TOWARDS DESIGN-BUILD ARCHITECTURAL EDUCATION AND PRACTICE

EXPLORING LESSONS FROM EDUCATIONAL DESIGN-BUILD PROJECTS

Hermie Elizabeth Delport

Thesis submitted in fulfilment of the requirements for the degree
Doctor of Technology: Architectural Technology
in the Faculty of Informatics and Design
at the Cape Peninsula University of Technology

Supervisor: Prof Johannes Cronjé
May 2016

DECLARATION

I, Hermie Elizabeth Delport, declare that the contents of this thesis represent my own work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed   Date

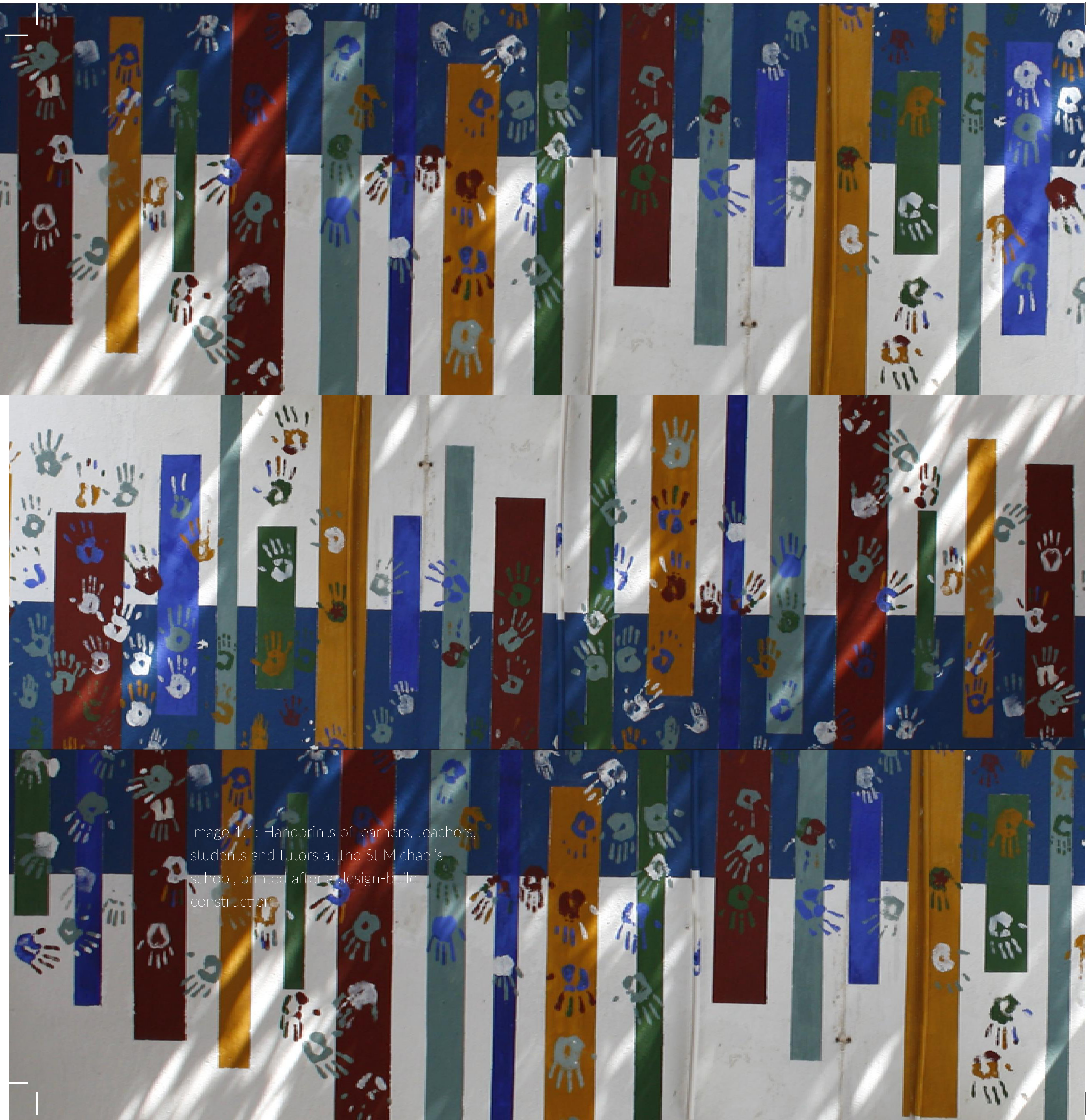


Image 1.1: Handprints of learners, teachers, students and tutors at the St Michael's school, printed after a design-build construction

ACKNOWLEDGEMENTS

I wish to thank:

My children, Jannis and Kristo, for their absolute patience.

My partner, Jan, for his wonderful support.

My parents, Koosie and Marietjie, for reading, referencing, listening, sustaining.

My graphic editor, Marcel, for assisting and enduring.

My editor, Wilna, for help and humour.

My construction partner, Rudolf, for confidence and labour.

My colleague Jolanda, for conceptualising on-site and on-line.

My supervisor, Johannes, for persistence and wisdom.

All my wonderful friends and colleagues, for advice, mentorship and comforting encouragement.

The financial assistance of the National Research Foundation towards this research is acknowledged. Opinions expressed in this thesis and the conclusions arrived at, are those of the author, and are not necessarily to be attributed to the National Research Foundation.

For we may soon find that we have too many architects skilled at designing museums and mansions and too few able to work with indigent people and communities in need of basic housing, sanitation, and security.

(Fisher in Bell & Wakeford, 2008: 10)

PROLOGUE

In the not too distant future I see an architectural student who has just graduated and is about to enter the architectural profession. This soon-to-be architect knows how to engage meaningfully with a community, how to collaboratively generate solutions, how to manage a project from inception to completion, how to physically contribute to the making of the building, how to sustainably implement technology, where to find funding, how to set up an entrepreneurial business, and that the future of her country depends on her actions. She wants to pursue a career in public architecture, both the building of the community and building for the community. She is ready to make a difference in the lives of those who, under normal circumstances, cannot afford her architectural services. She knows she cannot just sit and wait, but has to go out and get started.

ABSTRACT

This research explores design-build projects in architectural education. The design-build studio is an alternative to the conventional theory-oriented studio. In design-build projects students both design and build real buildings. Internationally, design-build projects have increased rapidly in architectural programmes over the past decade. Literature suggests that design-build projects are relevant for architectural education, but that there is a definite need for more theoretical and critical exploration.

Design-build projects in the context of this study are defined as socially responsive, inhabitable, full-scale investigations. The value of this pedagogical construct for educators, students, architectural practice and society in general was an underpinning theme guiding this exploration.

Design-build projects are located on the boundary between theory and practice. This research provides a view into my journey across this boundary, immersing myself in both the theoretical and practical. Principles of the design-build process and design research mapped the research path. The research process commenced with the initiation of and active participation in a number of design-build constructions. Through critical reflection on the construction experiences and the literature, specific pedagogical and practice implications were explored. Cultural historical activity theory provided me with a sense of theoretical direction in this journey.

Collaboration as a pedagogical tool and the possibility of exposing students to alternative practice possibilities were foregrounded as being uniquely situated within the design-build project. The value of this research is the contribution it makes to the current international call for a clearer understanding of the pedagogical and practice merit of design-build projects.

[1]The researcher is situated within a Department of Architectural Technology at a university of technology, but uses the term architectural education throughout, as internationally it refers more generally to architectural education in traditional as well as in technical universities.

Image 1.2: Author assisting learner to make a handprint at the St Michael's 1 design-build construction handover ceremony

HOW TO READ THIS DOCUMENT

This research explores design-build projects in architectural education. The organisation of the physical thesis document reflects the design of the research and is depicted in Figures 1.1, 1.2 and 1.3. Five main chapters are presented. The document can be read from start to finish, or the reader can construct their experience by first reading the threshold situated between Chapters 3 and 4. The threshold involves both reflection and rationale: a presentation of what has gone before and of what comes next. Before the threshold one finds the foundation for the research, a blueprint for the research design, process and methodology, and a literature study that locates the research. After the threshold there are three explorative windows. These windows open onto collaboration as a unique educational opportunity in design-build projects and onto the link between design-build architectural education and professional design-build practice.

The graphic development of this document was part of the research process. As the word design-build indicates, design-build projects deal with both designing and building, crossing a boundary that often exists in conventional architectural education. Design-build projects are located at several boundaries in the architectural landscape. Just as the threshold became a boundary in the research process and the research document, so the graphic layout of the physical document has been developed around a midpoint boundary. This midpoint boundary runs horizontally throughout the document. This boundary informed the development of the overall layout and the development of the graphics. The graphic boundary is visually prominent, and conceptually linked to the content.

