically contested was productive of networked knowledge that has influenced evolution of a real-world context. Immersing students within the lived dynamics of particular settings, activated dormant relationships through the speculative, imaginary and performative aspects of the design process. Through an ecology for learning that drew disparate networks together, the relational connections between these groupings were invigorated. Student project presentations acted as communicative catalysts in how the creative design proposals prompted civic responses. What seemed futuristic and fantastical in the student design proposals came to be through a mutual process of agentive learning for students and local stakeholders – a shared social imaginary that created new possibilities for inhabiting the urban fringe (Fendler 2013).

Case #2: Projecting fictional urban futures

Project: Longyearbyen 2050

Engaging people creatively and critically in looking into urban futures in the wider context of climate change is a difficult task. Urbanism has a considerable legacy of imaginary, visionary and purely conceptual projects geared towards reimagining the city (e.g. Amin and Thrift 2002). In courses in urbanism and interaction design students may be encouraged to engage creatively in their responses to the immediate world and to work towards and into the conjectural (e.g. Lim 2017). For us this has been a matter of making space for connections between futures studies and design that is concerned with prevailing needs and emerging complexity (Celi and Morrison 2017). This case takes this up in pedagogy of design urban fiction as part of a wider argument for examining further design literacies (Sheridan and Rowsell 2010).

Design, learning and the city

Design fiction has blossomed in the past decade as a mode of speculative inquiry that works with imagined future scenarios that are positioned as means to critique present contexts, especially technologies and policies often framed within a humanities perspective that is prospective (Morrison 2017a). This has extended to critiques of the 'smart city' and prevailing ideologies centred on techno and infrastructural determinism. Drawing on traditions of science fiction imagery and writing, a design fiction innovation and open experiment was devised as an adjunct to master's in urbanism studio at the Oslo School of Architecture and Design (AHO). Called 'Urban Design: Arctic City – Longyearbyen', the studio took place in Longyearbyen, the main town of Svalbard with a population of around 2000 workers, students, scientists and increasingly eco- and experience-driven tourists. As physical

resource exploitation of the archipelago of Svalbard shifts – from coal mining to satellite data mining, and climate monitoring and prediction – the social and economic conditions of this northernmost inhabited urban settlement are under transformation.

This studio invited students to learn about Arctic urban zones connected to emerging futures and matters of sustainable living, planning and development. They engaged in field work, held meetings with local authorities, commercial and community actors and developed a variety of projects. An open invitation was made to the students to participate in a related, parallel project outside the frames and deliveries of the curriculum, about developing visions of a future urban arctic via design fictional work during and after their visit to Svalbard.

Called *Longyearbyen 2050,* the project drew in twelve individual submissions. These offerings, together with those of the researcher motivating this experiment, were then presented at the related research project *Future North*'s open seminar including urbanism and landscape students and researchers, as well as at international conferences on design and futures (e.g. Morrison 2017b). This was done in relation to what was termed a 'para-pedagogy' that engaged students in drawing on and slipping off the frames of the given curriculum and deliverables. The invitation was taken up and enacted variously through dialogue in cafes, by way of display and discussion of draft visualizations, and through individual production and annotation. The material generated covered a variety of visual styles, scenarios and thematics, from hand drawn and computer generated images to collages of future streets and waste management and prowling polar bears and overhead daylight lighting in former mines. The results were unexpected and varied, involving a mix of genres from a scribbled shopping list to a hand-drawn elaborate pen and inked bird's-eye view of the entire town, part of it submerged. Each student contribution asked viewers to read and to look into freshly generated creative mediations of alternative urban futures.

In the selected two examples (Figure 3) we see two blueprint-like visualizations of a future Longyearbyen. In the upper image, Wai Fung Chu presented a front facing sectional drawing of an underground city scheme, one she also annotated with a series of questions and possible scenarios. Benjamin Astrup Velure created computer-generated line drawings from the future in 2050 overlaid on a photographic vista of the contemporary city. Luminous in both time scales, the past and the future appear synchronic yet distanced, his intention to create a sense of potential, and an etched vision of a potential city scene of a vista of the future city with high rise buildings and extensive lighting and transportation. These two urbanism students are clearly familiar with visualization and point of view devices as part of their emerging repertoire of disciplinary and professional literacies.

The next two examples (Figure 4) differ considerably in style and tone, one ludic and inviting and the other hypercritical and challenging. Veronica Gallina presenting an urban game for *Longyearbyen 2050* in plan view centred on the competition to be the best planner of the future right now, though with an already altered main street, suggesting that the present might indeed already be in the future. In his collage Minh Tin Phan hacked the iconic WW2 image of US flag raising at the battle of Iwo Jima, transposing it to a future Longyearbyen occupied by Norway. His accompanying written text described how Norway has supplanted its (current) custodial role with one of appropriation, grey military might lurking in the unfrozen waters of the future.

Figure 3: Longyearbyen 2050. *(Top) An underwater future city (Image: Wai Fung Chu); (Bottom) Projected urban infrastructures (Image: Benjamin Astrup Velure).*

For these four students, finding a stance from which to engage their core interests was central: their contribution connected the motivation of different views and the different styles adopted to convey them. The submissions revealed rich multimodal and collaborative futures multiliteracy of urban change and future potential, covering the utopian and the dystopian. The overall work is being revised as a larger design fiction with non-linear storylines.

Reflections

This case was an instance of an expanded classroom (Erstad and Sefton-Green 2013) but one that shifted into the conceptual and conjectural, including focus on abandoned mines, geo-politics, climate change and food security within this unique Arctic archipelago. Design fiction provided means to developing informal practices of co-creative inquiry and agentive learning

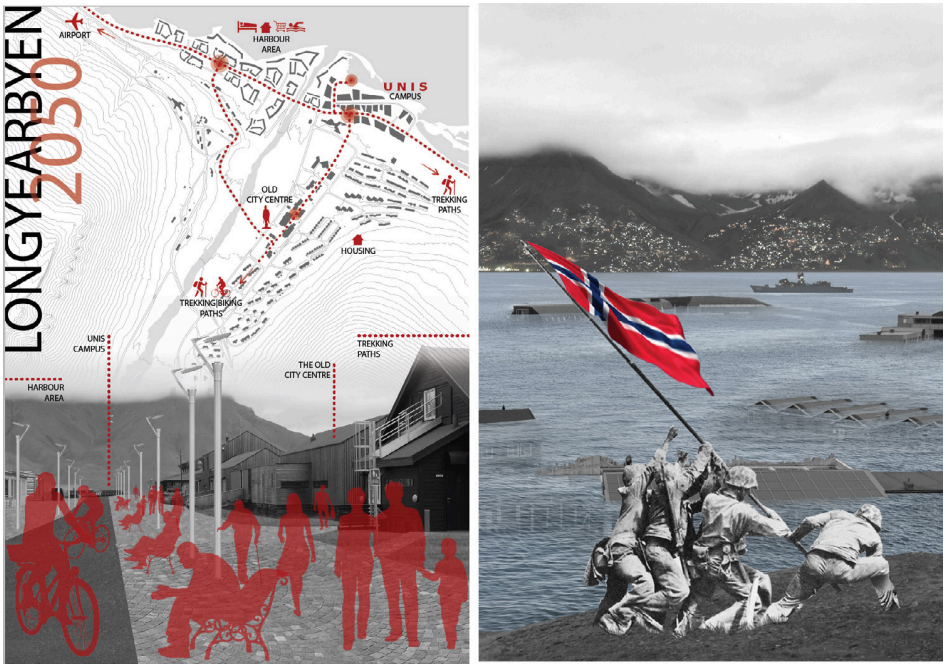


Figure 4: Longyearbyen 2050. *(Left) An urban game (Image: Veronica Gallina); (Right) The occupation of Svalbard (Image: Minh Tin Phan).*

in liminal spaces (Morrison 2017a: 8). We developed *Longyearbeyen 2050* out of the central principle of situated learning but propelled this outward and onwards into a setting of projected and eventful climatic and social change. We engaged in a mode of what we term 'future situated learning'.

Case # 3: Learning ecologies and the Arctic city

Project: Urban Design – Arctic City: Kirkenes

Kirkenes on the Russian/Norwegian border is, as many Arctic communities, rapidly reconfiguring its economy, identity and demographics. Its iron ore mine has closed, and this former industrial town has to re-imagine its future, including a process of urban learning. In this reorientation, urban planning and design proposals by students of architecture and landscape architecture align with urban learning in various ways.