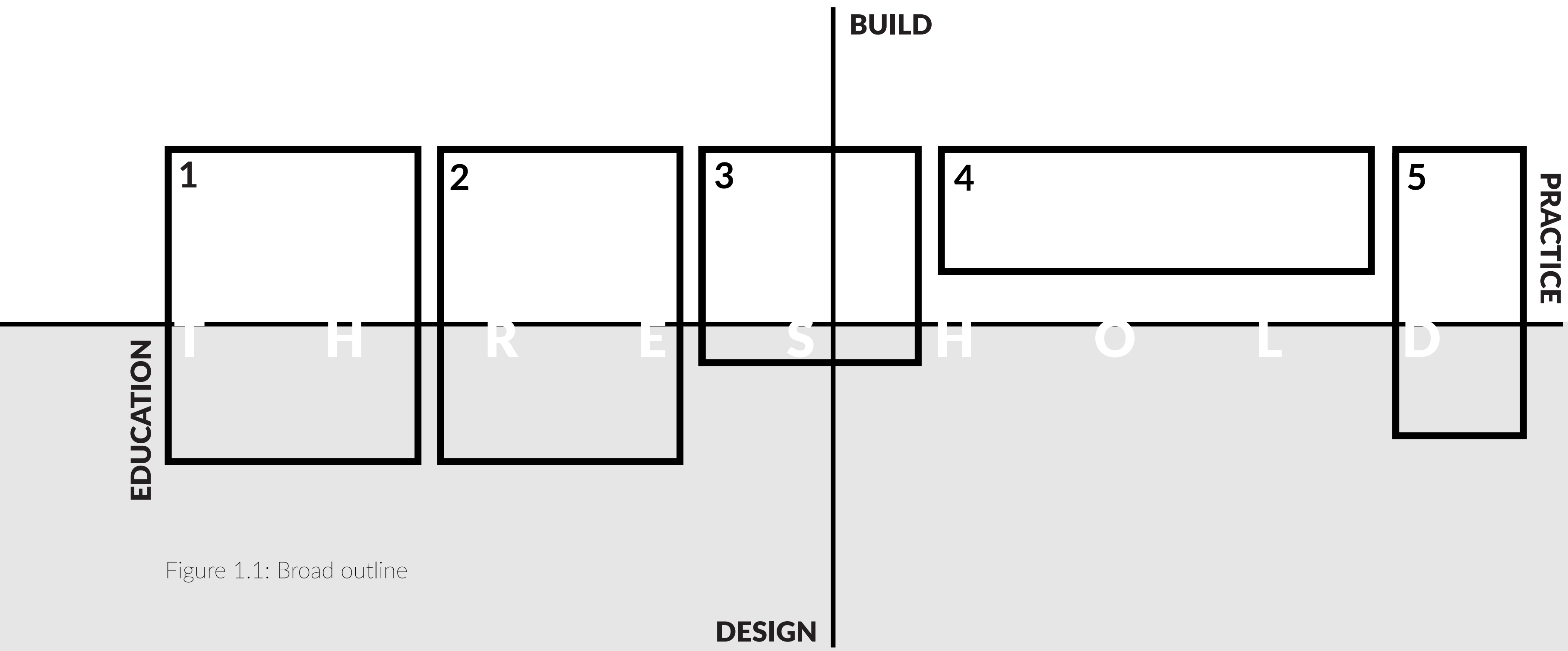


Figure 1.1: Broad outline

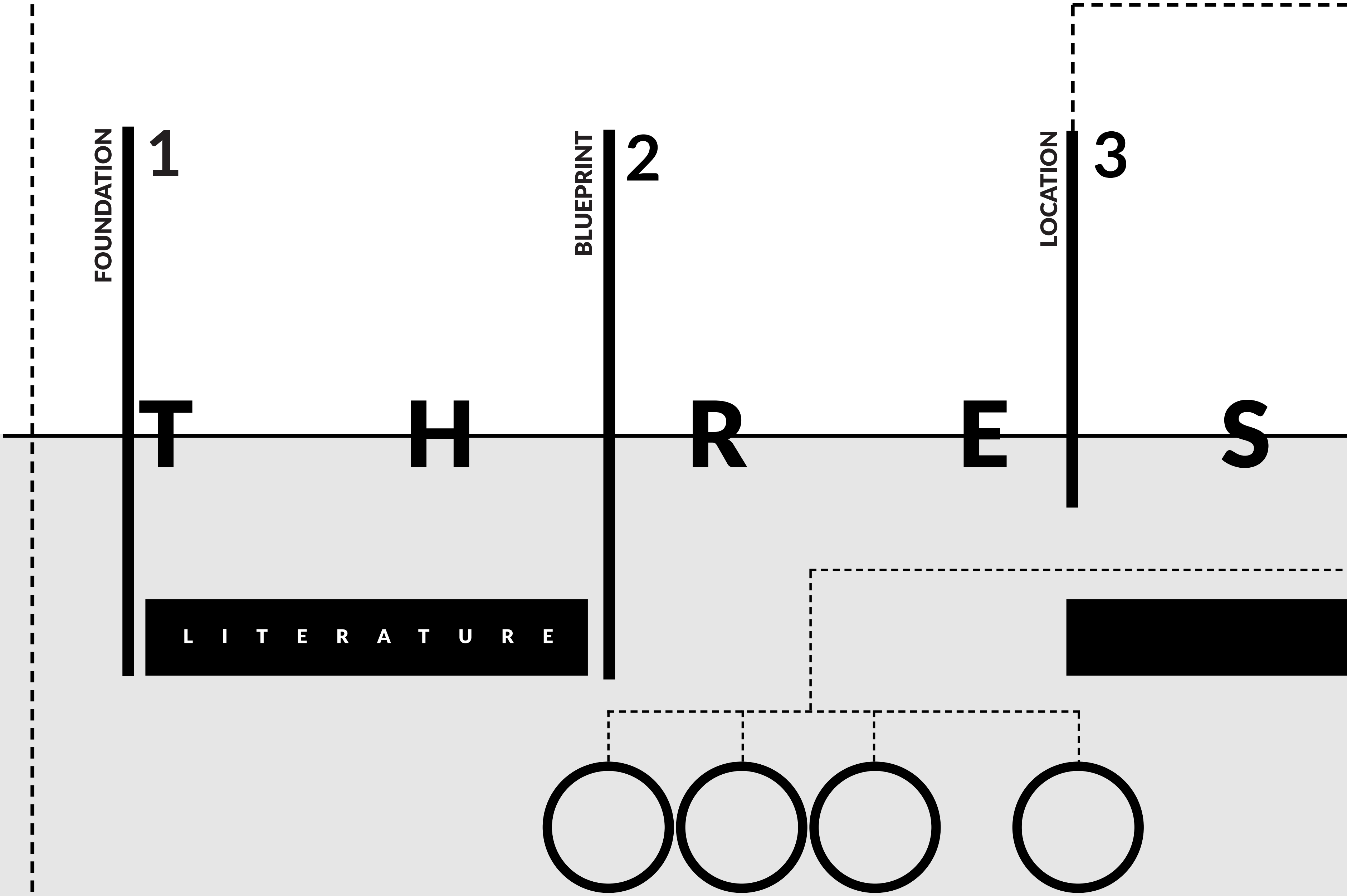
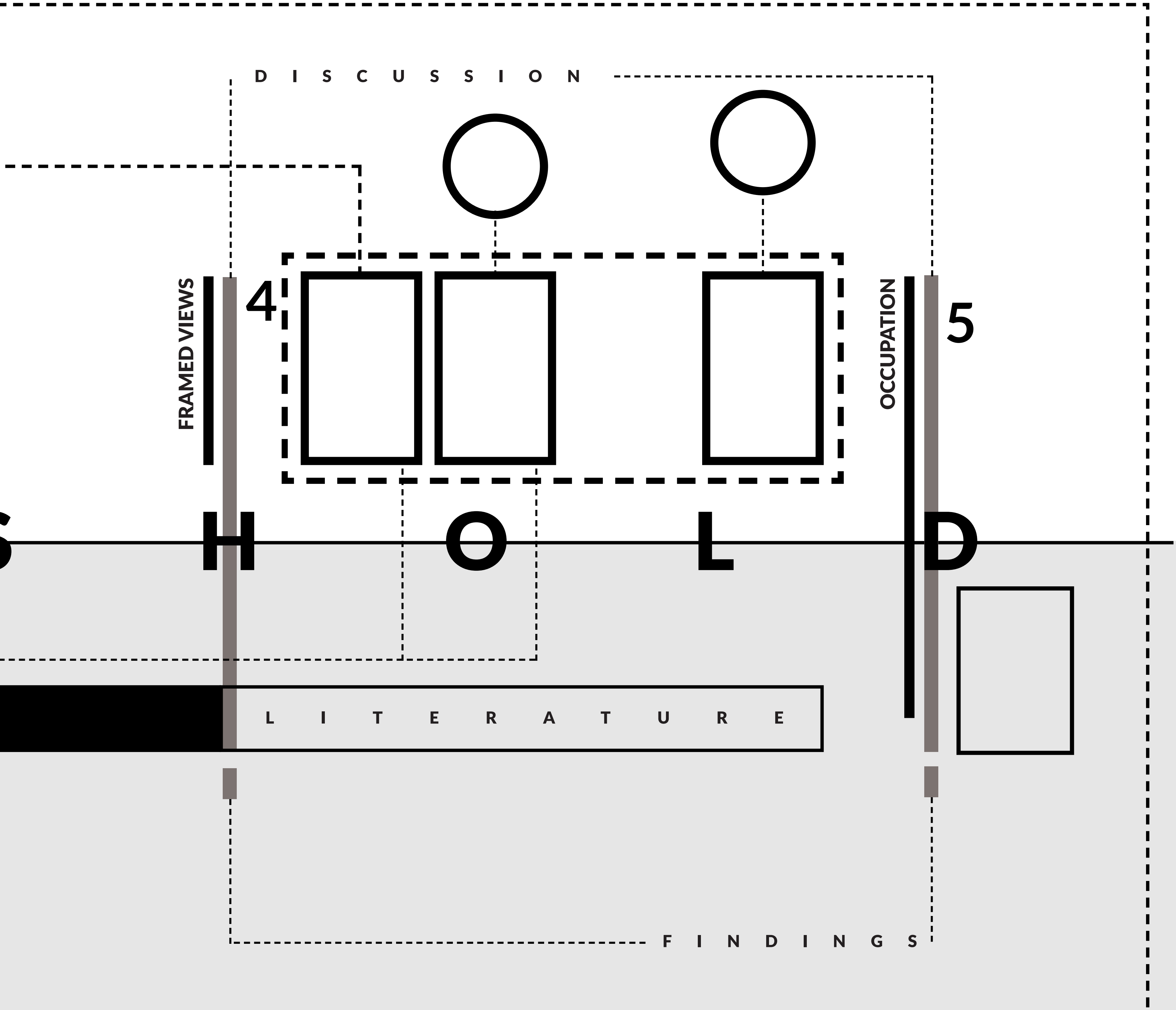
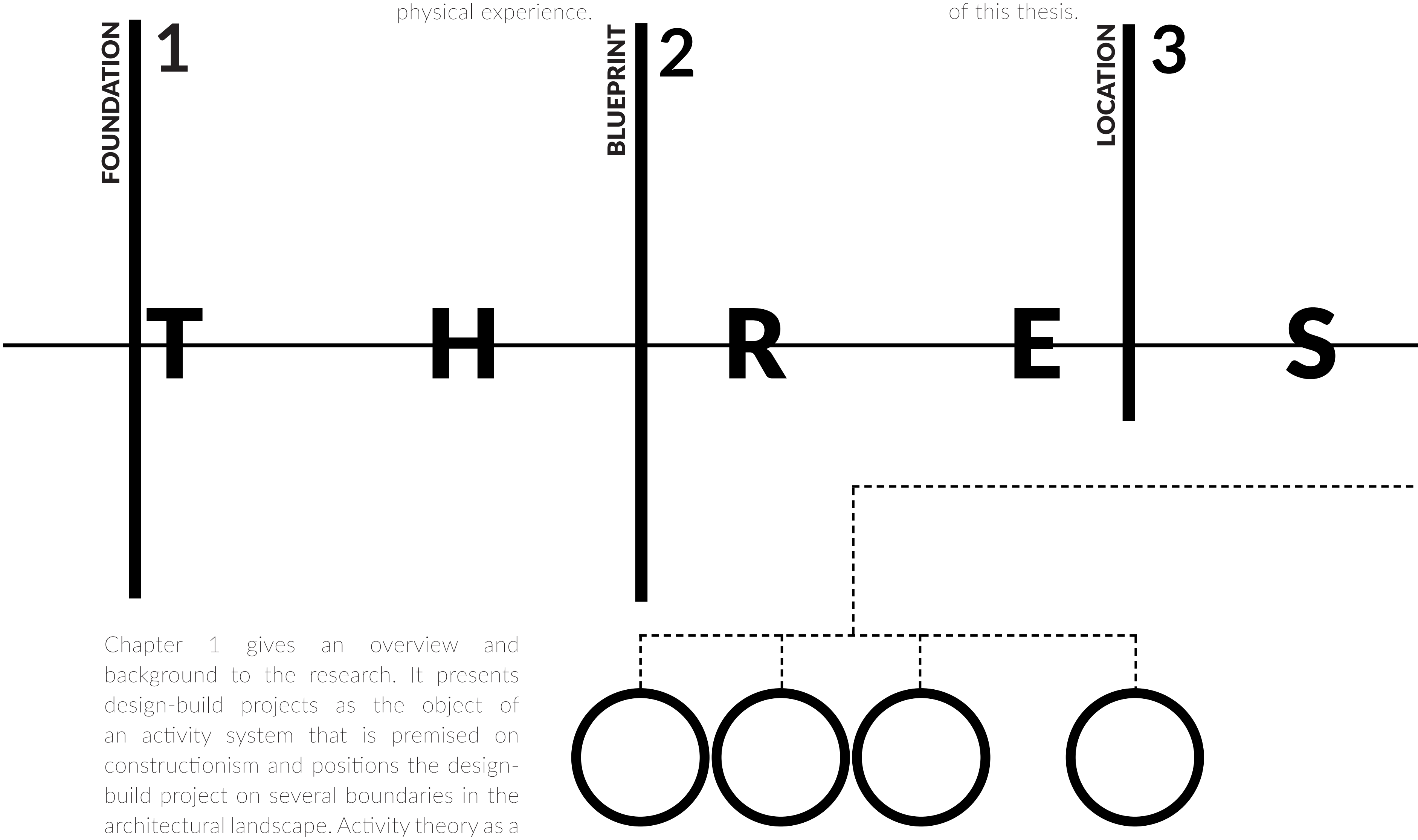


Figure 1.2: Relationship of literature, discussion and findings to the chapters


DISCUSSION
FRAMED VIEWS
4
OCCUPATION
5
S H O L D
LITERATURE
FINDINGS

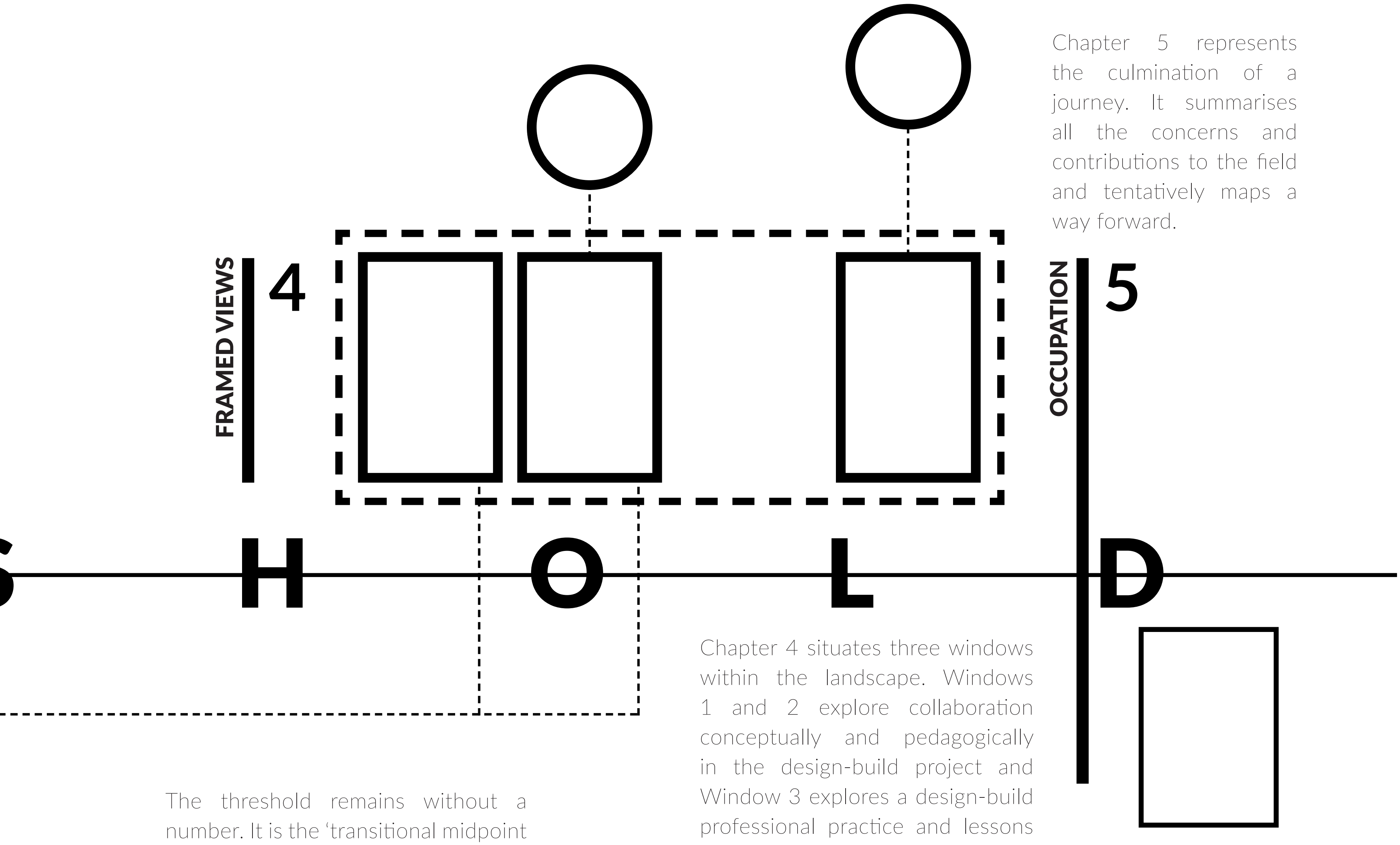
Chapter 2 explains the research design, data elements, research method and limitations. It accounts for the research intent and journey, and maps the research process. It includes a photographic essay of each design-build construction with the aim of immersing the reader as much as possible in the physical experience.

Chapter 3 grounds the research by providing an in-depth literature study that uses activity theory as an organisational framework, defines the design-build project as the object of the research and ties the current literature to the significance of this thesis.



Chapter 1 gives an overview and background to the research. It presents design-build projects as the object of an activity system that is premised on constructionism and positions the design-build project on several boundaries in the architectural landscape. Activity theory as a heuristic framework for the interpretation of the research is presented.

Figure 1.3: Overview of the five chapters



The threshold remains without a number. It is the 'transitional midpoint proposition' (Bachman, 2010: 470), both within the physical document and within the research process. It summarises the concerns and patterns that emerged through the data events and through the literature study and proceeds to suggest the opening of specific explorative windows. In essence it provides a departure point for the framed views that follow in Chapter 4.

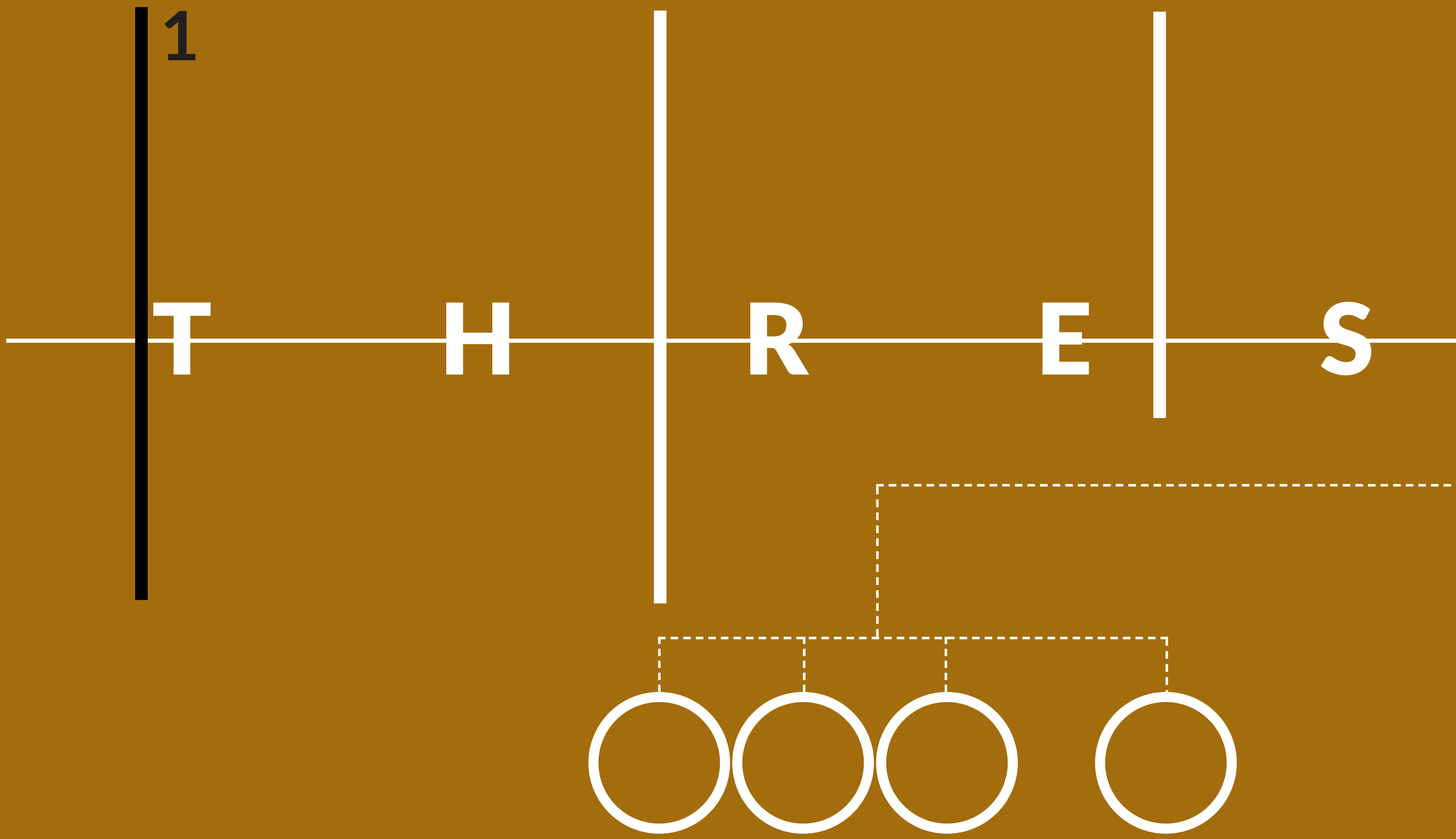
Chapter 4 situates three windows within the landscape. Windows 1 and 2 explore collaboration conceptually and pedagogically in the design-build project and Window 3 explores a design-build professional practice and lessons learned from the practitioners. Each window also acts as an independent construct that can be read and understood separately from the broader research.

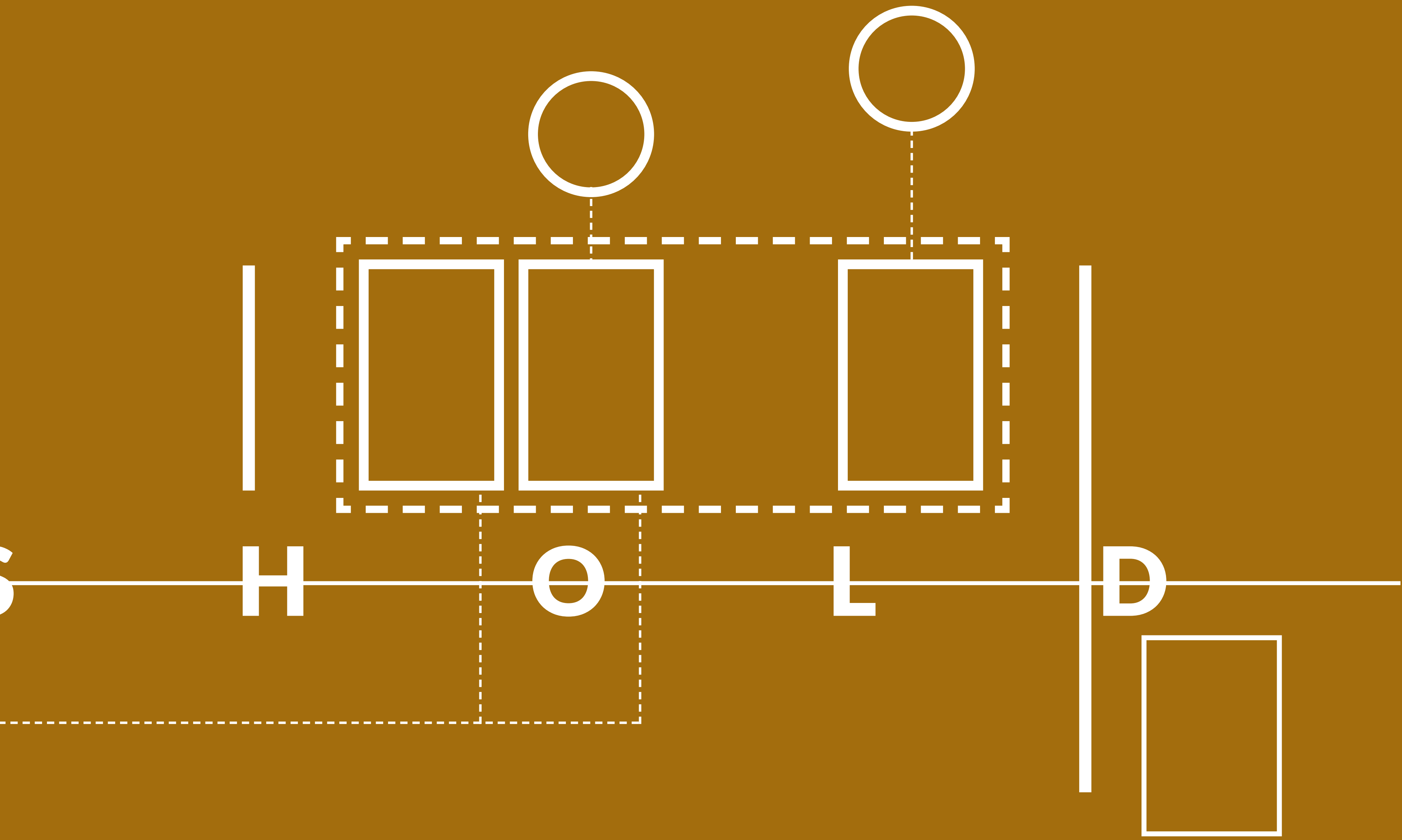
Chapter 5 represents the culmination of a journey. It summarises all the concerns and contributions to the field and tentatively maps a way forward.

Table of contents
List of figures
List of tables
List of images
References

OVERVIEW

1





CHAPTER 1
FOUNDATION

1.1 PERSONAL RATIONALE

This research commenced with the premise of simply exploring the design-build project as an alternative form of architectural education and it then became a varied journey into an uncharted landscape. Neither in my own education nor while practising as an educator had I experienced a design-build project before. I did, however, always find a profound relevance in making either objects and artwork or physical models. In my teaching I encourage students to work predominantly with physical models as idea development tools and I experienced the value this was contributing to their understanding and learning (Voulgarelis & Morkel, 2010).

A special interest in the social impact and tactility of projects by the Rural Studio (Dean & Hursley, 2002), the design-build studio, which is probably every architectural educator's first encounter with these projects, led to a more general curiosity about the design-build project and a wish to explore these projects in my own context. I believe design-build projects are specifically relevant to a university of technology, as it addresses tacit knowledge and technological exploration. Challis writes that

> incorporating the science of the art of construction... is best realised when a design concept is actually constructed and an interaction between user and artefact occurs (Challis, 2002: 4).

There was a time when I found myself questioning my position in the architectural landscape. Here I draw on the notion of a 'landscape of practice' as introduced by Wenger-Trayner, who posits that

> the 'body of knowledge' of a profession is not best understood as a reified curriculum, but rather as a 'landscape of practice' consisting of a complex system of communities of practice and the boundaries between them, each with their own histories, domains, and regimes of competence (Wenger-Trayner, 2014: 23).

The architectural landscape holds various communities of practice, including educational, research and professional practices. Positioning a variety of practices in the architectural landscape presented me with a contextual perspective of the position, possible relationships and boundaries of these practices and the opportunity to examine the operational as well as ideological and socio-cultural perspectives and principles of design-build architecture.

> Like any such professional domain, architecture is comprised by realms of professional principles, occupational practices, educational orientation, and disciplinary knowledge … all connected by discourses in knowledge, experience, principle, and value (Bachman, 2010: 3).

I found myself questioning how one traverses from one type of practice to another. And how did my disciplinary discourse contribute to my students' sense of identity within this varied landscape? In my own history I had exchanged full-time private practice for the academic world as I became disillusioned with the exploitative commercial milieu. And then I found myself teaching students to enter that very space I had left …

> A conventional architectural practice is driven by profit and procedures that delineate a clear and well defined boundary around a particular set of established professional activities … Any practice is shaped by values. These values form a boundary around the activities of a practice. The boundary extents delineate the range of activities, and the boundary definition describes the degree of separation between a practice and its social context (Perkes, 2009:64).

I am interested in both the process of teaching and the object we produce through our teaching. Saidi (2005: i) noted that nationally architectural learning sites 'fail to provide architectural education that addresses the wider issues of the South African society'. Engaging in this research has enriched my own teaching practice and I hope it will contribute to enriching the teaching practice of other architectural educators.

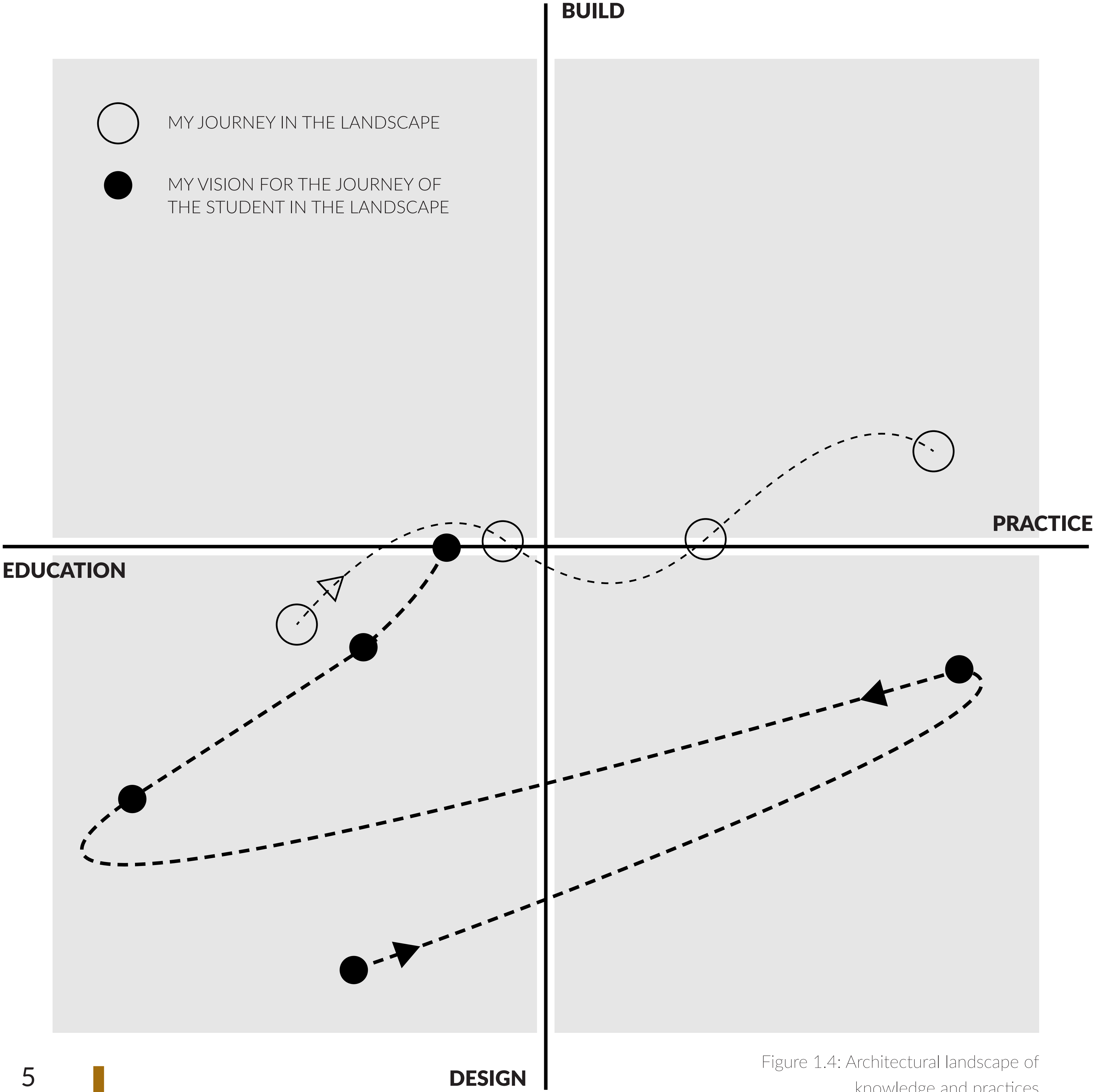


Figure 1.4: Architectural landscape of
knowledge and practices

1.2 AIM

This research explores design-build projects in architectural education at a university of technology. Through active participation in a series of design-build constructions, embedded opportunities were identified, with an emphasis on the unique pedagogical and professional possibilities integral to this educational practice. A series of reflective articles present the findings.

1.3 RESEARCH FOCUS

Design-build projects have increased rapidly in architectural programmes over the past decade (ACSA, 2014a). Literature speaks about the relevance of design-build courses for architectural education (Abdullah, 2014) and explains that students are more enthusiastic about learning and enjoy these projects more than the conventional studio projects (Canizaro, 2012; Melcher, 2013a).

In this research, 'design-build' projects are defined as 'socially responsive, inhabitable, full-scale investigations'. To read the development of the definition, see Chapter 3 section 3. Socially responsive, inhabitable, full-scale investigations are contextualised as one of six possible design-build typologies and posited as part of the broader definition of 'live projects'.

The structure and execution of design-build projects are well presented in numerous descriptive case studies that narrate procedural development and indicate many outcomes. These outcomes include students learning about the contributions they can make to their community (Vlahos, 2000; Tovivich, 2010) and gaining skills not possible to gain in the conventional studio (Sara, 2004). Brown posits that one of the most valuable outcomes for live projects is 'the revelation to student and educator of the subjectivity of our own academic and professional value systems' (Brown, 2013: 3) .

The value system of conventional architectural education is very specific, educating students, both locally and internationally, in a theoretically oriented curriculum to predominantly serve the wealthy minority (Fisher in Bell & Wakeford, 2008). Design-build architectural education offers the possibility of the development of an alternative value system. Alternative forms of education that include the exploration of social and tacit knowledge could lead to alternative

[2]Live Projects as defined by Anderson and Priest (2012)

forms of practice that could serve the poorer majority (Boyer & Mitgang, 1996).

At a recent design-build conference the question of exploring design-build 'as a distinct pedagogic practice', was one of the leading themes (ACSA, 2014b: 4). Brown writes that it is the architectural educator who should take on the task of engaging with the complexity of these projects 'in order to theorize and critique their practice' (Brown, in Harriss & Widder, 2014a: 57). The pedagogy of design-build projects still needs extensive theoretical development.

The theoretical exploration of the pedagogy of design-build projects as contributing to an understanding of the possibility of instilling alternative values in both architectural education and professional practice is the focus of this research.

1.4 CONTEXT

The architectural studio and the teaching of architectural design is the primary underlying structure of architectural education. In other design disciplines, for example jewellery design and fashion design, students learn through the making of full-scale prototypes. Architectural students work predominantly in the studio with representations of buildings, drawings and scale models. Design-build projects provide an alternative experience. Design-build projects are physical, hands-on and grounded in making, and provide students with the opportunity to learn through full-scale design.

The inherent nature of full-scale making positions design-build projects on several boundaries within the architectural landscape. These boundaries are spaces or edges where change is possible and negotiated. The most obvious, as suggested by the name, is the boundary between designing and building. There are several other boundaries.

This section introduces an awareness of the value of making and of design-build as boundary practice to contextualise this study. A broader contextual perspective is provided in Chapter 3, the underpinning literature study.

1.4.1 DESIGN-BUILD AS MAKER CULTURE

> …there can't be 'making without sense-making'
> (Blickstein in Martinez, 2014: 14)

Learning through making has become increasingly valued in general education. A maker culture puts the student at the centre of learning, constructing their own knowledge through the making of meaningful objects in authentic learning activities. The essential premise of constructionism is that, in order to create a 'public entity, whether it's a sand castle on the beach or a theory of the universe', learning towards the making of that entity is necessary (Papert & Harel, 1991: 2). This implies that the creator would be intrinsically motivated and inspired to find and construct the necessary knowledge to complete the entity.

The value of making in the architectural studio has always been of special interest to me. My research endeavour in architectural education started with an investigation into the use of models as idea generators in the design studio (Voulgarelis & Morkel, 2010).

> Students, like most of us, tend to internalize learning in a more lasting way when they analyze theoretical principles in terms of real places and events they can see, hear and touch (Vlahos, 2000:95).

In a world where the technological is developing rapidly there is a danger that a reliance on technology starts to separate the physical and the virtual. Weber writes:

> One of the unintended side-effects of embracing the virtual has been the tendency among many students towards a lack of rigor in considering the actual materials from which their buildings are to be constructed. Yet these are the notes that, strung together, become the symphonic whole of any great architectural work (Weber, 2014: 22:22).

On the other hand, the value of making and the value of advanced technology are also intertwined. Digital production is becoming more affordable and accessible and new digital ways of producing buildings are developing rapidly. Making by hand and making digitally are now part of the making of architecture. Huang and Belton (2014: 62) speak of a design-build project where they researched 'craft as it applies to architecture with the introduction of digital fabrication methods'. Design-build projects become the context for moving between different ways of making. Deal describes one project where

> critical understandings were gained in the areas of wood structure, formwork, flexure, mitering and milling, in cutting and welding steel with consideration for expansion, contraction, bending and tolerances, as well as in the lessons surrounding pouring, vibrating, patching and finishing concrete (Deal, 2014: 24) .

Although architects seldom personally physically make the buildings they design, it is the knowing how to and the knowledge of materials and the technological possibilities that are essential in the execution of their work. Pallasmaa posits that architects need to

> understand the possibilities and limits of materials and crafts, and communicate their ideas and intentions to the specialist craftsman, whose hands become the designer's surrogate hands in the execution of the work ... a wise architect ... searches deep personal friendships with craftsmen, artisans and artists in order to reconnect his/her intellectualized world and thinking with the source of all true knowledge: the real world of materiality and gravity, and the sensory and embodied understanding of these physical phenomena (in Van der Wath, 2013: 193.)

Van der Wath (2013) explains that there are arguments against design-build in education because it is not necessarily what students do once they go out and practice. She explains further that it is the value of material and technological understanding embedded in design-build projects that negates these arguments.