Design, learning and the city

Kirkenes is reinventing itself in a process of urban learning in formal or informal arenas, including town spaces (Banerjee 2010; Candy 2003). How then may spaces and configurations of social relations become enabled for learning through urban design and planning, when 'knowledge, resources, materials and histories become aligned and contested' (McFarlane 2011: 1)? Understanding such alignment is essential to appreciating how urbanism is constituted in any location, particularly in rapidly transforming Arctic communities.

In 2017, an international group of students of architecture and landscape architecture, in association with researchers at AHO, studied Kirkenes in the context of the research project *Future North* into future Arctic landscapes and a related three year one one called *Arctic Cities* that investigated place-specific urbanism for sustainable communities in the Arctic. In this studio students developed urban design proposals that engaged ongoing transformation processes relating to urban space, industry, shifting demographics, cultural mutations, as well as a changing climate. The studio aimed to engage in local urban contexts and everyday life in ways that make evident and challenge the dominant conceptions of Arctic cities. The Arctic is a paradigmatic and urgent case of economic globalization with new trade routes opening up, fragile ecosystems being exposed by new industries and vulnerable indigenous communities being exposed to new economies and transient populations (Kampevold Larsen and Hemmersam 2018). To address local conditions rather than meta-narratives, the studio was based on fieldwork and fieldwork methodology. The case addresses urban learning on three levels, each of these is illustrated below in a successfully completed student project.

> *(1) Mapping and design briefs:* The fieldwork mapped a wide range of issues including physical dimension of urban space, historical development and future plans, and mental urban images and aspirations of locals. We call these processes of inquiry-based learning and project emergence 'building the brief' (Hemmersam et al. 2018). (*2) Design approaches to the study of place*: The studio was linked to research on cultural landscapes of the Norwegian-Russian borderlands by Ph.D. student Morgan Ip (2018) in his design of a social digital and Public Participatory Geographic Information Systems platform to map urban aspirations and desires for urban futures across national boundaries in the region. (*3) Learning moments in urban space*: The urban design proposals developed by students in the studio were connected to how they cast light on how learning takes place in the everyday urban space (McFarlane 2011).

Examples of student projects include Zarina Belousova's proposal for a redesign of the library (Figure 5) as a continuity of the town centre urban space by opening up the ground floor to enable pedestrian flows through the building, and even extending library function in buildings across the main square from the library. Increasing the public interface of the building, and including functions such as a tourist information, enhances the social relevance of the library as a meeting space in contrast to its receding role as a book repository. It thus became a 'knowledge space' (Dvir 2006). This student learned that concern for, and stewardship of, the public realm as public space exists in embryonic forms in institutions such as the municipal library. Concerning urbanism, learning for her included situated understanding of the agency of architecture when framed in an urbanist discourse.

The project by Femke Peters is an ecosystem-based transformation of a potential post-industrial site on the harbour front of Kirkenes (Figure 6). Designed as a park, it consists of trees of the local biome where climate change is advancing. This proposal builds on the unique location of Kirkenes, just south of the circumpolar boundary between the boreal taiga and the treeless tundra. At the same time, it preserves elements of the industrial structures of the site, thus documenting the maritime industrial heritage of the town. This

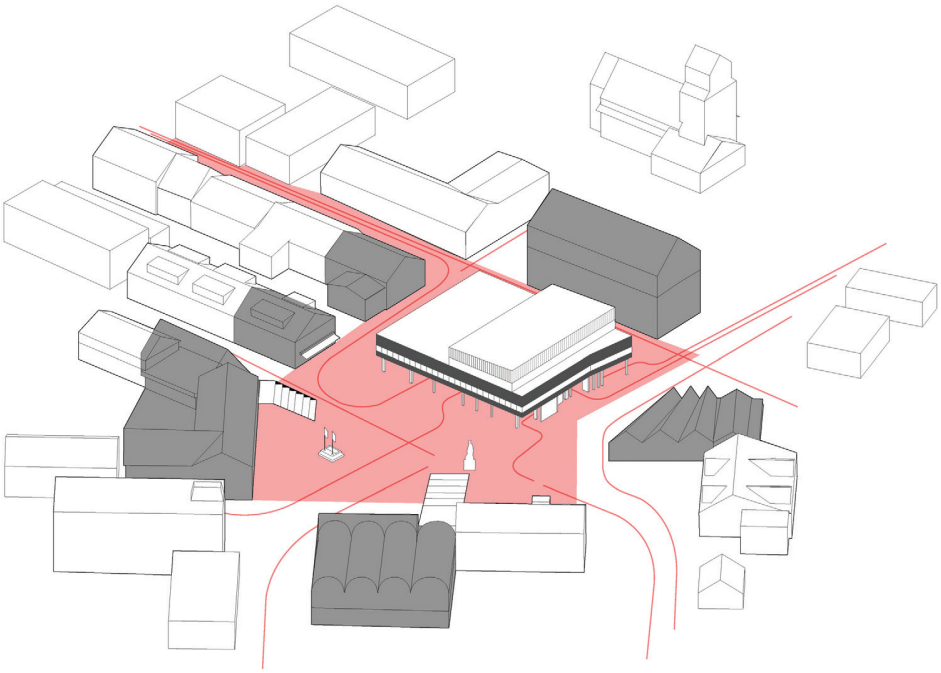


Figure 5: The ground floor of the library is opened up, enabling pedestrians to move through the building to the square or to the books in the levels above (Image: Zarina Belousova).

Figure 6: 'The Arctic Edge'. The unique site between city and subarctic nature provides opportunities for a new connecting urban space in the form of an Arctic experimental arboretum (Image: Femke Peters).

student learned that locals have a clear understanding of where 'nature' starts, and that the urban edge is an important feature of the town as the transition to nature and outdoor life. Learning urbanism for her included widening the scope of design conceptualization beyond traditional planning and landscape design parameters to include cultural perspectives and conflicting aspirations and concerns of groups and individuals.

The final project by Kristine Skarphol is a landscape-based approach to revealing and re-activating the many subterranean structures from the fortification of Kirkenes during Second World War (Figure 7). Through a variety of physical interventions and programmatic additions, they are transformed into social spaces in the town such as parks or small retreats. A prominent example in a residential district is the Andersgrotta, an air raid shelter converted into an improvised museum. Tracing the outline of the underground shelter on the surface by exposing the bedrock and other interventions in private gardens, the historical fragment literally resurfaces as a recreational space and a tourist attraction. This student learned that certain identities (such as the underground history) can play a minor role in the sense of place, while for outside groups they dominate the perception of a location (such as the online subcultures that view Kirkenes as an outstanding example of a Second World War fortification worth visiting and exploring). She learned to articulate place

Figure 7: 'Rediscover Dark'. Kirkenes is home to an extensive dark infrastructure: caves, underground military installations, bunkers and evidence of its mining history. The project reveals this heritage and complicates the reading of urban space (Image: Kristine Skarphol).

specific urbanism based on linking mapping and architectural conceptualization in ways that move beyond dominant formats and models of urban space.

Reflections

In accentuating the shift from the industrial worker to the knowledge worker, this case study articulates the transition from modernist, instrumental forms of urban planning towards postmodern forms in which information and knowledge are challenged, and the legitimacy of planning is uncertain (e.g. Beauregard 1991). In this context, moving beyond preconceived notions of urban space is critical to begin conceptualizing how urban space can become integral to urban learning in the exposed and rapidly changing Arctic community.

Case #4: Citizen-based participatory design

Project: Doornbach community – Solid Waste Management

Contemporary urban South Africa is experiencing great stress on urban housing due to massive migration from rural areas (and neighbouring countries) into cities since the fall of apartheid in 1994. In the Western Cape, this is exacerbated by a constant inflow of people whose work and residency were previously restricted along racial lines. For design students and educators this presents a complex scenario for understanding and working towards social innovation and sustainability in a public sphere founded on futuring design practices and participatory design pedagogies.

Figure 8: Street view of Doornbach informal settlement (Image: Andrea Couvert).

Design, learning and the city

Set against the backdrop of Cape Town's World Design Capital designation in 2014, an initiative was established for CPUT to lead a collaborative co-design project with a peri-urban community and local government. The main focus was to apply participatory design methods in exploring service delivery challenges relating to solid waste management (SWM) processes within the informal settlement of Doornbach, located on the urban fringe of Cape Town (Figure 8). At issue was the policy that services cannot be provided by government to people who occupy private land illegally (Futerman 2015). Such a setting presented a considerable challenge in navigating the sociopolitical landscape in a city run by the minority opposition party (Democratic Alliance) with ward councillors supportive of the dominant ANC party in SA.

The aim was to engage and build trust between all stakeholders over time, thereby improving a process of service delivery that is severely hampered by the haphazard growth of high-density housing (Figure 9). Participatory design pedagogy opened up a space that could allow a variety '[…] of voices and mutually vigorous but tolerant disputes among groups united by passionate engagement', in a place marked by structures of past and current hegemony (Björgvinsson et al. 2012: 129). To this point one participant commented that communication and '[…] negotiation has possibly been the most time-consuming process, negotiation with city, negotiation with the various power structures' (Futerman 2015: 167). Careful attention was given to how mutual learning would be enabled through a process of respectful engagement entailing walking the site repeatedly, work-shopping with photographic documentation, sketching and prototyping over time.

So as not to inflate expectations for the community members, great care was taken to communicate how the project aimed to discover what the existing systems relating to SWM were in order to leverage and augment what was already working. No initial promises were made that any particular designed product would be delivered. It was important to build trust with a small group

Figure 9: (Left) Doornbach, a high-density informal settlement housing 5033 people (Image: City of Cape Town); (Right) Collaborative workshops enabled a shared community of inquiry (Image: Andrea Couvert).

Figure 10: Evidence of house-proud residents (Images: Andrea Couvert).

Figure 11: Before and after the participatory design process (Images: Andrea Couvert).

of community members (through a local Council member) and for everyone to learn from the participatory process of understanding what the real needs and particular design challenges were on the ground.

An example was when photographic evidence was exhibited at a local crèche of how some community residents were organizing and beautifying their front yards (Figure 10). This positively affirmed what was working well. Community members animatedly identified the houses and commented on the different approaches to separating, storing or managing waste through growing vegetable and flower gardens.

The expression of shared emotion through noticing positive actions in the poverty-stricken environment enabled shared agency for community members and the project group. This sparked continued dialogue on how this existing community momentum could be leveraged in the design process. Once consensus had been reached around the development of a waste bin to suit the cramped informal settlement pathways, the design prototyping process began to ascertain its shape, size, positioning and functionality; a final moulded prototype was arrived at (Figure 11). A batch of twelve were then produced and delivered to homes for user testing, culminating in local

government finally advertising the tendering process for mass production of these bins.

Reflections

The emergence of a collaborative learning space was largely driven by the pace of participant activities rather than city or academic timeframes. This was enabled and mediated through developmental processes, designed artefacts and tools over time, showing 'how the future can unfold [and] […] be made visible, performed and debated' (Björgvinsson et al. 2012: 127–28). What became visible through shared experience reinforced the value of participatory processes and ownership of solutions for community members even in a setting where people do not legally own their houses. This led to a final design 'solution' of one bin per house that people would 'own' and take care of, rather than communal or mobile ones open to abuse and vandalism. An ecology of learning emerged through pedagogic processes that illuminated intersectional and relational possibilities for designing in ways that reveal assumptions and blind spots within the wicked problems of everyday lived experience in contested contexts.

DISCUSSION

Towards design learning ecologies

Landscapes and ecologies are apt metaphors to describe complex domains such as learning and design. They are useful insofar as they are able to incite action and offer some comfort to educators and students as they journey forward into uncertain futures. Through the diverse cases presented we have shown that when multiple learning pathways coalesce in project-based learning settings to 'create, draw upon and steward collective knowledge resources' (Facer 2011: 103), the outcomes may be understood as propositions and perspectives of sustainable futuring scenarios that can be realized in time. Such a pedagogical approach supports the development of futures literacies through project-based co-creation with civic partners, and as preparation for transdisciplinary professional work that will require resilience, flexibility, openness and empathy. Learning in and with the city (e.g., Amin and Thrift 2017) is exploratory of speculative spatial imaginaries of where and when education occurs, and for and with whom it might happen.

Design-based conceptual findings

Drawing on the cases, we suggest that a design-based perspective on urban learning ecologies may be understood by way of an assemblage (McFarlane 2011) of six nested learning modalities with four learning perspectives (see Table 2) that can be read multi-directionally.

Our main contribution, embodied in this modal assemblage, is to show the relational amongst these modes and their associated qualities of design learning through being, doing and knowing. Importantly, the pedagogical emphasis is on how design-based approaches can explore, enact and articulate such relationality, in the moment and as developing of futures literacies that capacitate students as materializers of the '"not yet" now' (Brassett and Marenko 2015: 12). In this we advocate for agile design pedagogy as a nomadic modality that, through designing practices of making can bring to the surface and support an array of speculative and pragmatic context-specific articulations.

Modalities	Associated qualities	Learning views	Exploratory positions	Knowledge activities
Decentering and transposing	Abductive leaps across codes and domains of design, urbanism, futures and biology	Nomadic, dedicated, discursive, accountable and materially embedded	Transdisciplinary and cross-boundary thinking	Doing and being is core for capacity to engage with wicked, systemic problems
Space and place making	Learning ecologies are spatiotemporal and context-sensitive	Learning spaces are enabled, allowing transitioning flow and reorientation	Opening up and making space for an ecology of place to come into being	Responsive to the nature of the learning happening in situ
Symbiosis	Mutually beneficial learning happens with, rather than for or about others	Open principles for process engagement and room for flexible negotiation	Emergent community of practice competence in relation to that of others	Socially distributed knowledge generation and distribution
Non-hierarchical and non-linear	Learning happens all the time in and out of formal conditions	Para-Pedagogy is outside of formal spaces, enabling questioning of current forms and processes	Speculative, conjectural modes of re-imagining the world in less instrumental pathways, openness to difference	All options from minor, under privileged, less known to dominant and obvious
Interplay	Dynamics of learning ecologies entails constant alignment and realignment	Between personal experience of own competence and through emergent community of practice	Through explorations and articulation in use	Interplay infuses and motivates wider learning actions in emerging learning practices
Mediation	Learning through dialogue, aspects of individual and group interchange with wider communities	Realized materially and discursively through appropriate channels and situated contexts	Vital in driving feedback loops and enabling development via new ideas and processes	Part of a wider socio-culturally mediated communicative ecology

Table 2: Charting an assemblage of relational modalities in design-based learning ecologies.

Key to this then is a pedagogical attentiveness to the micro-dynamics (e.g. Lemke 1997) of what is emerging through processes of relational interplay in design-based urban learning ecologies.

In our cases, we have shown work that has moved beyond the given project task to be communicated beyond to include wider stakeholder groupings. The urban design fictions in the Norwegian cases have travelled to a diversity of conceptual and speculative learning and research contexts; in the South African cases, dormant relationships became activated and ownership of co-creation processes led to outcomes, e.g. the waste bins in Doornbach

are in production. We have aimed to show by reading these cases through the literature on transformative learning and learning ecologies, that when the modalities of such a design-based urban pedagogy become animated, we start to see the emergence of 'agencies in the massively plural' (Cope and Kalantzis 2009: 173).

Through our varied cases we found that their making and speculative material-discursivity (e.g. Mewburn 2010) helped design learning become more proactive (Findeli 2001). We further established how participants may work together to *release* and *realize* potentials in current project settings. Another key contribution of the research is demonstrating how what we term 'a pedagogy of attentiveness' may include processes of releasing inherent possibilities in institutional and informal settings (e.g. Erstad and Sefton-Green 2013). By releasing futuring possibilities in and through design-based techniques and tools of transformative representation, we see in these cases how alternative and sustainable futures may be realized in time. This extends the notion of futures literacies (Miller 2007), to a pedagogy of shaping sustainable design-based learning futures.

Ecologies are dynamic and self-regulating and always context dependent. In short we found that design-based learning ecologies can therefore be enabled through a pedagogy of care-full attentiveness to possibilities that are contextually mediated and released: through walking and mapping, speculative questioning and imagining, sketching and visualizing, playing with and in time, making and prototyping, communicating and researching. In this design-based learning ecology we emphasize attentiveness towards emergent micro-ecologies within such mediations and release, and point to relational emergence as potential for energizing and exercising the futures literacies our design students urgently require.

However, we see two main constraints. The emergent qualities of such experimentation may make it difficult to connect and strategize across disparate elements. Such emergent pedagogies may often demand investment of time and participation that do not fit easily into academic semester programmes. Design futures literacies may therefore need extended processes and the development of trust and engagement in and over the life of an emergent design-based learning ecology.

CONCLUSION

With transitions in design and urbanism away from dominant practice grounded in the disciplinary bound studio-based status quo, we argue that it is incumbent on design researcher-educators to actively explore pedagogy that leads students into learning opportunities where they engage in and co-create with dynamically emergent bodies of knowledge and critical re-imagining (Braidotti 2006). These intersectional and transpositional processes transverse knowledge in social, cultural, ecological and technical domains and are ones associated with participatory design research as part of the practices, commitments and histories of everyday activity of communities (Gutiérrez et al. 2016).