Learning in design-build projects 'extends far beyond the realm of craft' (Brillhart, 2014: 8). Brillhart writes about a design-build project in which he was involved that revealed that some knowledge

> can only be experienced while making … in reflecting on the 'making' experience, the initial concept was thickened, if not altered; we came to view the installation as a microcosm working at the scale of the body, building and city; drew typological parallels that considered the context of history; and recognized the expanding boundaries and preoccupations of architecture in contemporary practice. In doing so, the project gained deeper meaning. (Brillhart, 2014: 8).

Design-build projects are positioned in the educational realm as a means to expose students to the art and craft of making in architecture, giving them knowledge and skills they can transfer in a variety of ways to their practice in education and the professional world.

Image 1.3: Construction hats ready for the day at a St Michaels design-build construction

1.4.2 DESIGN-BUILD AS BOUNDARY ACTIVITY

Architecture has always found itself on the boundary between art and science. Although the physicality of the scientific such as gravitation and technological solutions determine the structural performance of a building, it is the haptic experience of the spatial that fundamentally influences our being in the world.

strong personalities, defines where a school or department is situated within an educational structure.

By nature, the design-build educational studio is also positioned on various boundaries within the landscape of architectural knowledge and practices.

> 'The experiential and lived space, not physical or geometric space, is also the ultimate object and context of both the making and experiencing of architecture' (Pallasmaa, 2009: 8).

Locally and internationally, architectural schools are situated in a variety of university faculties, from design and arts to engineering, agriculture and the social sciences. The specific orientation of each school and programme, often linked to historical and cultural influences of context and

Sara posits a similar notion, the design-build studio as between. She writes that 'this between location affords a range of teaching and learning opportunities which critique and re-energise the traditional studio learning model' (Sara, 2011: 119). Some possible boundaries, each with its own challenges and opportunities, are described below, contextualising and positioning this study.

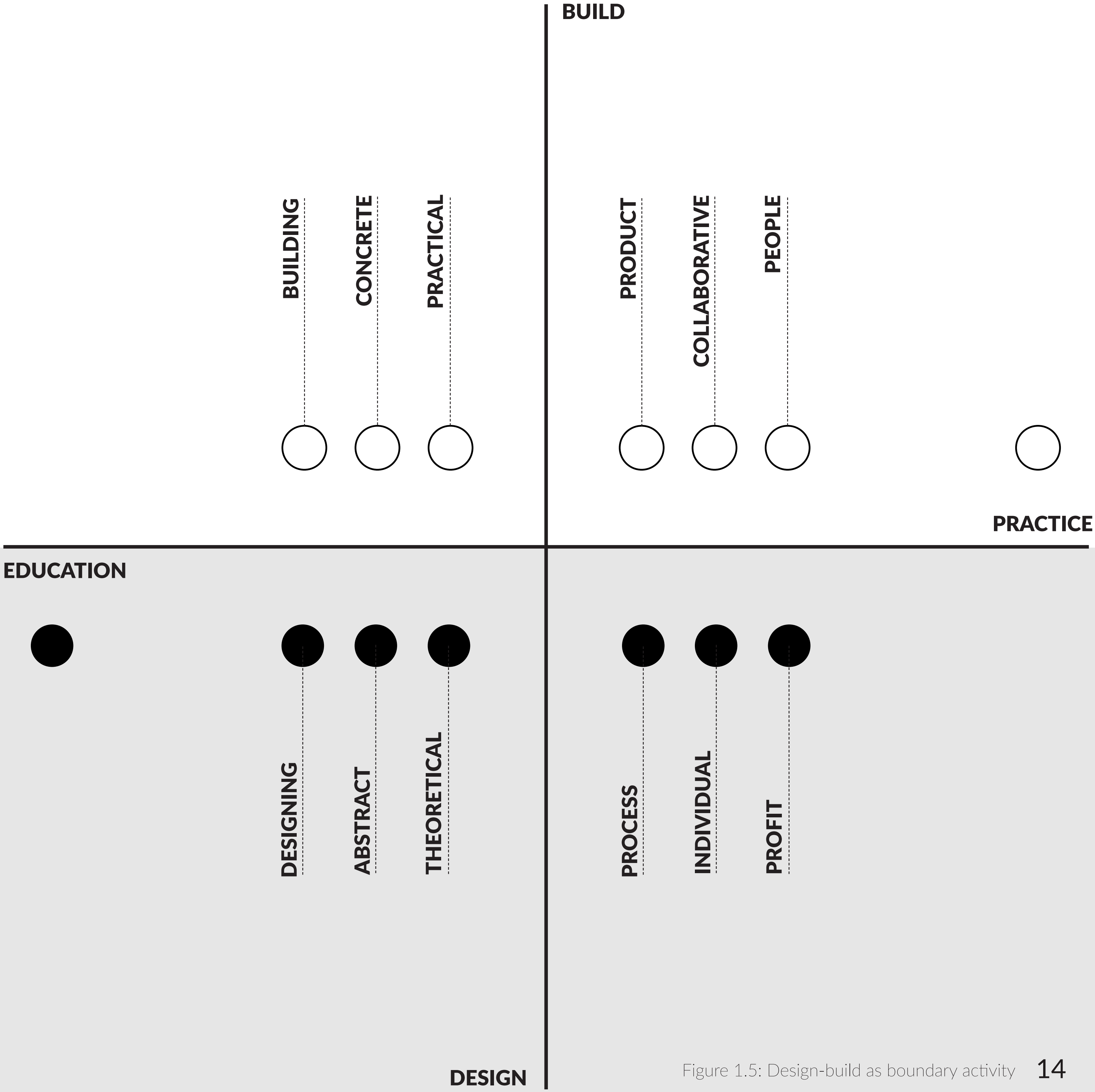


Figure 1.5: Design-build as boundary activity

1.4.2.1 DESIGNING VS. BUILDING

Designing and building have, ever since architecture has been formally taught, not really been well integrated in education. The nature of the curriculum, the structuring of subjects and the different approaches to teaching by faculty are just some of the aspects that enforce the boundary between designing and building. Building management, construction management and quantity surveying are often not even located in the same faculty as architecture departments, further contributing to this separation.

In practice, architects and builders also find themselves on different sides of the (boundary) wall. For architects, building is mostly that which is executed once the design has been documented already. The architect often believes the builder is incapable of understanding and executing the documented design. The builder believes the architect does not understand the building process and construction complexities. Abdullah states that both 'builder and designer tend to guard their own area' and puts forward the argument that it could be the 'result of a philosophical difference between thinkers (designers) and doers (builders)' (Abdullah, 2011: 2). Erdman (2002) writes that this separation between designing and building is a new development in the history of building and she reflects on a paper by Jemtrud, who

> proposes that hands-on design-build projects, in attempting to close the gap between designing and building, actually replace the reflective process of design with the active process of building. He further argues that the interpretive act of representation plays an essential role in bridging design and construction
> (Erdman *et al.*, 2002: 6).

Representation and design-build projects become a means of crossing the boundary between designing and building. Allowing students to engage in both representation and design-build projects in their education provides them with a more holistic knowledge of the entire process of realising a built structure. However, the need for this closer relationship depends on the intent of the education.

1.4.2.2 EDUCATION VS. PRACTICE

Design-build straddles the space between education and practice. Morrow (in Harriss & Widder, 2014b: 21) describes these projects as existing 'between the two tectonic plates of learning in academia and in practice'.

It is not necessarily the act of building that students will practice in their careers, but being involved physically in building allows 'students to reconcile their drawings with real structures they can build, weld, wire, and plumb' (Nepveux, 2010:77). Students are brought closer to aspects of practice if they consider that what they draw will actually be built.

Students and educators must realise that design-build is still a pedagogical construct with definite educational outcomes, and not real practice. Students must realise that being students affords them a different power relationship with collaborators outside the educational structure. This relationship would not necessarily exist in professional practice. Chiles and Till write that

> there is an interesting balance between practice and education which encourages the student to position themselves politically. They have to re-assess the relationship between client, business and community in the context of the university rather than from an office perspective ... Students fill a unique mediating role that a professional would struggle to do (Chiles & Till, 2004: 3).

1.4.2.3 ABSTRACT/THEORETICAL VS. CONCRETE/PRACTICAL

In the conventional studio students engage predominantly with abstract, theoretical projects and do not often cross the boundary to concrete, practical projects. Feuerborn (2005: 9) writes that the 'teaching of strictly hypothetically design and theory produces students who are knowledgeable of just that'. Vlahos posits the conventional studio projects as presenting a disconnect

> from the needs of people and places and the understanding of different cultures. The outcomes of the theoretical studio projects are strongly developed, controlled, formal solutions with little understanding of the architectural intervention in communities (Vlahos, 2000: 95).

Being involved with design-build projects gives students the opportunity to move from abstract to concrete and from theory to practice.

Van der Wath describes this movement as an oscillation between the abstract and concrete that allows students to 'develop the intellectual agility to tackle the complexities of architectural innovation and experimentation that they will use in professional practice' (Van der Wath, 2013: 192). This sentiment is shared by Abdullah (2011: 3), who reiterates that design-build projects are the 'connection between the abstract and real world.'

I believe that design-build projects allow a way to cross the boundary between the abstract/theoretical and concrete/practical. Students who are allowed the experience of physically constructing the spaces they have designed are able to access what Pallasmaa (2009: 2) describes as 'the mental task of architecture' that goes beyond 'functional performance, physical comfort and aesthetic values'. He further writes that

> the mental sphere of architecture cannot be approached by instruments of measurement; its poetic essence is grasped solely through an embodied encounter, intuition and empathy ... Existential meanings are lived rather than understood intellectually. This silent and voiceless knowledge of our bodies is very badly neglected in the currently prevailing educational ideologies (Pallasmaa, 2009: 2).

The value of concrete and practical experience is therefore not limited to a technological or material understanding of making, but contributes to a mental and qualitative understanding of the spatial.

1.4.2.4 PROCESS VS. PRODUCT

Whether design-build projects contribute more to the value of the design process or to the design product is not clear from the literature. Developing a reflective and critical design process is part of what students learn in the conventional studio. One of the criticisms of design-build projects is that the focus on completion within a specific time frame overrides the value of process, as the project is 'guided by credulity rather than scepticism' (Christenson & Srivastava, 2005: 235). Chiles and Till see the shortened timescale of design-build projects as removing the 'luxury of the long-term studio project development ... so prevarication is not possible' (Chiles & Till, 2004: 6). They also point out that design-build projects are often students' most productive projects.

Foot (2012) again argues for the value of process over product. He mentions that, where the completion and a focus on the end product are taken out of the equation, the notion of reflection, open-endedness and non-linearity allows students to discover a variety of possible solutions. Erdman (2002) points out the rich variations in the design process that could be investigated in different types of design-build projects.

Design-build projects have as outcome a physical product made through a process that can vary greatly in scope, focus and intent. The rich variety of completed design-build projects described in the literature provides reflection on and ideas to adapt from for application in many circumstances and different contexts. I believe that value could be found for each future design-build project in both process and product.

1.4.2.5 INDIVIDUAL VS. COLLABORATIVE

In design-build projects, students work together on designing and building projects, as it is simply not physically possible to do this individually. Working together is in direct contrast to the conventional studio where students usually design and then present individual projects. The value of working together is voiced by students in a study by Abdullah (2011), who writes that students enjoyed the sharing of responsibility for the outcomes of group work, being able to voice their opinion and the equal treatment regardless of their role in the team.

One of the biggest critiques of the conventional studio is the focus on individuality and the individually oriented practitioner this practice creates. Cuff (1991: 45) addresses the 'primacy of the individual', which originates in the studio as an outcome of the primary relationship that exists between a student and tutor. Nicol and Pilling discuss Cuff's notion further, saying that the 'familiar model of architectural education seems unlikely to foster in students a positive attitude toward collaboration' (Nicol & Pilling, 2000: 6). Boyer and Mitgang (1996) spoke about the making of connections within the architectural discipline and beyond as the most important challenge of architectural education. It seems that this challenge is still with us today, and specifically in South Africa. Osman writes that in the South African architectural landscape the architect is still seen as the creative individual who focuses on wealthy clients and posits that this orientation is directly linked to education (Osman, 2015).

In the design-build project students also get the chance to work with other professionals, the client and broader professional community, a chance that is not readily available in the conventional studio. Collaboration and the learning of collaborative skills are therefore wider than the collaboration of students with each other. Collaboration extends to include others beyond the conventional studio and opens up avenues of collaboration for the educator. About live projects Brown (2014a: 57) writes that 'the greatest opportunity presented by the Live Project is not that it is a place to reflect on one's own learning but that it is a place to share that learning and reflection with others'.

Image 1.4: Students at the completion of the first design-build construction at St Michael's

1.4.2.6 PROFIT VS. PEOPLE

Conventional architectural practice is profit driven. In South Africa, where the majority of people cannot afford architectural services and live in informal contexts, 'conventional methods of architectural practice are deemed to be of limited use or value' (Bennett & Osman, 2013: 1). Both locally and internationally there is currently a renewed emphasis on the relevance of and need for the development of a more people-oriented architectural practice.

> Contemporary practice is not the same as in the past. It has to serve a wide society in which issues of poverty and equity are paramount. Further there is increasing competition from other professionals who offer similar or even better articulated services to the clients. The influence of the architect in the built environment has suffered significantly. While others see the need to regain that influence as more important, it may also be time to look at other services in which architects can provide a better service to society than anyone else (Saidi, 2005: 2).

Tovivich (2010: 2) calls for a new kind of architectural practitioner or 'a new architectural professionalism' that would serve the majority of people. Although there are conventional firms taking on people-oriented or community-oriented projects, these projects are usually fringe projects, pro bono and not seen as sustainable for a commercial practice. People-oriented projects are not the dominant focus of the international profession. Non-profit organisations like Architecture for Humanity have been trying to establish more formal avenues for people-oriented practice. However, a boundary still exists between these practices, possibly due to this work being experienced as unprofitable.

In architectural education real work in communities is finding a place in live and design-build projects. Although the academic and experiential value of these projects is not contested, real projects take more time, organisation and resources than conventional studio projects. This implies that these projects are less profitable for an academic institution that is dependent on student fees and government subsidy. 'All in all the organization and financing of a design/build endeavour discourages many administrators and department heads who would otherwise be sympathetic to the educational benefits' (Lonman in Canizaro, 2012: 29).

The challenge situated in the boundary between profit-driven and people-driven architectural practice and education is complex. The biggest challenge might lie in the transfer that happens from education to practice. In education students are supported to participate, but are they being equipped to implement these projects in practice as an alternative to the conventional?

1.4.3 SUMMARY

This research explores the space that design-build education occupies as a hands-on, full-scale alternative to the conventional studio. It takes into account the possibilities presented at the various boundaries occupied by design-build projects in the landscape of architectural knowledge and practice. Wenger-Trayner explains that the 'principle is to systematically make boundaries a learning focus rather than assuming or seeking a seamless applicability of knowledge across practices' (Wenger-Trayner, 1998: 5).

1.5 EXPLORATORY RESEARCH QUESTIONS

THE MAIN QUESTIONS THAT DRIVE THIS RESEARCH ARE:

1. WHAT ARE THE UNIQUE EDUCATIONAL OPPORTUNITIES AND POSSIBILITIES PRESENT IN DESIGN-BUILD PROJECTS?
2. HOW DO THESE UNIQUE OPPORTUNITIES AND POSSIBILITIES POTENTIALLY INFORM :

i THE DEVELOPMENT OF FUTURE DESIGN-BUILD PROJECTS AND THE BROADER ARCHITECTURAL CURRICULUM?

ii PROFESSIONAL ARCHITECTURAL PRACTICE?

Image 1.5: Design-build projects are a hands-on approach to architectural education

1.6 ACADEMIC RATIONALE

This research is both a comment on current architectural pedagogy and an exploration of design-build as an alternative pedagogy. Conventional architectural education is primarily oriented towards producing individual designers who have as their main premise the design of iconic buildings for a wealthy minority. This pedagogy has a few significant constraints. Students engage predominantly with theoretical, fictional projects that are removed from the social realities of everyday life (Vlahos, 2000). There is also a disconnect from tacit knowledge in a world that is increasingly technological. The individualistic identity that students develop through immersion in the dominant architectural culture informs their identity as practitioners.