When new habits and habitats for learning, research and design practice intersect, away from formal institutional norms and settings, it is possible that emergent agency may come into being through recombination's of mediation processes and tools, diverse and dynamic learning partnerships, figurations and fabrications (Morrison et al. 2019a). As shown in the cases, agency concerns an individual's learning ecology as a habitat within which a person

can think, do and learn – and how such learning as a developmental, iterative process creates and contributes to wider ecologies for learning. What counts as value and meaning for the co-design group and for the individual student is emergent through symbiotic (Eikeland 2013), dynamic contextual reinvention and interplay.

Today, and augmented via social media, peer learning and membership of various groups impacts on design learning. Equally, curriculum renewal projects may enable student learning pathways to be located in commercial or community settings. Here students need to understand and work with formal leadership, management and teamwork practices alongside processes of bottom-up grassroots work with minimal material resources and demanding daily living conditions (e.g., Facer and Buchcyzk 2019). In this sense, a conceptual framing of ecologies for learning reveals the political and hidden power relations in contexts, and examines how relational dynamics may be made apparent, become changed and translated into connected activities for alternate design infused futures.

These are processes that we have viewed in this article through the conceptual perspectives of ecologies for learning, transformative learning, learning the city, and framed as futures literacies that might propel students out of present modes of habitual and socially reinforced norms in need of critical re-imagining. We offer the above relational and navigable modalities as ways in which design educator–researchers might explore and chart possibilities in their pedagogy, and as an attentive way-in to noticing change as it emerges for and with students through ecologies for design learning and learning designs.

ACKNOWLEDGEMENTS

We would like to acknowledge the following people at the Cape Peninsula University of Technology (CPUT) and the Oslo School of Architecture and Design (AHO). CPUT cases: fellow teachers Prof. Mugendi M'Rithaa, Dr Rael Futerman, Johan Van Niekerk as well as students and City of Cape Town participants in both cases. AHO cases: fellow studio teachers Lisbet Harboe and Morgan Ip as well as students at the Urban Design – Arctic City: Borderlands studio. The AHO contribution is part of the research project Future North, funded by the Research Council of Norway grant #220656.

REFERENCES

Amin, A. (2014), 'Lively infrastructure', *Theory, Culture & Society*, 31:7&8, pp. 137–61.

Amin, A. and Thrift, N. (2002), *Cities: Reimagining the Urban*, Cambridge: Polity Press.

——— (2017), *Seeing Like a City*, Cambridge: Polity Press.

Banerjee, I. (2010), '"Educational urbanism" – The strategic alliance between educational planning, pedagogy and urban planning', in M. Schrenk, V. Popovich, D. Engelke and P. Elisei (eds), *REAL CORP 2010 Proceedings*, Vienna: REAL CORP, 18–20 May, pp. 1–16, https://publik.tuwien.ac.at/files/PubDat_193027.pdf. Accessed 28 October 2019.

Barad, K. (2007), *Meeting the Universe Halfway*, Durham: Duke University Press.

Beauregard, R. (1991), 'Without a net: Modernist planning and the postmodern abyss', *Journal of Planning Education and Research Journal of Planning Education and Research*, 10:3, pp. 189–94.

Biao, I., Esaete, J. and Oonyu, J. (2013), 'The role of building learning cities in the rejuvenation of Africa', *International Review of Education*, 59:4, pp. 469–88.

Björgvinsson, E., Ehn, P. and Hillgren, P.-A. (2012), 'Agonistic participatory design: Working with marginalised social movements', *CoDesign*, 8:2&3, pp. 127–44, https://doi.org/10.1080/15710882.2012.672577. Accessed 28 October 2019.

Boling, E., Schwier, R., Gray, C., Smith, K. and Campbell, K. (eds) (2016), *Studio Teaching in Higher Education: Selected Cases*, Abingdon: Routledge.

Braidotti, R. (2006), *Transpositions: On Nomadic Ethics*, Cambridge and Malden, MA: Polity Press.

Brassett, J. and Marenko, B. (2015), 'Introduction', in B. Marenko and J. Brassett (eds), *Deleuze and Design*, Edinburgh: Edinburgh University Press, pp. 1–30.

Candy, J. (2003), 'Planning learning cities', in P. La Greca (ed.), *Proceedings of the 39th ISoCaRP Congress*, Cairo: International Society of City and Regional Planners, 17–22 October, http://www.isocarp.net/Data/case_studies/251.pdf. Accessed 28 October 2019.

Carayannis, E. and Campbell, D. (2012), *Mode 3 Knowledge Production in Quadruple Helix Innovation Systems*, New York: Springer New York, http://link.springer.com/10.1007/978-1-4614-2062-0. Accessed 28 October 2019.

Celi, M. and Morrison, A. (2017), 'Design and anticipation', in R. Poli (ed.), *The Handbook of Anticipation*, Vienna: Springer, pp. 1–25.

Cope, B. and Kalantzis, M. (2009), '"Multiliteracies": New literacies, new learning', *Pedagogies: An International Journal*, 4:3, pp. 164–95.

——— (eds) (2017), *E-Learning Ecologies*, London: Routledge.

Costandius, E. and Botes, H. (eds) (2018), *Educating Citizen Designers in South Africa*, Cape Town: SUN PreSS.

Cross, A. (1983), 'The educational background to the Bauhaus', *Design Studies*, 4:1, pp. 43–52.

Dubberly, H. (2017), 'Connecting things: Broadening design to include systems, plaforms, and product-service ecologies', in L. Atzmon and P. Boradkar (eds), *Encountering Things: Design and Theories of Things*, London: Bloomsbury, pp. 153–65.

Dvir, R. (2006), 'Knowledge city, seen as a collage of human knowledge moments', in F. Carrilo (ed.), *Knowledge Cities: Approaches, Experiences and Perspectives*, Oxford: Elsevier, pp. 245–72.

Ehn, P. (1998), 'Manifesto for a digital Bauhaus', *Digital Creativity*, 9:4, pp. 207–17.

Eikeland, O. (2013), 'Symbiotic learning systems: Reorganizing and integrating learning efforts and responsibilities between higher educational institutions (HEIs) and work places', *Journal of Knowledge Economy*, 4:1, pp. 98–118.

Erstad, O. and Sefton-Green, J. (2013), *Identity, Community, and Learning Lives in the Digital Age*, Cambridge: Cambridge University Press.

Facer, K. (2011), *Learning Futures: Education, Technology and Social Change*, London: Routledge.

Facer, K. and Buchczyk, M. (2019), 'Towards a research agenda for the "actually existing" learning city', *Oxford Review of Education*, 45:2, pp. 151–67.

Fendler, R. (2013), 'Becoming-learner coordinates for mapping the space and subject of nomadic pedagogy', *Qualitative Inquiry*, 19:10, pp. 786–93.

Findeli, A. (2001), 'Rethinking design education for the 21st century: Theoretical, methodological, and ethical discussion', *Design Issues*, 17:1, pp. 5–17.

Freire, P. (1973), *Education for Critical Consciousness*, London: Continuum.

Friedman, K. (2012), 'Models of design: Envisioning a future design education', *Visible Language*, 46:1&2, pp. 132–53, https://www.questia.com/library/journal/1P3-2684780041/models-of-design-envisioning-a-future-design-education. Accessed 28 October 2019.

Futerman, R. (2015), 'Design for collaboration in South Africa: An activity theory perspective on participatory design', D.Tech. thesis, Cape Town: Cape Peninsula University of Technology, http://etd.cput.ac.za/handle/20.500.11838/2268. Accessed 18 September 2017.

Gee, J. (2008), 'A sociocultural perspective on opportunity to learn', in P. Moss, D. Pullin, J. Gee, E. Haertel and L. Jones Young (eds.), *Assessment, Equity, and Opportunity to Learn*, Cambridge: Cambridge University Press, pp. 76–108.

Gutiérrez, K. D., Engeström, Y. and Sannino, A. (2016), 'Expanding educational research and interventionist methodologies', *Cognition and Instruction*, 34:3, pp. 275–84, https://doi.org/10.1080/07370008.2016.1183347. Accessed 28 October 2019.

Hemmersam, P., Aspen, J., Morrison, A., Sem, I. and Havnør, M. (2015), 'Exploring locative media for cultural mapping', in M. Sheller and A. de Souza e Silva (eds), *Mobility and Locative Media: Mobile Communication in Hybrid Space*, London: Routledge, pp. 167–87.

Hemmersam, P., Harboe, L. and Morrison, A. (2018), 'Building the brief: Developing a place-specific urban practice', in E. Lorentsen and K. Torp (eds), *Formation: Architectural Education in a Nordic Perspective*, Copenhagen: Architectural Publisher B, pp. 200–16.