Design-build projects have the potential to educate students differently. In a rapidly changing world where inequality is glaring, there is a need for architects to get involved with the broader community through projects that are situated in real life. A hands-on approach or learning through making brings tacit knowledge into the curriculum. To design and build together introduce the notion of collaborative identity, as it is not possible to do these projects individually. The perceived shortcomings of conventional architectural education and the potential of design-build projects are well documented; some of these aspects are discussed in context. Prior research into design-build projects and alternative practice has mostly focused on the 'how-to information' through narrative project descriptions (Melcher, 2013b: 72).

As architectural educators we need to have more than procedural knowledge and outcomes, we need to understand the 'pedagogic as well as … practice ready value' of these types of projects (Harriss, 2012: 8). Critically exploring what makes design-build projects successful will enable curriculum development and teaching and learning strategies of design-build projects that are informed from a more theoretical perspective.

As far back as 2002 Erdman wrote that what

> remains clear is that design-build activities continue to resist theorizing and critical discourse. It is ... extremely difficult to discuss these projects, because evidence of success is often anecdotal, and is framed in terms of student empowerment, skill-building, or community and social agendas. Too often, their benefits are seen as self-evident and in no need of critical examination, privileging the irrefutable power of activity over the more reflective act of theory. Typical theoretical investigations address the products of a process and not the process itself ... The challenge lies in our ability to meaningfully integrate pedagogy with process (Erdman, 2002: 175) .

As recently as 2014 Harriss and Widder expressed the need for

> an overarching framework that goes beyond collating descriptions of project A, B, or C and, instead, suggests coherent and crafted pedagogies...to build that pedagogical framework...we need the component parts of a conceptual framework: a working definition, categorized exemplars, and analysis of content and method, that are specific, though not necessarily exclusive, to the concept (Harriss & Widder, 2014: 21).

This research begins to address the need for a clearer and more theoretical pedagogical understanding.

1.7 RESEARCH PARADIGM

Radical humanists are interested in the subjective world, but feel the need to transcend or even overthrow current societal arrangements. Their aim is to explore alternatives (Cronjé, 2012: 16).

To explain my ontological and epistemological position I need to first give some personal context. I am a professional architect. I come from a traditional university and started my career in a commercial practice. I am also an educator, engaging in a discourse of knowledge to bring disciplinary theory and technique to the realm of teaching (after Bachman, 2010: 3).

To teach at an architectural learning centre in South Africa you have to be registered with the South African Council for the Architectural Profession (SACAP). However, there is no requirement that one has to know anything about educational theory or practice. Architectural educators rely predominantly on how they were taught themselves. This seems to be the trend internationally, where teaching practice is informed by one's prior experience as a student. Being immersed in full-time teaching made me very interested in the way we teach. I realised that how, why and what we do not only influence the disciplinary knowledge gain of the students, but also their identity and sense of place in the architectural profession. I knew I was beginning to engage in some kind of reflective practice (after Schön, 1983), but as a young academic did not have the underlying vocabulary to articulate what I was doing. This realisation prompted my research into various aspects of my own practice in architectural education. But I did not yet have the identity of an educational researcher and needed to become acquainted with the philosophical underpinnings of different paradigms within educational research. I had to reflect on my own ontological and epistemological viewpoints, which in short was a reflection on how I view the world and how I perceive knowledge construction and social reality.

I find it easier to make decisions on the basis of a clear set of rules and I would probably feel safer operating in a positivist environment, but I also believe fundamentally that there is not just one reality in the world, no black and white answers, that 'it's all invented' (Zander & Zander, 2000) and that perceptions, knowledge and ideas can change with time and context. There are certain rules of nature that one cannot change, but I believe one's interpretation and view of those rules and of what the truth is, are very subjective. To further describe my view of the world, it was useful to look at the four paradigms as developed by Burrell and Morgan (1979). I find myself in the radical humanist paradigm. The subjective radical humanist paradigm holds that potential change in the world is possible by creating awareness of patterns of dominance. Morgan explains that:

> through a process of awareness we are more able to freely engage in the construction of a social reality dedicated to human liberations as opposed to dominance … by changing the way people think, see, and understand the world. You try to bring about a new world view, a new paradigm, which allows people individually and in conjunction with others to reorganize their experiences. Consciousness is the driving force; it is the essence of radical humanism (Morgan in Mills, 1990: 4).

Here I need to accept that there are many cautions against defining one's positions strictly to a specific paradigm at the risk of excluding other positions and becoming increasingly subjective. This research is both qualitative and subjective. And the radical humanist paradigm is seen 'as a way of focusing attention rather than as a means of classification' (Deetz, 1996: 191).

Exploring the design-build project took me out of my comfortable, familiar and conventional studio and made me conscious of its limitations and habitual patterns. It opened avenues for proposing radical change that can shift the cultural orientation of our teaching and possibly introduce alternative forms of architectural practice.

Epistemologically I subscribe to the view that knowledge is socially constructed and acquired through experience, and that it is bound by context. These essential ideas were articulated by Vygotsky (1930–1934/1978), who worked predominantly in educational psychology and developed a sociocultural theory on learning, also described as social constructivism. He explained that learning happens first externally, with others in social situations, before the social conversation is internalised through reflective thought. Bruffee interprets what Vygotsky implies and explains that 'knowing is not an unmediated, direct relationship between subject and object. It is a disjunctive, mediated process involving the agency of other people' (Bruffee in Warmoth, 2000: 3).

More specifically I support the concept of constructionism. Social constructivism influenced the idea of constructionism, developed by Papert. Papert sees constructionism as sharing

> constructivism's connotation of learning as 'building knowledge structures' irrespective of the circumstances of the learning. It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe (Papert & Harel, 1991: 1).

The simplest way to describe constructionism would be learning-by-making (Papert & Harel, 1991), or in simple epistemological terms it would be learning as the construction of knowledge in the mind whilst engaged in the construction of an object.

For the purpose of the research I did not investigate student learning itself, but I support McMillan (2009: 43), who used 'learning as a way to understand the social practices and activities between students' and others, whether it be community, academics or professionals. I also agree with Wenger, who states that learning 'is not just acquiring skills and information; it is becoming a certain person — a knower in a context where what it means to know is negotiated with respect to the regime of competence of a community' (Wenger, 2010: 2) It is this becoming through the process of learning in a social context that I found especially important in this investigation.

Specifically in terms of architectural education, I also wholeheartedly agree with Hamdi, who writes that

> knowledge is the acquisition of principles, based on experience, which shape our universe of understanding: it demands progressively drawing principles from practice in order to inform action. Know-how is the accumulated skills, practical wisdoms and intuition one needs to solve problems, and is the foundation of our ability to improvise in the face of uncertainty and chance which one is bound to encounter in practice. Good practice (unlike best practice) is the application of knowledge or principles modified to fit locally specific circumstances, using the resources of local crafts people, artists, builders who have the know-how to solve practical problems. Good practice is both practical and strategic in its objectives, combining both knowledge and know-how. It is intensely participatory, enabling us to deal with some of the primary causes of problems and issues we face (Hamdi, 2011: 5).

If I share the beliefs of Vygostky, Papert and Hamdi about knowledge acquisition, I cannot apply these beliefs only to the way I teach my students. I also need to apply it in my own essential learning. In that sense these beliefs also shaped the design and methodology of this research project.

In terms of student learning the underlying assumptions that I am working from are that, through our traditional studio culture, a student 'becomes' a more theoretical practitioner who is orientated towards continuing their professional practice in what is defined in this study as 'conventional architectural practice' (Tovivich, 2010: 2). Is it possible to accept a young student into the landscape of architectural knowledge and open up the idea of becoming something other than a conventional practitioner? The question is really one of shaping identity and values. Will introducing design-build projects work towards establishing that goal, to introduce a different becoming?

1.8 THEORETICAL UNDERPINNING

For me it's more of a heuristic for orienting myself to the world and thinking about what I need to be aware of. And so culture, history, and activity are things that I need to be aware of. But then, like you, I need to create tools that are appropriate to the object of inquiry and this is a point that oftentimes doesn't come into the discussions of method. We're talking about activity theory … and we fall into a mistake that the creators of activity theory had not wanted us to fall into, namely, we talk about activity in general and the abstract when, in fact, VYGOTSKY (e.g., 1989) wanted to have a 'concrete human psychology.' It's about the real world, concrete situations we need to look at activities that we want not only to understand but to transform. It is praxis that we want to understand and transform. And so, that praxis really is at the heart of our endeavor, not the theory for itself. It's a theory for action, it's not just a theory for understanding. It's one that's there to assist us, perhaps, as a heuristic for going about transforming this world…

(Roth, Radford & LaCroix, 2012: 3.2).

1.8.1 THEORETICAL PERSPECTIVE

The research commenced with the intention to explore the design-build project in architectural education and to position design-build as an alternative to the conventional studio. My research journey was grounded in a process of exploration and discovery. To understand and interpret the data, I had to find a way to frame what I was seeing. From what perspective would I start exploring the complexities of this pedagogical activity (Brown, 2012)?

I considered that Erdman et al. posited that, in design-build projects, theory and critical discourse are overshadowed by the 'power of activity' (Erdman et al., 2002: 175) and the physical product of the process. Taking into account Erdman et al.'s observation, which is also reiterated by others (Brown, 2012; Voulgarelis, 2012; Abdullah, 2014; Harriss & Widder, 2014b), I wanted to move beyond exploring just the physical object of the design-build process.

At the same time, I did want my theoretical perspective to reflect the inherent nature of design-build educational projects, practical, complex and situated, and to not just recognise, but use analytically and reflectively, the 'power of activity' that Erdman et al. (2002: 175) had spoken of. I was searching for a theory that would provide tools for engaging with the design-build project at a deeper and more meaningful level.

The theoretical perspective had to recognise the collective and the dynamic relationship of all the role players within a design-build project. The perspective further had to resonate with the idea of development and change. This included change needed to move from the conventional studio towards the design-build studio, change reflected in the consciousness of the participants and the idea of dynamic change where the design-build project straddles several boundaries in the architectural landscape.

In activity theory I found a 'powerful descriptive and analytical tool for understanding the interpretations and conceptualisations' (Torres, Buchem & Attwell, 2011: 30) of all these concerns. In addition, activity theory is acknowledged and used widely in educational research, especially in social learning situations, it recognises the role of artefacts or tools as playing a part in social learning, it looks at motivation, contradictions and conflicts as a driving force within and between activity systems (Engeström, 2001) and it takes into account context, culture and history (Roth & Lee, 2007).

1.8.2 AN INTRODUCTION TO ACTIVITY THEORY AS THEORETICAL TOOL

Activity theory originated primarily from the social learning or sociocultural theory of Vygotsky (1930–1934/1978), which still influences contemporary teaching practice. Vygotsky considered cognitive development as a cultural activity within a social context and as dependent on interaction with others. Communication, through language and other cultural artefacts and collaborative learning are seen as essential tools by which externally developed cognition is internalized.

Leont'ev and Luria worked alongside Vygotsky in the early development of activity theory (Ryder, 2015). More recently Engeström (1987) developed activity theory as a contemporary theoretical framework that is still constantly evolving. In activity theory 'the concept of activity, the prototype of which is work, constitutes a basis for understanding the nature of knowledge and reality' (Miettinen, 2006: 389). The activity or work is directed towards an object, and object-oriented action is one of the basic principles of activity theory. Other basic principles include 'the dual concepts of internalization/externalization, tool mediation, hierarchical structure of activity, and continuous development' (Ryder, 2015: 3). Activity theory takes into account social, cultural and historical influences and the community that is part of the activity.

The people from whose perspective an activity is explored and who are part of the activity system are referred to as the subjects in the activity. The subjects are interacting with each other and the community* of which they are part towards achieving an object with specific outcomes. The 'human interactions with each other and with objects are mediated through the use of tools, rules and division of labour. Mediators represent the nature of relationships that exist within and between participants of an activity in a given context' (Torres et al., 2011: 6).

* In this thesis 'community*' is used to refer to predominantly underprivileged communities in South Africa that do not have the financial means to afford architectural services. Where only the word 'community' is used, it is used to refer to a concept within activity theory that refers to all role players taking part in an activity.

Activity theory recognises the complexities that are involved in social interactions and provides a framework that resonates with the practical nature of design-build as a physically oriented activity. I see activity theory as giving me a perspective within which to explore this research and I agree with Roth et al. who write that, in activity theory, the 'praxis really is at the heart of our endeavor, not the theory for itself. It's a theory for action, it's not just a theory for understanding' (Roth et al., 2012: 26).
Activity theory moves beyond the understanding of individual learning and action towards collective activity (Engeström, 2000). It is the notion of collective activity that made me select activity theory over the situated learning theory of Lave and Wenger (1991). Arnseth argues that, since

Lave and Wenger adhere to a strong version of situationism, they are not able to account for the dynamic character of collective activity. That is to say, from Engeström's perspective, their theory remains limited to the level of actions, which, in accordance with Leont'ev's (1978) tripartite model of activity, are conceived as very short lived and limited to a particular time and place. In contrast, activity systems evolve and develop through longer time-spans (Arnseth, 2008: 299).

Another principal aspect of activity theory that is visibly present within the design-build project, as defined in this research, is the principle of motivation. According to Engeström (2000: 965) a 'collective activity system is driven by a deeply communal motive. The motive is embedded in the object of the activity'.

In the design-build project, the object contributes to social change and improving the lives of others. There is an emotional connection to this visible and tangible outcome that is both immediate and easy to share. In that sense the almost euphoric feeling of achievement might tend to overpower the reflective and interpretive process. Here we need to revisit Erdman et al. (2002), who were basically saying that the object and the outcomes of design-build activities have been receiving all the attention and that a deeper exploration of pedagogy and theoretical inquiry is still lacking. One of the reasons for this attention to the object is the strong motivational drive of social upliftment and helping to improve the lives of others that exist within socially oriented design-build projects.

Garraway and Morkel explain the idea of motivation as a driving force for engagement from an activity theory perspective[3]. They write that:

> Stetsenko (2008) argues that change (transformation) is not neutral in activity theory terms, but that it is also fundamentally activist in nature. Activism, drawing on the Marxist roots of activity theory, refers to transforming the world to improve the human condition and through this particular interaction actors come to realize their own humanity. Furthermore ... activity is always purposeful for the individual subject and this purposefulness/ motive drives them to engage in the system. Where, as Stetsenko suggests, the purpose of activity within an activist transformatory framework is one of social uplift or social justice, then this too becomes the main driving force for engagement in the activity
> (Garraway and Morkel in Bozalek *et al*., 2014: 26).

Activity theory gives us a tool to describe and analyse everyday activities and ultimately to transform our practice(s). I find that the embedded idea of change and transformation in activity theory resonates with the radical humanist paradigm with which I associate myself. Change and transformation act towards the construction of consciousness. According to Ryder,

[3]Garraway and Morkel specifically explored architectural students in different work situations, that of the office and the design-build project. They are possibly the only researchers who have used cultural historical activity theory as an analytical framework related to design-build projects and inspired the use of activity theory in this thesis.

> activity theorists argue that consciousness is not a set of discrete disembodied cognitive acts (decision making, classification, remembering ...) and certainly it is not the brain; rather consciousness is located in everyday practice: you are what you do (2015: 4).

Activity theory further allows us to take into consideration aspects of history and culture. Conventional studio culture is a recognised and integral part of architectural education and in even broader terms 'architecture, at its most meaningful, is the physical embodiment of culture' (Raab & Steshyn, 2014: 54). Conventional studio culture has inherent values, beliefs, and ways of perceiving (Irvine and York, 1995). These values, beliefs, and ways of perceiving are what we would need to understand and consider in exploring the change towards the design-build studio. Activity theory provides us with a framework to do this.

1.8.3 GENERATIONS OF ACTIVITY THEORY

Activity theory is a living theory that is still developing. I am working within what is generally acknowledged to be the third generation of activity theory (Figure 1.6) as developed by Engeström (1987). First-generation activity theory is premised on Vygotsky's theory of social learning and the idea of cultural mediation. Diagrammatically it is presented as a single triangle with subject (individual), object (with an outcome) and tools that are in a relationship with each other within the activity.