Hemmersam, P. and Morrison, A. (2016), 'Place mapping: Transect walks in arctic urban landscape', *Spool*, 3:1, pp. 23–36, http://dx.doi.org/10.7480/spool.2016.1.1392.g1514. Accessed 31 October 2019.

Hjorth, L., Horst, H., Galloway, A. and Bell, G. (eds) (2017), *The Routledge Companion to Digital Ethnography*, London and New York: Routledge.

Ingold, T. (2011), *Being Alive: Essays on Movement, Knowledge and Description*, London: Routledge.

Kampevold Larsen, J. and Hemmersam, P. (2018), 'What is the future north', in J. Kampevold Larsen and P. Hemmersam (eds), *Future North: The Changing Arctic Landscapes*, London: Routledge, pp. 3–15.

Kelly, A., Lesh, R. and Baek, J. (eds) (2008), *Handbook of Design Research Methods in Education: Innovations in Science, Technology, Engineering, and Mathematics Learning and Teaching*, New York: Routledge.

Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J. and Wensveen, S. (2011), *Design Research through Practice: From the Lab, Field, and Showroom*, Amsterdam: Elsevier.

Langa, M. (ed.) (2017), *#Hashtag: An Analysis of the #FeesMustFall Movement at South African Universities*, Johannesburg: Centre for the Study of Violence and Reconciliation, https://www.csvr.org.za/pdf/An-analysis-of-the-FeesMustFall-Movement-at-South-African-universities.pdf. Accessed 28 October 2019.

Lave, J. and Wenger, E. (1991), *Situated Learning*, New York: Cambridge University Press.

Lemke, J. (1997), 'Cognition, context, and learning: A social semiotic perspective', in D. Kirshner and J. Whitson (eds), *Situated Cognition: Social, Semiotic, and Psychological Perspectives*, New Jersey: Lawrence Erlbaum Associates, pp. 37–56.

Lim, C. J. (2017), *Inhabitable Infrastructures: Science Fiction or Urban Future?*, Abingdon: Routledge.

Lury, C., Fensham, R., Heller-Nicholas, A., Lammes, S., Last, A., Michal, M. and Uprichard, E. (eds) (2018), *Routledge Handbook of Interdisciplinary Research Methods*, Kindle ed., London Taylor and Francis.

Lury, C. and Wakeford, N. (eds) (2012), *Inventive Methods*, London: Routledge.

McFarlane, C. (2011), *Learning the City: Knowledge and Translocal Assemblage*, Chichester: Wiley-Blackwell.

Meadows, D. (1999), 'Leverage points: Places to intervene in a system', Donella Meadows Institute, http://www.donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/. Accessed 28 October 2019.

Meadows, D. H. (2009), *Thinking in Systems: A Primer* (ed. D. Wright), London: Earthscan.

Mewburn, I. (2010), 'Lost in translation. Reconsidering reflective practice and design studio pedagogy', *Arts and Humanities in Higher Education*, 11:4, pp. 363–79.

Mezirow, J. (1991), *Transformative Dimensions of Adult Learning*, San Francisco, CA: Jossey-Bass.

Miller, R. (2007), 'Futures literacy: A hybrid strategic scenario method', *Futures*, 39:4, pp. 341–62.

——— (ed.) (2018), *Transforming the Future. Anticipation in the 21st Century*, Paris and Abingdon: UNESCO and Routledge.

Morrison, A. (2017a), 'Future north, nuture forth: Design fiction, anticipation and Arctic futures', in J. Kampevold Larsen and P. Hemmersam (eds), *Future North: The Changing Arctic Landscapes*, London: Routledge, pp. 119–43.

——— (2017b), 'Design fiction in design education: Urbanism, para-pedagogy and futures literacies', in C. Kung, E. Lamb and Y. Lee (eds), Open Design for E-very-thing. Proceedings of CUMULUS Hong Kong 2016, 21–24 November, pp. 105–112, http://www.cumulusassociation.org/cumulus-working-papers-3316-cumulus-hong-kong-2016-open-design-for-e-very-thing/. Accessed 24 October 2019.

Morrison, A. and Aspen, J. (2013), 'Building appetites: The design of locative media apps for learning the networked city', in J. Reitan, P. Loyd, E. Bohemia, L.-M Nielsen, I. Digarnes and E. Lutnæs (eds), *Proceedings of DRS / CUMULUS 2013 Oslo: The 2nd International Conference for Design Education Researchers*, vol. 2, Oslo: HiOA, 14–15 May, pp. 1040–58, https://www.academia.edu/8995210/Design_Education_from_Kindergarten_to_PhD_Design_Learning_for_Tomorrow_Proceedings_of_the_2nd_International_Conference_for_Design_Education_Researchers_Vol._1. Accessed 24 October 2019.

Morrison, A., Aspen, J. and Westvang, E. (2013), 'Making the mobile and networked city visible by design', *Proceedings of Crafting the Future, 10th European Academy of Design Conference*, Gothenburg: HDK, 17–19 April, http://www.craftingthefuture.se. Accessed 24 October 2019.

Morrison, A., Erstad, O., Liestøl, G., Pinfold, N., Snaddon, B., Hemmersam, P. and Grant Broom, A. (2019a), 'Investigating agentive urban learning: An assembly of situated experiences for sustainable futures', *Oxford Journal of Education*, 45:2, pp. 204–23.

Morrison, A., Mainsah, H. and Rygh, K. (2019b), 'Sharp edges, blunt objects, clean slices. Exploring design research methods', in L. Valentine, J. Bletcher and L. Cruickshank (eds), position paper presented at *13th International Conference of the European Academy of Design*, '*Running with Scissors*', Dundee: University of Dundee, 10–12 April, https://www.tandfonline.com/doi/abs/10.1080/14606925.2019.1598132. Accessed 24 October 2019

O'Sullivan, S. (2001), 'THE AESTHETICS OF AFFECT: Thinking art beyond representation', *Angelaki*, 6:3, pp. 125–35, https://doi.org/10.1080/09697250120087987. Accessed 28 October 2019.

Painter, A. and Shafique, A. (2017), *Cities of Learning in the U.K.*, London: RSA.

Rudd, T., Gifford, C., Morrison, J. and Facer, K. (2006), *Futurelab: What if...? Re-Imagining Learning Spaces*, https://telearn.archives-ouvertes.fr/file/index/docid/190334/filename/rudd-2006-Learning_Spaces.pdf. Accessed 28 October 2019.

Salama, A. (2009), *Transformative Pedagogy in Architecture and Urbanism*, Solingen: UMBAU Forlag.

Sanders, E. and Stappers, P. (2008), 'Co-creation and the new landscapes of design', *Codesign*, 4:1, pp. 5–18.

Schön, D. A. (1983), *The Reflective Practitioner: How Professionals Think in Action*, New York: Basic Books.

Sheridan, M. and Rowsell, J. (2010), *Design Literacies*, London: Routledge.

Shrank, A. (2006), 'Case studies: Case-based research', in E. Perecman and S. Curran (eds.), *A Handbook for Social Science Field Research: Essays & Bibliographic Sources on Research Design and Methods*, London: Sage, pp. 21–38.

Snaddon, B. and Chisin, A. (2017), 'Futures oriented design pedagogy: Performing a space of powerful possibility', *Proceedings of NORDES 2017 Design + Power*, Oslo, AHO, Norway, 15–17 June, http://www.nordes.org/. Accessed 5 May 2019.

Snaddon, B., Morrison, A. and Grant Broom, A. (2017), 'Learning spaces for sustainable futures: Encounters between design and rhetoric in shaping nomadic pedagogy', *Kairos*, 22:1, http://kairos.technorhetoric.net/22.1/topoi/snaddon-et-al/index.html?path=contexts/cape-town.html. Accessed 28 October 2019.

Stake, R. (1995), *The Art of Case Study Research*, Thousand Oaks, CA: Sage.

Stappers, P. and Giaccardi, E. (2017), 'Research through design', in P. Stappers and E. Giaccardi (eds), *The Encyclopedia of Human-Computer Interaction*, 2nd ed., Hershey, PA: Idea Group Reference, pp. 1–94.

Swanborn, P. (2010), *Case Study Research. What, Why and How?*, London: Sage.

Wenger, E. (1998), *Communities of Practice: Learning, Meaning, and Identity*, Cambridge: Cambridge University Press.

Wertsch, J. (1998), *Mind as Action*, New York: Oxford University Press.

Wilkie, A., Savransky, M. and Rosengarten, M. (eds.) (2017), *Speculative Research: The Lure of Possible Futures*, London: Taylor & Francis.

SUGGESTED CITATION

Snaddon, B., Morrison, A., Hemmersam, P., Grant Broom, A. and Erstad, O. (2019), 'Investigating design-based learning ecologies', *Artifact: Journal of Design Practice*, 6:1&2, pp. 2.1–2.30, doi: 10.1386/art_00002_1

CONTRIBUTOR DETAILS

Bruce Snaddon is a senior design lecturer and researcher at the Cape Peninsula University of Technology, has an M.Phil. Education (UCT), and is currently a Ph.D. fellow at the Oslo School of Architecture and Design. His research interest includes transformative design pedagogy that addresses sustainable design futures. He has recently published on the dynamics of experimental off-campus learning spaces that enable dispositional shifts and eco-literacies in design students.

Contact: Design Department, Faculty Informatics & Design, PO Box 652, Cape Town 8000, South Africa.
E-mail: snaddonb@cput.ac.za

https://orcid.org/0000-0003-1775-5058

Prof. Andrew Morrison, Director of the Centre for Design Research at (AHO), leads design research projects on Communication and Interaction Design, collaborating on service, systems and product design. He works on design writing, fiction and criticism, and design and technology critiques. His recent books are *Inside multimodal composition* (Hampton Press, 2010) and *Exploring digital design* (Springer, 2010). He was co-chair of the *Design+ Power NORDES 2017 Conference* and Chair of the *2019 Anticipation Conference*. Also he led the *AHO Research Review 2014-2017*.

Contact: Institute for Design, Oslo School of Architecture and Design (AHO), Maridalsveien 29, 0175 Oslo, Norway.
E-mail: andrew.morrison@aho.no

Prof. Peter Hemmersam is an architect who leads the Oslo Centre for Urban and Landscape Studies. His research interests include city centre retail design and place-making, digital cities, periurban landscapes, and Arctic urbanism and landscapes. Ongoing research includes the project Displacement, Placemaking and Wellbeing in the City and a book on Arctic urbanism. Recent publications include *Future North: The Changing Arctic Landscapes* (Routledge, 2018).

Contact: Institute for Urbanism and Landscape, Oslo School of Architecture and Design (AHO), Maridalsveien 29, 0175 Oslo, Norway.
E-mail: peter.hemmersam@aho.no

https://orcid.org/0000-0002-0483-8869

Andrea Grant-Broom is an independent design consultant and educator who has a background in art direction, communication strategy and new product development. With twenty years as a communication design educator at the Faculty of Informatics & Design at the Cape Peninsula University of Technology, her great interest is in creating and facilitating design-in-practice learning environments which often include biomimetic methodology.

Contact: 8 Basil Road, Plumstead, Cape Town 7801, South Africa.
E-mail: andrea.broom@gmail.com

Prof. Ola Erstad, Head of Department of Education, focuses on digital literacy in social and cultural contexts of learning beyond the technological, especially with children and youth. He is vice-chair of COST Action, board member of several international journals, and elected Chair of the Scientific Advisory Committee of Science Europe. His recent publications are *Learning Identities, Education and Community* (Erstad Gilje, and Sefton-Green, CUP, 2016), and *Learning beyond the School* (Routledge, 2019).

Contact: Department of Education, Postbox 1092 Blindern, 0317 Oslo, Norway.
E-mail: ola.erstad@iped.uio.no

PUBLICATION 5
DESIGN PEDAGOGY FOR SUSTAINABILITY: DEVELOPING QUALITIES OF TRANSFORMATIVE AGENTIVE LEARNING

Snaddon, B. (2019). Design pedagogy for sustainability: developing qualities of transformative agentive learning. Paper presented at *Designing Sustainability for All. LeNS World Distributed Conference*, Cape Town, South Africa, 3–5 April, 2019.
Available at: http://www.lensconference3.org/images/program/VOLUME4.pdf

Design pedagogy for sustainability: developing qualities of transformative agentive learning.

First Author

Bruce Snaddon

Design Department
Faculty of Informatics and Design
Cape Peninsula University of Technology
District 6 Campus
Box 652, Cape Town,
8000 South Africa

Senior Lecturer
snaddonb@cput.ac.za

ABSTRACT: For design educators who are developing students readiness as sustainably aware design practitioners, it remains a challenge to create meaningfully transformative learning experiences. We contend that, in tackling this challenge, it is key for design educators to develop compelling pedagogy where students experience their evolving agentive selves in relation to wider systemic relationships. To explore this we examine a project case where Biomimicry was introduced to complement a pilot course promoting a Sustainable Product Service System (S.PSS) view and tools. The question framing this research paper is: What are the qualities of an ecologically immersive pedagogy that is productive of sustainable design dispositions in students? By connecting social learning theory and design for sustainability, we draw together concepts of learning ecologies, and agentive learning. Conducted as participatory action research, the qualitative inquiry process reveals how pivotal learning moments were found to have cultivated attributes of resilience, performative adaptability, and relational awareness.

Key Words: Sustainable design pedagogy, learning ecologies, agentive learning, Biomimicry, S.PSS.

1. INTRODUCTION AND BACKGROUND

This paper reflects the efforts of five design educators in the Cape Peninsula University of Technology (CPUT) in developing pedagogy and curriculum over a five-year period that prepares design students for a world urgently in need of sustainable design practitioners. Against this backdrop we argue for compelling design pedagogy that seeks to enable authentic ontological shifts in a student's sense of self and emergent designing agency in relation to wider human and non-human ecologies (e.g. Snaddon et al., 2017). Bringing about transformative learning experiences for students is the challenge for all educators, but in empowering young designers to move beyond dominant unsustainable anthropocentric habits in designing, this challenge is one of paradigm shift. This requires inventive thinking, practice and methods not commonly found in many design programmes. In our experience such approaches need to expand beyond didactic skills-based agendas to emphasise pedagogy that enables agentive, experiential learning that is transformative for a learning subject. An important aspect of this is situating students' experiential learning within new sites for pedagogy where they are exposed to 'community realities' (Taylor & Fransman, 2004) as a means of locating "individual action within the broader context of its consequences" (Sachdev, 2014, p. 438). In this paper we explore how students negotiate learning as agentive subjects moving across disciplinary, social, environmental and personal learning thresholds.

To do this we present the conceptual framings informing these perspectives, followed by the methodology we have used in provoking the above learning and resultant dispositions. Next we report on learning within a project case as prompt for our analysis and close with a discussion and a set of propositions for what constitutes the qualities of an ecologically immersive pedagogy for sustainable design.

2. THEORY AND CONCEPTUAL FRAMINGS

In adopting a sociocultural perspective on situated and experiential learning (Lave & Wenger, 1991; Leander et al*.,* 2010; Freire, 2015; Shreeve, 2016) we acknowledge processes of learning as not only contained in individual minds but distributed across and mediated by people, tools, language, and learning environments (Leander et al., 2010). The question of the relationship "between an individual with both a mind and a body and an environment in which the individual thinks, feels, acts, and interacts" (Gee, 2008, p.81) is a prompt for design educators to explore potential learning spaces and places that are relationaly agentive. Agency so understood extends beyond localisation within individuals and is considerate of agentive entanglements (Haraway, 2016) that widen a nascent designers relational awareness of self in a wider systems view. To this point, Mathews argues that we as humans are "enmeshed unavoidably in ecological relations with other species and with the biosphere at large" (2011, p. 5). In a previous LeNSes conference, Narayanan (2010) has questioned the conventional starting points in design education for sustainability, and argued for initiating with an "integrated and holistic development of consciousness as core to a new form of design thinking – one that grounds autonomy, experience and agency" (p. 19). Sachdev (2014), also based at the Shrishti School of Art Design and Technology further develops

Narayanans pedagogical approach of combining "being with doing and creating capacities for ways of knowing, sensing and seeing our world" (p. 423). He argues for pedagogy that carefully considers "how we interact within the larger dynamic of participation and consequence of actions" (p. 439).

In terms of design pedagogy, these are important concepts for framing critical inquiry into transformative learning spaces that "forge participation in the times and spaces of relationality between inside and outside" (Ellsworth, 2005, p. 46) as students negotiate self in relation to others. Furthermore, Jackson (2013) develops the concept of an individuals 'learning ecology' comprising "their process and set of contexts and interactions that provides them with opportunities and resources for learning, development and achievement." Importantly for the concept of learning ecologies, Jackson cites Lemke's (2000) argument that for learning processes "each step along a developmental trajectory changes the way the system interacts with its environment at the next step" (p. 284). These are supportive views for design pedagogy that is reflexive and responsive to how meaning is made within an 'eco-social systems view' where a "developing person engages in socially meaningful interactions with others and with the non-human surround" (Lemke, 2000, p. 283).