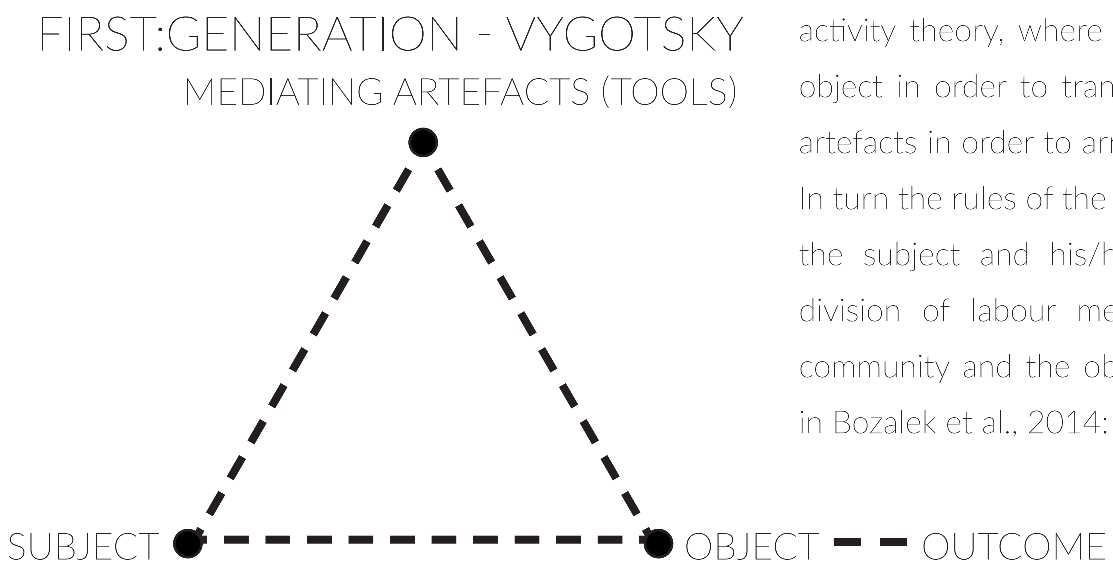


Figure 1.6: First-generation activity theory (Yamagata-Lynch, 2010: 17)

Second-generation activity theory saw Leont'ev develop individual activity into the idea of collective activity. While Leont'ev incorporated the concepts of an activity being collective and object-oriented, driven by motivation and 'hierarchical levels of human functioning, Leont'ev's theory does not go far enough to situate human functioning in context' (Hardman & Amory in Bozalek et al., 2014: 15). Engeström developed Leont'ev's three-level model of activity and conceptualised a dynamic activity system (Figure 1.7), referred to as second-generation activity theory, where 'the subject acts on the object in order to transform it using mediating artefacts in order to arrive at specific outcomes. In turn the rules of the system mediate between the subject and his/her community, and the division of labour mediates between his/her community and the object' (Hardman & Amory in Bozalek et al., 2014: 16).

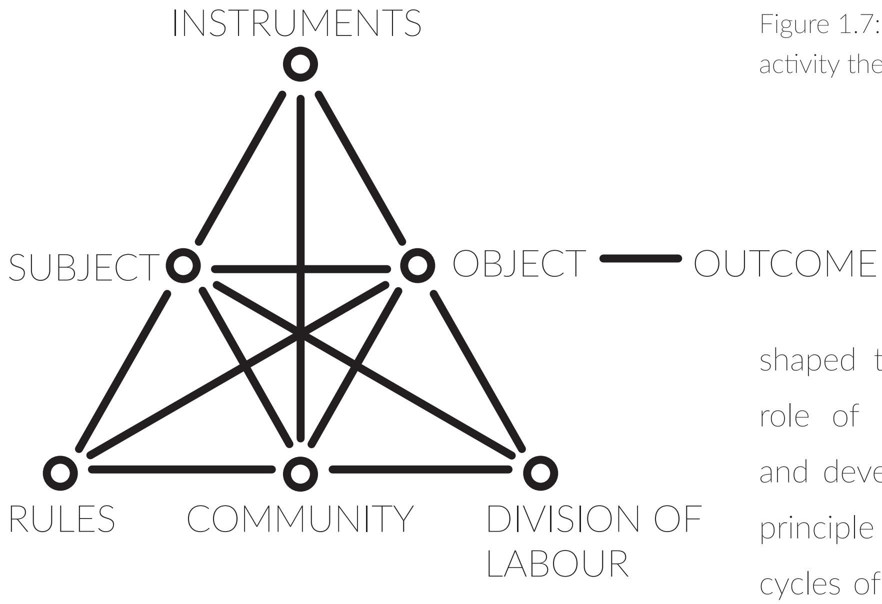


Figure 1.7: Third-generation activity theory (Engeström, 2000:962)

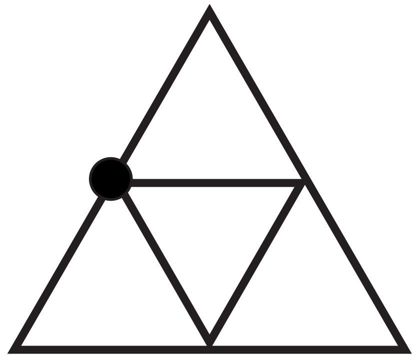
Third-generation activity theory was developed primarily by Engeström to study the relationships between activity systems. Third-generation activity theory is used in complex educational and social situations to explore contradictions in the activity systems as 'sources of change and development' (Engeström, 2001: 137). There are five basic principles for third-generation activity theory. The first is that the prime unit of analysis is 'a collective, artifact-mediated and object-oriented activity system' (Engeström, 2001: 136); the second is multi-voicedness, participants have various and different positions, histories and views; the third principle is historicity, which is the idea that activity systems develop over time and the history of the activity system has shaped the activity; the fourth is the 'central role of contradictions as sources of change and development' (Engeström, 2001: 137) and principle number five is the premise of expansive cycles of qualitative transformation (Engeström, 2001).

In third-generation activity theory there are at least two interacting activity systems (Engeström, 2001). In this thesis the primary system is the design-build activity system. There are several other activity systems to consider, and some of these are conventional studio education and professional practice, both conventional and alternative. Third-generation activity theory supports the concept of boundary crossing (Engeström, 2001: 135). With design-build projects situated on several boundaries within the architectural landscape, the relationship that the design-build activity system has with the other activity systems becomes the prime unit of analysis.

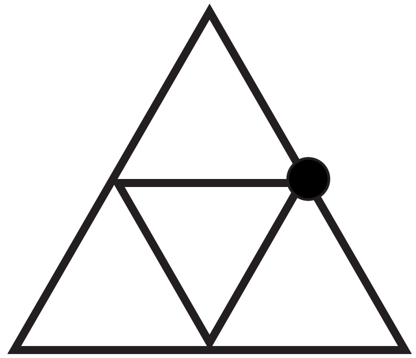
1.8.4 ELEMENTS OF THE ACTIVITY SYSTEM

The different elements of an activity system (Figure 1.8) are illustrated and explained below. The basic activity theory diagram by Engeström (Engeström, 2000: 962) is graphically simplified to exclude text to a great extent. This is in keeping with the graphic development of the document. After the elements various activity systems are introduced.

SUBJECT: In activity theory the subject is the person (or persons, defined by Engeström, 1987, as a 'collective subject'), i.e. a primary actor/agent, who is the source of an activity and the starting point for the analysis (Torres et al., 2011: 8). This research is presented from the perspective of different subjects in the design-build activity system.



OBJECT: The object of the activity in this research is the design-build project. Various definitions are investigated and six design-build typologies are posited as a presentation of the full spectrum of design-build projects (refer to Chapter 3). Of the six typologies inhabitable, full-scale investigations are the primary object of this research.



RULES: The rules for a design-build activity system are developed from the definitions and the rules applicable to inhabitable full-scale investigations and are discussed in the literature study (Chapter 3).

TOOLS: The rules tell us where we are and could and want to be, the tools tell us how it is possible to get there. The rules will define design-build projects; the tools can aid in reaching that definition and ultimately the outcome(s). The tools are mediating human thought and behaviour, and tools bring in the cultural and historical. In tools we will discover what others have done and used within the design-build activity system.

COMMUNITY: Community is a larger group with the subject as participant. Communities share the same objects, are governed by rules and divide tasks among participants who belong to a particular activity system (Torres et al., 2011: 21).

DIVISION OF LABOUR: Division of Labour is related to the organisation of the activity system, linked to roles, tasks and power relationships in an activity system (Torres et al., 2011: 26).

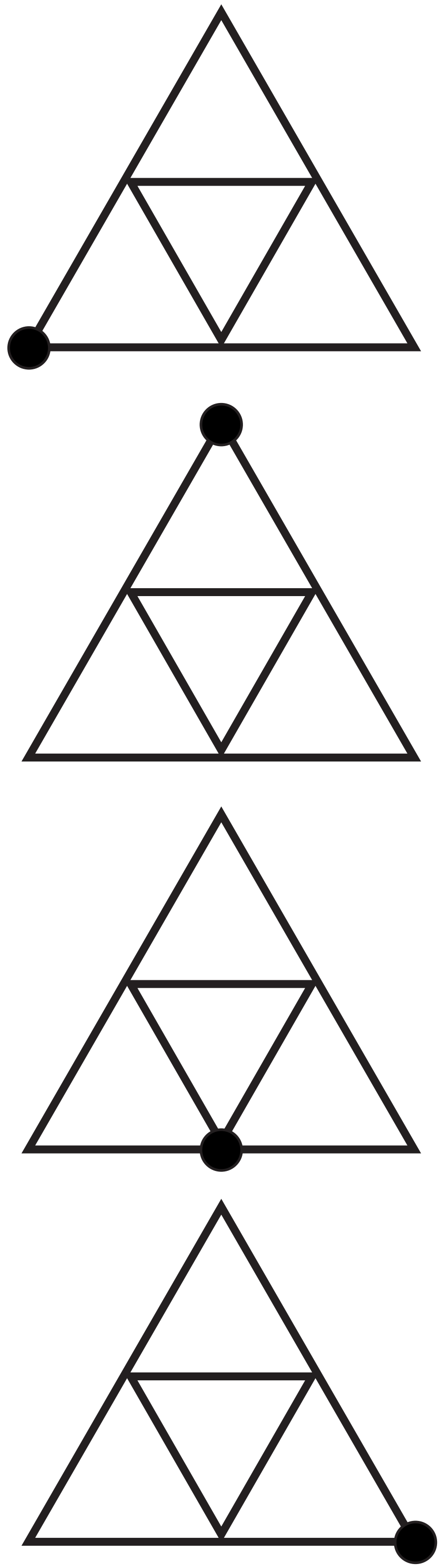


Figure 1.8: Different elements of the activity system represented graphically

1.8.5 ACTIVITY SYSTEMS IN THE RESEARCH

The design-build and conventional-studio activity systems are introduced as juxtaposed in this research. The juxtaposed systems are mirrored across the graphical boundary line. The principles of this graphic method of indicating the systems are depicted in Fig 1.9.

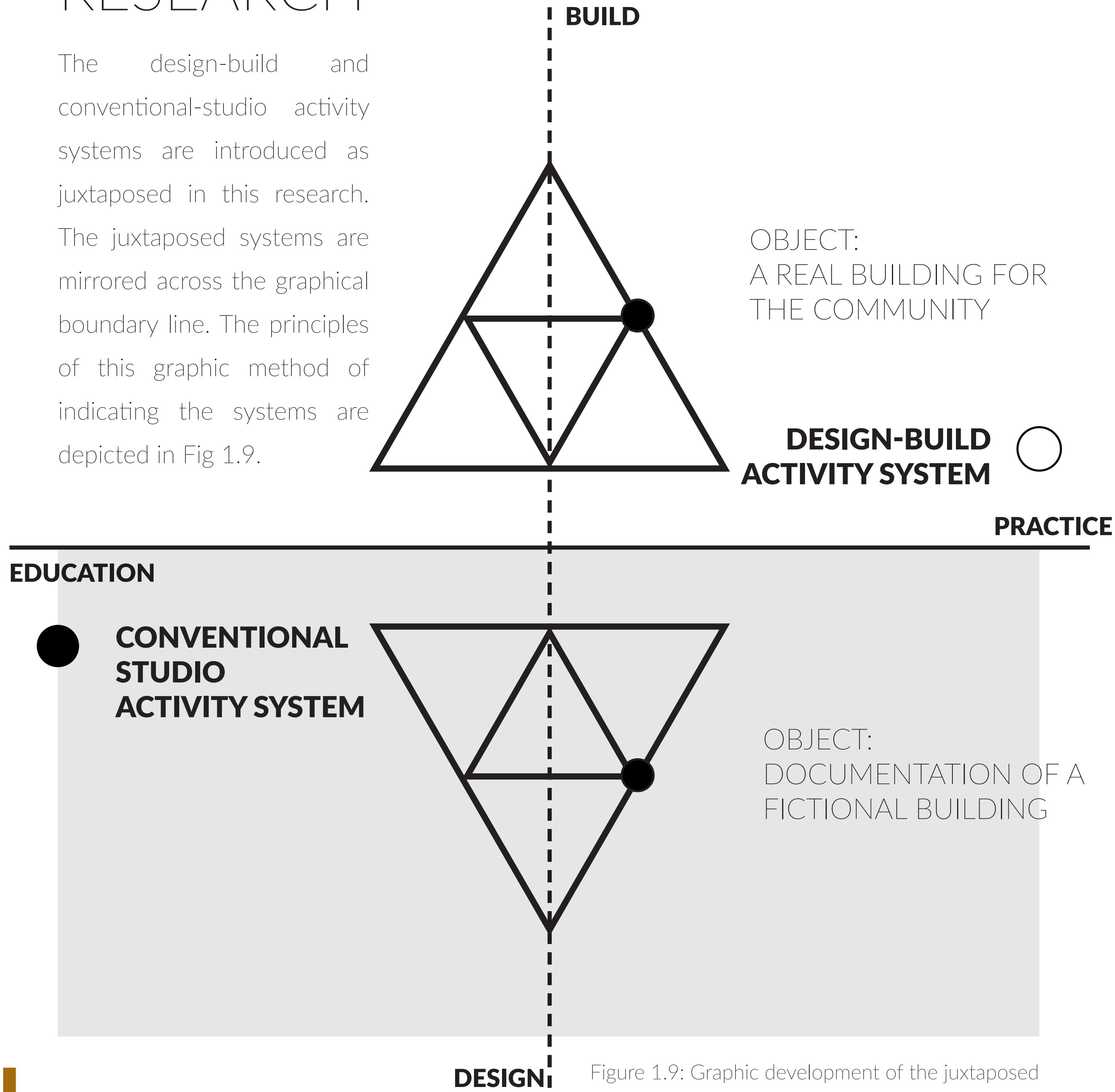


Figure 1.9: Graphic development of the juxtaposed activity systems

1.8.6 ACTIVITY THEORY IN THIS RESEARCH

The exploration of the contradictions between a conventional studio activity system and a design-build activity system is part of the premise of this research. It does not form the main premise of the research, but needs to be understood as contextual background for the research. These contradictions are further explored in the literature survey in Chapter 3.

> Activity theory proposes that activity cannot be understood without understanding the role of artefacts in everyday existence, activity theory is concerned with practice, that is, doing and activity, which significantly involve 'the mastery of ... external devices and tools of labor activity (Ryder, 2015: 5).

Activity theory allows us to have a broad and holistic view of the design-build activity system. Harriss and Widder explain that

> attempts to develop complicated pedagogies of architectural education struggle precisely because they tend to focus their attentions on either the internalized processes of experience and reflection or the binary teacher-student learning relationship, thereby neglecting the complex overlapping contexts of education (Harriss & Widder, 2014: 57).

Activity theory moves beyond the internal and binary relationship towards understanding collective action and motivation within the activity system.

In this thesis the perspective shifts to and from the academic as subject towards the student and practitioner as subject. Collaboration is highlighted as an emerging pattern and as the main contradiction between the conventional studio activity system and the design-build activity system. Collaboration is posited as both a tool and a rule in the design-build activity system. The motivation within the system distinguishes the design-build activity system from the conventional studio activity system.

In essence the change in object from the conventional studio activity system towards the design-build activity system allows the externalisation of theoretical knowledge in a realistic and practical setting. Not only in terms of the making of architecture but also in the real relationships created with the client/community and with fellow professionals.

1.9 THE SIGNIFICANCE OF THE RESEARCH

The contribution of this explorative research is the conceptualisation of theoretical, pedagogic and practice constructs that has the potential to inform design-build projects and research. The most significant are highlighted here:

- Activity theory is introduced as a framework for the research discussion with the intent of suggesting a theoretical underpinning for future research.