2.1. Methodology and research methods

The paradigm of inquiry is primarily constructivist while leaning towards advocacy and participatory approaches. We adopt the roles of participatory action researchers within a practice-based action agenda for transitioning curricular and pedagogical reform (Creswell, 2003; Denzin, 2017). That is, we planned and enacted our pedagogy and then through qualitative inquiry methods of participant observation during the coursework, and semi-structured post-project interviews we have been able examine and lift up nuanced understanding of emergent learning dispositions. In addition, we draw on survey data contained in the independent observers report which is a mandatory element of a pilot LeNSes course. These methods all contribute to a multivocal and dialoguing approach (Tracy, 2010) and generate a rich contextualisation and recounting of learning experience.

3. CASE STUDY: LEARNING TO DESIGN LIKE AN ECOSYSTEM

The pilot project ran over a period of eight weeks alongside regular coursework as part of CPUT's Industrial Design departments fulfillment of its mission as a member of the LeNSes partnership to integrate S.PSS tools into a curriculated trans-disciplinary course, the first of which dealt with renewable energy alternatives. The challenge was to develop alternative strategies for enabling access to energy for under-developed areas in Cape Town. The student and staff group comprised five educators and 30 undergraduate level students in the Industrial Design and Mechanical Engineering Departments at CPUT. Consent has been given by students for interviews and material generated by the project to be used in this study.

In addressing local challenges of socio-material change in relation to a wider context of complex ecosystems, the methodology and tools of S.PSS[1] and Biomimicry[2] were used. In this way, the pedagogical approach and ethos of Biomimicry was introduced to draw students' social ecologies into closer proximity with local natural ecology. By immersing the group in a natural setting, students were exposed to alternative solutions for energy production based on their observations. After this exploratory phase, a process of abstracting design principles from observed natural strategies followed. The Life's Principles[3] checklist, in conjunction with other biomimetic design tools were used in a series of exercises. This enabled students to explore possibilities for innovative product design by first understanding existing energy systems currently used in rural, peri-urban and urban social contexts, and then to assess the potential for adaptation according to efficient energy systems prevalent in nature. Students then established a relationship with a local community partner to map the existing socioeconomic and environmental context using S.PSS methods. The final outcome was a conceptual product prototype designed using an S.PSS view and tools, achieved through a process of engagement with deep social and environmental sustainability as a benchmark.

A comprehensive analysis of the project outcomes are beyond the scope and topic of this short paper and so we focus now on learning brought about through the inclusion of biomimetic pedagogy, and how students navigated their experience of this approach as a meaningful starting point for sustainability education.

---

[1] Sustainable Product-Service Systems (S.PSS) is a promising model to couple environmental protection with social equity, cohesion and economic prosperity in different contexts around the world (LeNSin Project, n.d.).

[2] Biomimicry is the conscious emulation of tried and tested strategies found in nature to develop sustainable solutions to human challenges (Benyus, 2002).

[3] Life's Principles are drawn from overarching patterns and strategies evident among species thriving on earth. By learning from these deep design lessons that have evolved over 3.8 billion years, students can model innovative strategies, measure their designs against these sustainable benchmarks and be "mentored by natures genius using Life's Principles as… aspirational ideals" (DesignLens: Life's Principles, 2016).

3.1.1 Suspension and inspiration

Our project work commenced with a detailed overview of Biomimcry, its methodology and methods along with inspirational examples of the use of this approach in various disciplinary domains ranging from healthcare to architecture and product design. We then shifted our studio to the biodiverse Kirstenbosch Botanical Gardens to intitiate the first phase of scoping and discovering, which would prove to be a key step in expanding ecological awareness that would enable students to sense and see the world differently. As students learned, with assistance from a biologist, about the strategies evolved by local fauna and flora to sustain life over billions of years, they entered "unfamiliar territory, in a process of discovery" (Fendler, 2013, p. 787). One student commented on how this phase levelled hierarchies often prevalent in the studio: "When you are taken out of the class environment and into nature you let all of that drop… everything is new to you, everyone is on the same level". In being introduced to a new language of how natural systems work and 'quieting' their designing cleverness, an egalitarian trans-disciplinary space was opened up. In one students words, "It was like first year all over again, you felt uncomfortable because everything was new". Students learnt how to suspend their usual competitive rush for task completion, listen to each other and also widen their view of where inspiration might come from. This would be a significant move towards seeing nature as mentor, as an immense resource for modelling, and as an existing measure for sustainable solutions.

3.1.2 Application and evaluation

A second phase challenged students to apply their new learning in a designerly way involving two exercises known as 'Design to Biology' and 'Biology to Design'. In the latter exercise, drawing on deeply observed biology and selected natural 'champions' would later move students to consider how evolved symbiotic processes can inspire design solutions[4]. For example, observing a Strelitzia flowers 'valve' petal which acts as a perch for a bird pollinator by releasing pollen due to its weight, inspired one group of students to later emulate this valve release action in a design concept for a biogas stove. Gas only flows with the weight of a pot, thereby preventing fire if knocked over.

[Figure 1] Close observation of a biological 'champion' coupled with the S.PSS mapping tool enabled this student group to address the socio-economic and environmental challenges within a particular peri-urban community context. Images: Andrea Grant Broom.

Student reflections on their experience go beyond the strictly procedural and highlight interesting threshold crossing moments where socially meaningful learning ecologies were forming. Some commented on the confidence gained as their groups community of practice started functioning like an ecosystem, where unexpected resources were shared and the groups interdependence ensured that no member would be left behind as progress was made. One student reflected that Biomimicry was a catalyst for her creative process and that along with "dreaming and motivation helped her come up with wild ideas for real world problems". Another confided that, being such a turning point in her young design career, she would find it difficult to go back to previous ways of thinking and working. Others commented that even though they were bewildered and scared by the complexity of working beyond their disciplines, they found motivation and confidence in how the evaluative Life's Principles

[4] Students used the AskNature website to explore a library of biological strategies that have been mapped to design challenges (AskNature, 2018).

tools could support their creative imaginings and the viable sustainability of their designs. “It was a dramatic performance as we shared ideas” said one student as she described a sense of euphoria in her group as they explored an expanded space for design possibilities. In summing up her experience one student said, “It made you think critically about things you wouldn’t normally consider, it gave me the chance to think like a different type of designer”. These reflections give some indication of transitioning steps towards trans-disciplinary thinking where students were able to move beyond habitual and siloed practices.

4. DISCUSSION AND CONCLUSION

We have briefly shown in descriptions of the case above and through reflective comments how the intensive and sometimes uncertain process yielded valuable experience in becoming self-regulated learners capable of handling risk and ambiguity (Edwards, 2014, p. 25). Educators involved in planning, coordinating and running this pilot course reflected that the Biomimicry methodology/tools and the S.PSS method/tools shared similarity in both having a systems thinking approach, while each brought different strengths i.e. a Biomimicry focus on the ecological and S.PSS focus on tools for economic and socio-political aspects of design for sustainability. Even though logistics prevented an extended immersive phase commonly used in biomimetic pedagogical approaches, the survey and interview data showed that students responded more positively to the experiential pedagogy than the S.PSS taught method which was handled in a lecture format in studio on campus. The early beta version of the LeNSes website also contributed as a barrier for students trying to engage with the material. The biomimetic approach was inspirational for them enabling them to ‘own’ their learning in a socially and ecologically mediated process. They learnt that ‘sustainability’ means deep consideration of designing agency within planetary limits and boundaries, and that Life’s Principles may be relied upon as a set of pinciples that can complement the S.PSS approach and add a deeper ecologically sensitive dimension to the analytical toolkit.