- Design-build definitions from the literature are expanded to introduce design-build typologies that could possibly influence the understanding and positioning of future discussion of design-build projects.

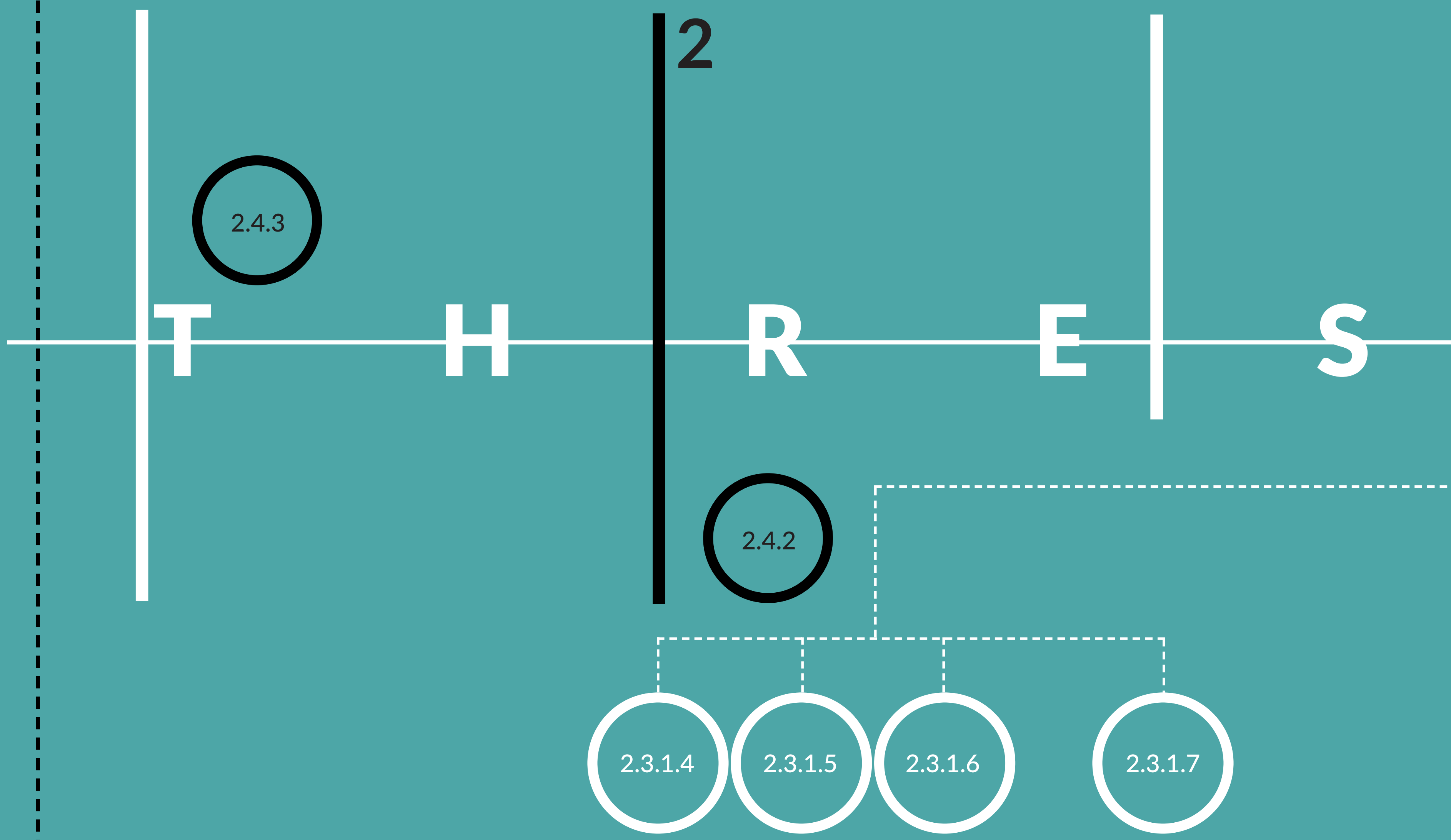
- Collaboration is the foreground as inherently situated within design-build projects, and a number of conceptual collaborative frameworks are explored.

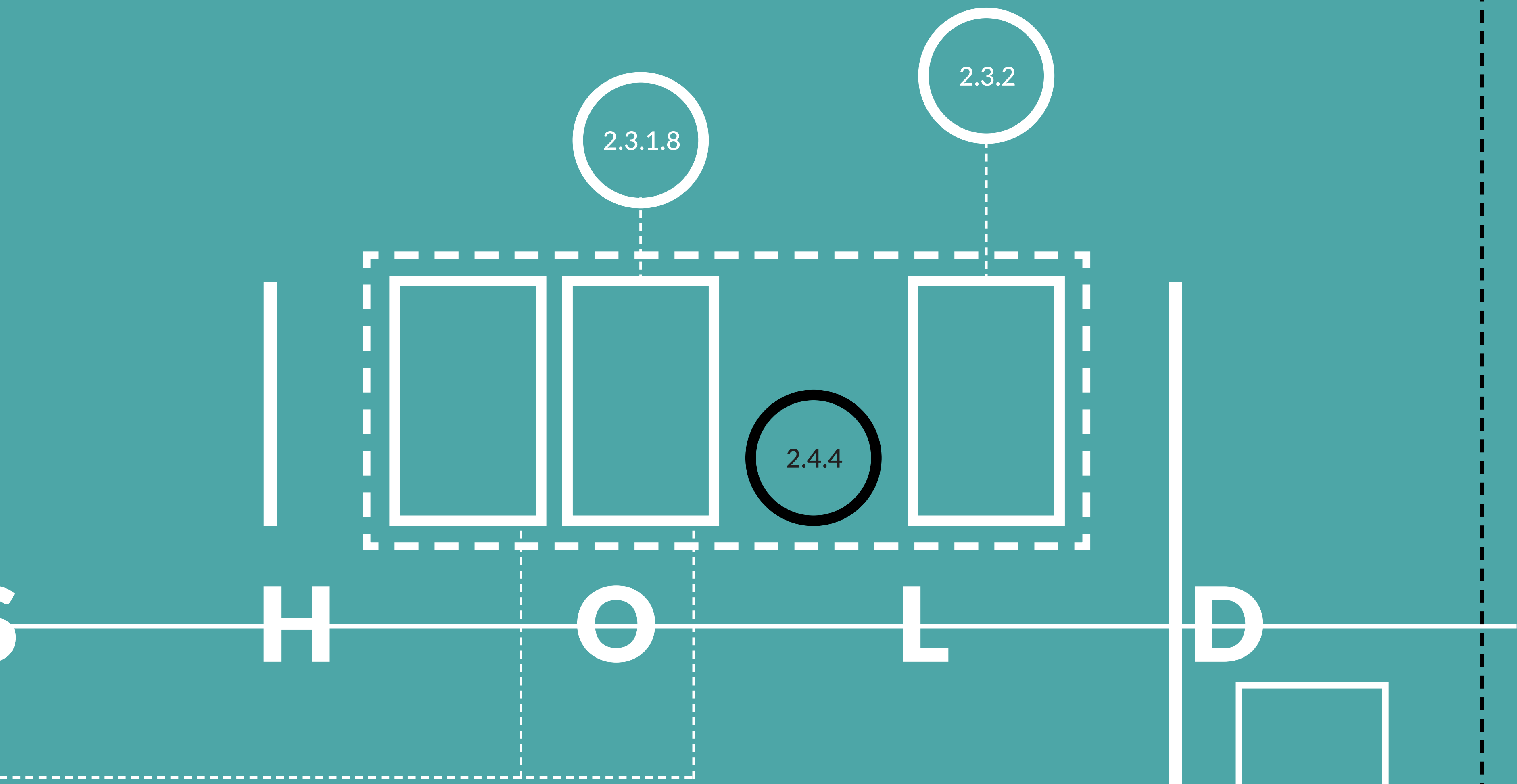
- A path from design-build education to the design-build professional is highlighted to extract method, skills and attributes that can be introduced for nurturing future design-build practitioners.

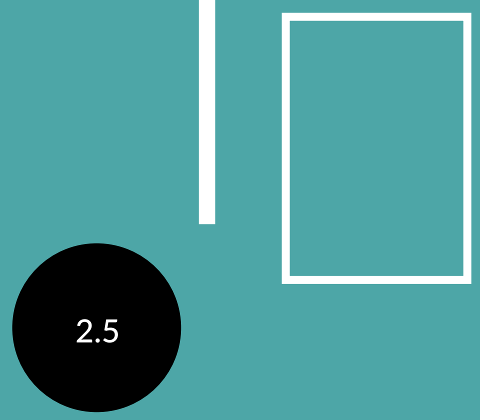
1.10 SUMMARY

Chapter 1 served as foundation for the research journey and the development of the thesis document. It provided the reader with a contextual perspective of design-build projects in architectural education and introduced activity theory as an underlying framework for the research exploration. Chapter 2 follows and introduces the research design, the data elements, the research methods and the limitations and delimitations of the research.

2







Conceptual design has been described as the art of seeing the design situation in multiple ways or ‘seeing as’. Designers are used to performing this little dance around a problem, taking stabs at it from different sides. This may sound chaotic but if done well it allows one to build up an integrated picture in the end (Lawson & Dorst, 2009: 26).

CHAPTER 2

BLUEPRINT

2.1 INTRODUCTION

The aim of the design of this qualitative, explorative research was to attain the integrated picture that Lawson and Dorst refer to above. To this end, the research design is underpinned by my inherent belief in the epistemology of social, hands-on construction and the methodological value of the design process.

My epistemological belief is linked directly to the object of this research, the design-build project, which is a physical and hands-on activity. Learning in the design-build activity can be understood through the principles of constructionism (Papert & Harel, 1991), in a simplified sense the idea of learning-by-making or learning-by-doing. I applied these principles to my research process as well. My experiential knowledge of the design process as a reflective, iterative process also found resonance with the research process and assisted me in continuously evaluating and revising where the research was headed.

2.1.1 RESEARCH PROCESS: OVERVIEW

The research process had two predominant sections. The underpinning reasoning for this is explored in the next part of this chapter. The two sections are the parts that form the whole of this thesis and are separated from each other by a 'transitional midpoint proposition' (Bachman, 2010: 271). At the same time the sections also overlap across this midpoint. The midpoint in the context of this research document is referred to as the threshold between the two sections.

Each research section contains some data-generating elements. In the first section of the process I took an active and physical part in what I was researching, exploring by immersing myself physically in four data elements. These were four design-build constructions in which I worked side-by-side with my students. Here I want to echo Nepveux, who writes about his own design-build research project and explains that 'to study a phenomenon that is highly focused on learning through direct experience I chose a research method (participant observation) that does the same' (Nepveux, 2010: 78). Also, during the first section of the research, I presented my work at a number of conferences and took part in an international design-build education symposium and exhibition in Berlin (Hartig, 2012). This allowed me to continually explore the developing literature concerning design-build projects and to discuss my own work with and get reflective feedback from other academics.

In the subsequent and more synthetic section of the research, as patterns started to emerge, I stepped away to some extent from being completely immersed in the process and became more of an external observer. One more design-build construction and an interview with the practitioners of a design-build professional practice became the data elements in the second section. Three explorative windows were opened in this section of the research and are in essence the strategic culmination of the path informed by the transitional threshold. The research design, data elements and research methods should be understood as reciprocal and intertwined, separated only in terms of their presentation on paper in this document to enable a clearer understanding of the research journey.

2.1.2 ORGANISATION OF THIS CHAPTER

The chapter organisation is graphically presented in Figure 2.1. The body of the chapter contains four main parts, the research design, the data elements, the research methods and the limitations and delimitations of the research.

2.1.2.1 RESEARCH DESIGN

The chapter commences with a broad introduction and exploration of the architectural design process as research process. To explore this process I introduce ideas of Bachman, Hamdi and Van den Akker. This exploration establishes the overarching principles that influenced the conceptual idea for the research process.

2.1.2.2 DATA ELEMENTS

The chapter then proceeds to introduce the various data elements. These are the four plus one design-build constructions (St Michael's 1, St Michael's 2, St Michael's 3, Sutherland and Hangberg) and the interview with the design-build practitioners of *Change Practice*[1].

Data gathered from the design-build constructions primarily informs the exploration of question 1 and 2i of this research. These questions are:

1. What are the unique educational opportunities and possibilities present in the design-build project?

2.i. How do these unique opportunities and possibilities potentially inform the development of future design-build projects and the broader architectural curriculum?

Data gathered from the interview primarily informs the exploration of question 2b of this research. This question is:

2.ii. How do these unique opportunities and possibilities potentially inform professional architectural practice?

[1] Name was changed

2.1.2.3 RESEARCH METHODS

The research methods are presented next. These are the graphic development of the document, the approach to the underpinning literature study, the methodology for each of the three windows opened in the landscape.

2.1.2.4 LIMITATIONS AND DELIMITATIONS

Lastly, the limitations and delimitations of the study are presented. The context of the researcher and the selection of the data events are the main discussions points.

2.2 RESEARCH DESIGN INTENT

This section on research design intent provides insight into my own thoughts and the ideas of others that influenced my conceptualisation of the research process. It is organised by looking first at the architectural design process as research process, then Bachman and research, Hamdi and participation, and lastly Van den Akker and educational design-based research.

2.2.1 THE ARCHITECTURAL DESIGN PROCESS AS RESEARCH PROCESS

The architectural design process, like any other design process, can be described in stages, cycles or as a series of iterative activities. Fisher describes iteration as a 'tool of design' (Fisher, 2015: 52). The design-build activity is similarly grounded in the design process, it is iterative and speculative, it looks for and makes use of opportunities that arise out of circumstances, action and collaboration. The design-build activity simultaneously promotes reflection, assessment and prioritising of ideas, activities and execution towards a variety of outcomes. My research was developed from this design process perspective or, to phrase it differently, by using a 'design-oriented approach' (Grocott, 2010: 2).

My practical experience and knowledge of the architectural design process served as a heuristic technique in my research process. Heuristic techniques have the capacity 'to solve unsolved problems, find new paradigms and introduce new methods into science' (Jungius in Kleining & Witt, 2001: 2). I understand exploration, the premise of the radical humanist, and discovery as embedded in the design process.

> Designers do not just work in (inside) a design project, they also create overviews of the design project to monitor its progress; they have to step back from the hands-on level of working within the project to reflect [on] what they are doing. This reflection on action can lead to devising new 'frames' or 'moves' (or series of moves, patterns of which can be captured in more or less formal 'design methods') to develop the design project (Lawson & Dorst, 2009: 62).

The design process echoes characteristics of explorative research. Kleining and Witt (2001) propose a set of rules to guide qualitative heuristic research. These resonate with the design process as it asks for letting go of any preconceptions, always being open to new concepts, realising that the research topic might only be confirmed at the end of the research, after proper exploration, making use of a variety of data collection methods and perspectives to include all possible views and looking for similarities in the data to discover patterns of structure.

The premise that explorative research and the design process are intertwined and support discovery and diversity both appealed and applied to me. However, I also proceeded with a measure of caution to not just unequivocally equate the design process to the research process. In this respect I found resonance with Bachman's (2010) and Hamdi's (2011) perspectives on the architectural design process and from a more generalist educational perspective with principles of educational design-based research (Van den Akker, Bannan, Kelly, Plomp & Nieveen, 2007).

2.2.2 BACHMAN AND RESEARCH

Both Bachman and Hamdi, for different reasons, propose reversing typical stages of the design process. Bachman, in a more theoretical manner, specifically links this reversal to the research process, while Hamdi, in a more practical manner, is concerned with redirecting the design process in participatory community projects. Studying Bachman influenced my theoretical perspective and understanding. By consulting Hamdi I found he had ideas similar to those of Bachman, but the ideas are linked to community* participation, which forms an underlying premise of my research.

In a design activity the conceptual idea leads to an integrated picture and the realisation of a designed object. In a research activity it leads to a new contribution to the knowledge field. Both activities can be described as culminating in a 'new accepted wisdom which is generalizable and useful' (Bachman, 2010: 2).