We now present an overall framing of what we call the qualities that are core to ecologically immersive pedagogy. These qualities are interdependent and individually significant as they collectively describe learning experience that is transformative of design dispositions relevant to complex contexts. Moreover, these qualities are seen as unfold*ing* and about do*ing* pedagogy with students that activates the present and empowers “a situation with capacity to provoke new relations”, co-creating a space where students can be in the presence of emergent values and their consequences (Tironi, 2018, Chapter 5, Section 3, para. 2). These qualities comprise:

Opening – spaces for suspending and deterritorialising in a spatio-temporal move away from anthropocentric environments. Thinking–feeling in a non-threatening trans-disciplinary mode encourages local attunement and noticing of what is already thriving in a real-world project context, socially and ecologically.
Becoming – affording design students opportunity to build their own learning ecologies through critically expanding their current knowledge (episteme) of sustainability through immersive being (ontology) in close proximity with living ecologies.
(Re)connecting – remembering that we are part of nature and not as disentangled from other species as we have come to believe (Mbembe, 2016). This is an ethical move that enables design students to operate with conviction and shared agency “within a wider realm of care” (Sachdev, 2014, p. 437). In this way students perform a move away from ego towards becoming ecosocially aware of their designing agency.
Integrating – by integrating the unexpected and being open to more than one narrative, cooperative relationships may be recognised and cultivated that enrich the design process. This includes a pedagogy of integration that draws together knowing, being and doing in ways that have the “ideals of social and ecological justice as its basis” (Sachdev, 2014, p. 423).
Emulating – enactive emulation (rather than appropriation or extraction) of natural strategies (rather than resources) through a process of learning with nature as model, mentor and measure, effects respectful design that is better suited to thriving futures for all.
Measuring – by evaluating creatively innovative design possibilities against a set of living principles, motivation and confidence to challenge the unsustainable status quo may be cultivated in young designers.

In conclusion, by reading this case through the literature; our position is that immersive, situated design pedagogy that is enacted with our students produces pivotal moments during the learning process which have been found to have been effective in transforming students’ dispositions, cultivating attributes of thoughtfulness, self-awareness, resilience, adaptability, and shared agency. These are moments that effectively enable design students to understand and more confidently create their social learning ecologies through collaborative interactions with their design peers, other disciplines, local communities and natural ecologies. These pivotal learning moments

are consistent with the skills and agency desired for knowing how to be sustainable designers in a rapidly transitioning world.

Cape Town's particular socio-economic and political complexity, together with its biodiverse natural environment provides a rich landscape within which we as educators are able to draw on and dynamically situate our pedagogy. In this paper we hope that in sharing this experimental pedagogical approach in the spirit and ethos of the LeNSes network, that we are contributing to and learning from a diversity of place-based methodological approaches that are unique to different parts of the world. In this way we can continue to develop the concept of ecologies for learning where the network learns as an ecosystem does.

REFERENCES

AskNature. (2018). Retrieved from https://asknature.org/

Benyus, J. (2002). *Biomimicry: Innovation Inspired by Nature*. New York: Harper Collins.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (2nd ed.). London: SAGE.

Denzin, N. (2017). Critical Qualitative Inquiry. *Qualitative Inquiry*, *23*(1), 8–16. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/1077800416681864

DesignLens: Life's Principles. (2016). Biomimicry 3.8. Retrieved from https://biomimicry.net/the-buzz/resources/designlens-lifes-principles/

Edwards, A. (2014). Designing Tasks which Engage Learners with Knowledge. In I. Thompson (Ed), *Task Design, Subject Pedagogy and Student Engagement* (pp. 13-27). London: Routledge.

Ellsworth, E. (2005). *Places of Learning: Media, Architecture, Pedagogy*. New York: Routledge.

Fendler, R. (2013). Becoming-learner: Coordinates for mapping the space and subject of nomadic pedagogy. *Qualitative Inquiry*, *19*(10), 786–793. Retrieved from http://journals.sagepub.com/doi/abs/10.1177/1077800413503797

Freire, P. (2015). *Pedagogy of Hope: Reliving Pedagogy of the Oppressed*. 30th anniversary edition. London: Bloomsbury.

Gee, J. P. (2008). A Sociocultural Perspective on Opportunity to Learn. In P. A. Moss, D. C. Pullin, J. P. Gee, E. H. Haertel, & L. J. Young (Eds.), *Assessment, Equity, and Opportunity to Learn* (pp. 17–41). Cambridge: Cambridge University Press. Retrieved from http://ebooks.cambridge.org/ref/id/CBO9780511802157A013

Haraway, D. J. (2016). *Staying with the trouble: making kin in the Chthulucene*. Durham: Duke University Press.

Jackson, N. J. (2013). The Concept of Learning Ecologies. In *Lifewide Learning, Education & Personal Development e-book Chapter A5.* Retrieved from http://www.lifewideebook.co.uk/uploads/1/0/8/4/10842717/chapter_a5.pdf

Lave, J., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. New York, NY: Cambridge University Press.

Leander, K. M., Phillips, N. C., & Taylor, K. H. (2010). The Changing Social Spaces of Learning: Mapping New Mobilities. *Review of Research in Education*, *34*(1), 329–394. Retrieved from https://doi.org/10.3102/0091732X09358129

Lemke, J. L. (2000). Across the Scales of Time: Artifacts, Activities, and Meanings in Ecosocial Systems. *Mind, Culture, and Activity*, *7*(4), 273–290. Retrieved from https://doi.org/10.1207/S15327884MCA0704_03

LeNSin Project. (n.d.). LeNS Learning Network on Sustainability international. Retrieved from https://www.lens-international.org/about

Mathews, F. (2011). Towards a Deeper Philosophy of Biomimicry. *Organization & Environment*. Retrieved from https://doi.org/10.1177/1086026611425689

Mbembe, A. (2016). Decolonizing knowledge and the question of the archive. Keynote address, Combined Conference of ICED and HELTASA: Ethics, Care and Quality in Educational Development, Cape Town, 22–25 November. Retrieved from https://www.youtube.com/watch?v=qLEEEyn4Hi0

Narayanan, G. (2010). Enactive Design. In *LeNS Conference, Bangalore, India* (Vol. 1, pp. 19–24). Bangalore, India: Greenleaf Publishing. Retrieved from www.lens.polimi.it

Sachdev, G. (2014). New ways of educating Articulating experience. In *Product-Service System Design for Sustainability* (pp. 422–440). Greenleaf Publishing. Retrieved from https://www.researchgate.net/publication/260831608_Product-Service_System_Design_for_Sustainability

Shreeve, A. (2016). Signature pedagogies in design, in M. Tovey [Ed.] *Design Pedagogy: Developments in Art and Design Education* (pp. 83-92). Abingdon: Routledge.

Snaddon, B., Morrison, A., & Grant Broom, A. (2017). Learning Spaces for Sustainable Futures: Encounters between design and rhetoric in shaping nomadic pedagogy. *Kairos A Journal of Rhetoric, Technology, and Pedagogy*. 22(1). Retrieved from http://kairos.technorhetoric.net/22.1/topoi/snaddon-et-al/index.html

Taylor, P., & Fransman, J. (2004). *Learning and teaching participation: exploring the role of higher learning institutions as agents of development and social change*. Brighton: Institute of Development Studies.

Tironi, M. (2018). Dissenting. In C. Lury, R. Fensham, A. Heller-Nicholas, S. Lammes, A. Last, M. Michael & E. Uprichard (Eds.), *Routledge Handbook of Interdisciplinary Research Methods*. [Kindle DX version]. Retrieved from Amazon.com

Tracy, S. J. (2010). Qualitative Quality: Eight "Big-Tent" Criteria for Excellent Qualitative Research. *Qualitative Inquiry*, *16*(10), 837–851. Retrieved from https://doi.org/10.1177/1077800410383121

Bruce Randal Angus Snaddon

LEARNING FOR FUTURE KNOWING NOW

Design educators working in higher education institutions face the enduring challenge of translating creative design practice into pedagogy and curricula that prepare students for entry into the world of work. This not only entails keeping up with current modes of designing but also requires critical attention to how the practice and discipline of designing, with its material and increasingly immaterial outcomes, are shaping and being shaped by a complex and connected world.

Design courses need flexible curricula and dynamic pedagogical approaches to address and respond to such flux, the changing needs of society and, importantly, the question of design and its relation to sustainability and the current climate crisis.

In this thesis, I take up the question of how design educators can actively explore different approaches to design pedagogy that might enable a transition for design education towards long-term sustainability. Such transition includes a critical review of how and where design learning might be carried out, so as to break with hegemonic orthodoxies in design practice, its education, and in broader society. This thesis is a practice-based inquiry into the need to shape design curricular and pedagogical activities to meet future work and professional practice as well as the burgeoning fields of design for sustainability and social innovation in an unsustainable world.

The main contribution of this study is a pedagogical framework that comprises a set of mutually reinforcing modalities and navigational principles for design education in a transitioning reorientation towards long-term sustainable design practice.

Bruce Snaddon is a Senior Lecturer teaching Communication Design at graduate and under-graduate levels in the department of Applied Design, within the Faculty of Informatics and Design at the Cape Peninsula University of Technology. He has 25 years' experience within this environment and has worked with colleagues to evolve curricula and pedagogy that are awake and relevant to world change. He holds an MPhil in Education (University of Cape Town, 2006) with research interests in phenomenological approaches to teaching and learning in design education.

ISBN 978-82-547-0331-1
ISSN 1502-217X

PhD thesis 102