Bachman asserts that architectural design inquiry and architectural research inquiry share three 'punctuation points' (Bachman, 2010: 470). These are an initial problem definition point, a midpoint where a proposition is made and an endpoint where a new architectural wisdom is disseminated (Figure 2.1). He points out, however, that it is the activities between these points that differentiate design inquiry from research inquiry. He writes that

> ... in design inquiry, the process between beginning problem definition briefing and midpoint propositional design intention can be described as generative-methodical in terms of the analytical thinking it usually entails: programming, site analysis, precedent reviews, code analysis and other aspects of strategic planning. Once this generative-methodical process leads to an adductive proposition midpoint, design then continues with the more creative-philosophical process of physical design from conceptual to schematic and on toward the endpoint of a realized work of novel architectural wisdom. *In broad conceptual terms, research-as-inquiry reverses those two processes*. Here the initial span from beginning

In this thesis 'community' is used to refer to predominantly underprivileged communities in South Africa that do not have the financial means to afford architectural services. Where only the word 'community' is used, it is used to refer to a concept within activity theory that refers to all role players taking part in an activity.

doubt and curiosity to midpoint research propositional hypothesis is the creative-philosophical one. *This is where a significant gap in existing knowledge is identified by analysis and exploration of existing knowledge*. Everything after that in research is essentially methodical-generative towards the synthetic results and findings published for peer review (Bachman, 2010: 470, my italics).

Bachman's description made me aware that the first part of the research process was not only about understanding the context in which I was working, that of the educational design-build project, but also about exploring it from a creative philosophical position. It is a process more divergent than the design process that aims to synthesise ideas into a proposal for functional artefact or building. The main idea with the first stage of the research was therefore to find the question(s) that I should be answering.

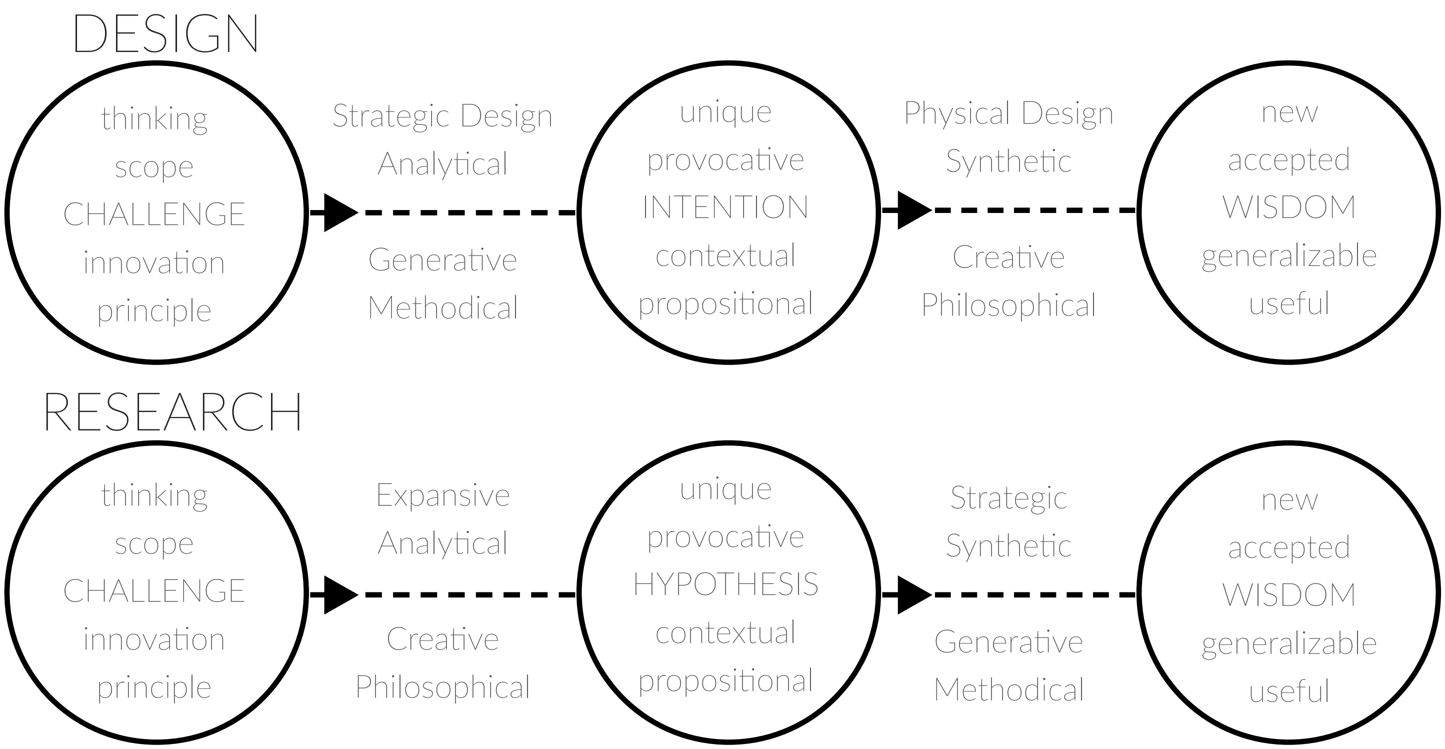


Figure 2.1: A framework for problem space models in design inquiry and research inquiry (Bachman, 2010)

2.2.3 HAMDI AND PARTICIPATION

Both Bachman and Hamdi provided me with insight into my own research process. I did not set out just to solve a specific predetermined question or problem or simply to do a methodological study of the design-build project. The intent was to explore and discover, through immersing myself in design-build constructions and the investigation of existing knowledge and know-how, that which is still not understood and theorised, and that which should be explored further. I did not intend to exclude any new information or chance encounters until the day I submitted my thesis.

Hamdi (2011) writes that architects, in tackling complex societal issues such as housing, tend to follow a very linear process where, after the proposal has been made, little room is left for new or chance discoveries and inputs. Architects typically engage with the design process precisely as Bachman also describes it, starting with a process they know, surveying and analysing, then planning and implementing. Hamdi explains this typical design process as usually excluding deeper social problems and ignoring new problems or opportunities that arise in the second part of the process. These deeper problems often are the underlying cause of the societal issues to begin with, and cannot be discounted. Hamdi describes a real process where

architects, typically, had turned the complex process of housing into things they could design. People became the objects rather than subjects of design (ibid, 3). To avoid this scenario he proposes reversing the typical design process. *It demands we work backwards: profile the problems, opportunities and aspirations; sort out goals and priorities; explore options and the trade-offs between options; then get something going, an action plan – a small practical intervention, a catalyst that would serve as an agent for change* (Hamdi, 2011: 7).

Hamdi's approach influenced my research process by making me aware of avoiding preconceived and overly designed answers. It meant delving into the process of making actual design-build constructions early on, starting that first small practical intervention, St Michaels 1. I had to allow all complexities, inputs and chance discoveries to emerge and inform the further development of the research. Waddell (2014) summarises Hamdi's intent for the design process well, and to my mind it can be transferred to the research process:

Hamdi suggests we think of design as a process that is wholly situated, as something that occurs incrementally over time; as opposed to conceiving an end result, that instantly restricts possibility and people's involvement within the process. *The plan may then unfold in several directions, reactive to changing objectives, as the final result is never defined* (Waddell, 2014: 5).

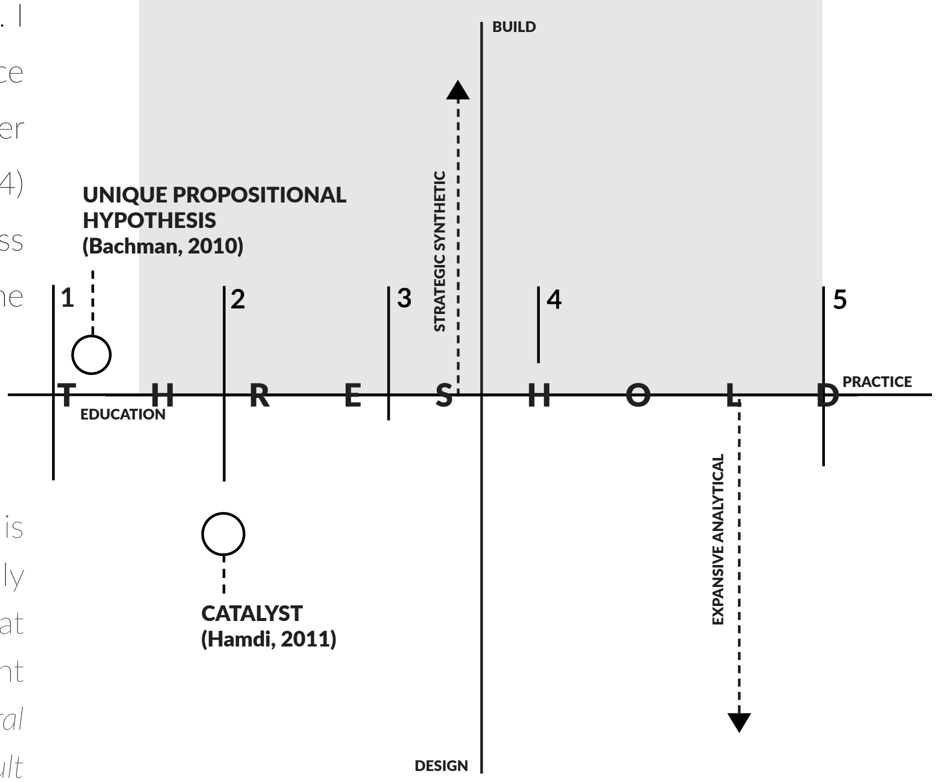


Figure 2.2: Incorporating ideas of Bachman and Hamdi

The design-build theoretical and practical field is developing continuously and new information emerges, much like Hamdi (2011) describes the typical context of a community project that constantly evolves. Understanding aspects of the research process as reversed from the typical design process allowed for 'practical and strategic work to run in parallel' (Hamdi, 2011: 15) and for keeping an open mind until the end.

Bachman acknowledges that the modes of inquiry are not simply a linear process, but he presented it graphically so as to make the two modes of inquiry clear. He says that 'both activities are more complex and messy' (Bachman, 2010: 470) and this is echoed by Pallasmaa (2011) and Cross (2001). The design process and, by deduction, the research process are iterative and often loop back on themselves. For the sake of the 'underlying theories ... (to) ... be more readily examined if the basic relations are clearly stated as a conceptual framework' (Bachman, 2010: 470), a linear type of graphic is also adopted in this thesis for explaining both the organisation and execution of the process.

However, Figure 2.3 below acknowledges the more complex and interrelated relationship within the research process by connecting parts within the linear graphic. The research process, the data elements and the research methods informed each other from the beginning to the end.

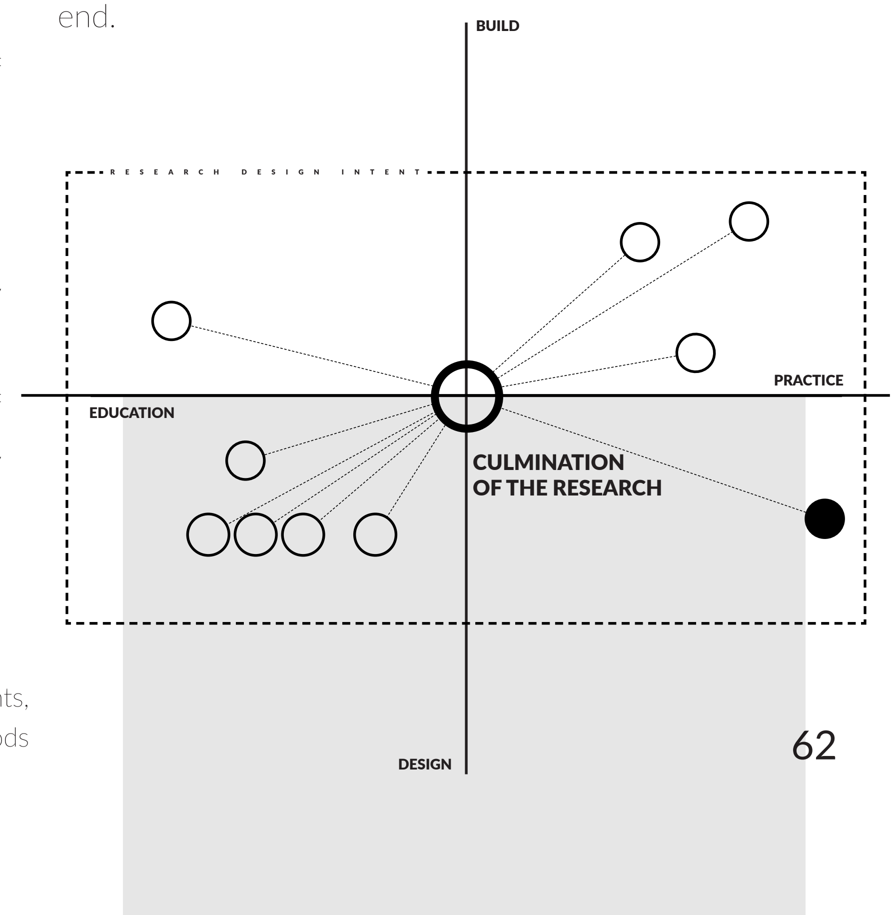


Figure 2.3: Interrelationship between process, elements, methods

2.2.4 VAN DEN AKKER AND EDUCATIONAL DESIGN-BASED RESEARCH

Some principles of educational design-based research guided the development of the various design-build constructions during the generative-methodological stage of the research. The aim was not to develop a set of guiding principles for design-build constructions per se, but to use the constructions simultaneously as a way to immerse myself in the practice of design-build and to explore and evaluate these interventions in my own context. In my research, after and during each construction, active reflection helped to establish directives for the subsequent construction. However, the aim was not necessarily to improve the specific practice of the previous construction (improving practice is predominantly the premise of educational design research), but to rather gain a broad understanding of various iterations of the process as understood from the literature and from the lived hands-on experience. The reflections and subsequent adaption of the construction methodology were based not only on my own experience, but also that of collaborating colleagues and professionals, the students and the community* where the work was executed.

To design the first construction I used knowledge gained from design-build literature available at the time to build an understanding of the possible procedural and pedagogic aspects, as well as my own knowledge and know-how of developing more conventional studio projects.

Educational design research is defined as

> the systematic study of designing, developing and evaluating educational interventions (such as programs, teaching-learning strategies and materials, products and systems) as solutions for complex problems in educational practice, which also aims at advancing our knowledge about the characteristics of these interventions and the processes of designing and developing them
> (Van den Akker *et al.*, 2007: 13).

This definition of educational design research resonates with a number of the principles for design-based research as proposed by Hinson and Miller. Their proposals were specifically to ensure rigour in the research process during the development of design-build projects (Miller & Hinson, n.d.; Hinson, 2007). These principles include analysis, reflection and looking beyond the scope of a single project.

The application of design principles or local theories from both the literature and my own lived constructions in the development of each subsequent construction allowed for 'not only developing an intervention, but at the same time exploring the validity of design principles (theory) developed in another context' (Van den Akker *et al.*, 2007: 24).

The aim of this section was to give the reader some insight into my conceptual thoughts on the research process. The next section introduces the data elements.

2.3 DATA ELEMENTS

The research process was punctuated with different data elements. The elements included five (four plus one) design-build constructions and an interview with the practitioners of a design-build professional practice. Each data element has a relationship with the three windows in the landscape, as depicted in Figure 2.4. The design-build constructions are a simulation of the activity system that is the unit of analysis of this thesis and are presented first. This presentation is followed by an introduction to the interview.

The literature study was not primarily designed as a data element, although it contributed to the development of the propositional threshold. The literature rather formed part of the general methodology; it is therefore discussed in the next section under research methods.

A variety of qualitative data-gathering methods were used and varied instruments were selected for the different data events (Kleining & Witt, 2001). The methods were explored and constructed as much as the research itself to ensure that all voices were heard. Each data event presented subtle differences; student groups' sizes differed, professionals involved differed and project methodology differed. These differences needed to be accounted for to some extent in the method of data collection.

The data collection methods included the researcher as participant and observer, unstructured and semi-structured interviews, open-ended reflective essays, structured and semi-structured reflective diaries. Physical drawings and models also formed part of the data collection. Social media served both as reflective space and to capture sequencing and images of events.

2.3.1 THE FOUR PLUS ONE CONSTRUCTIONS[2]

Architectural constructions organize and structure our experiences, beliefs and fantasies of the world; they project distinct frames of perception and experience, and provide specific horizons of understanding and meaning (Pallasmaa, 2009: 1).

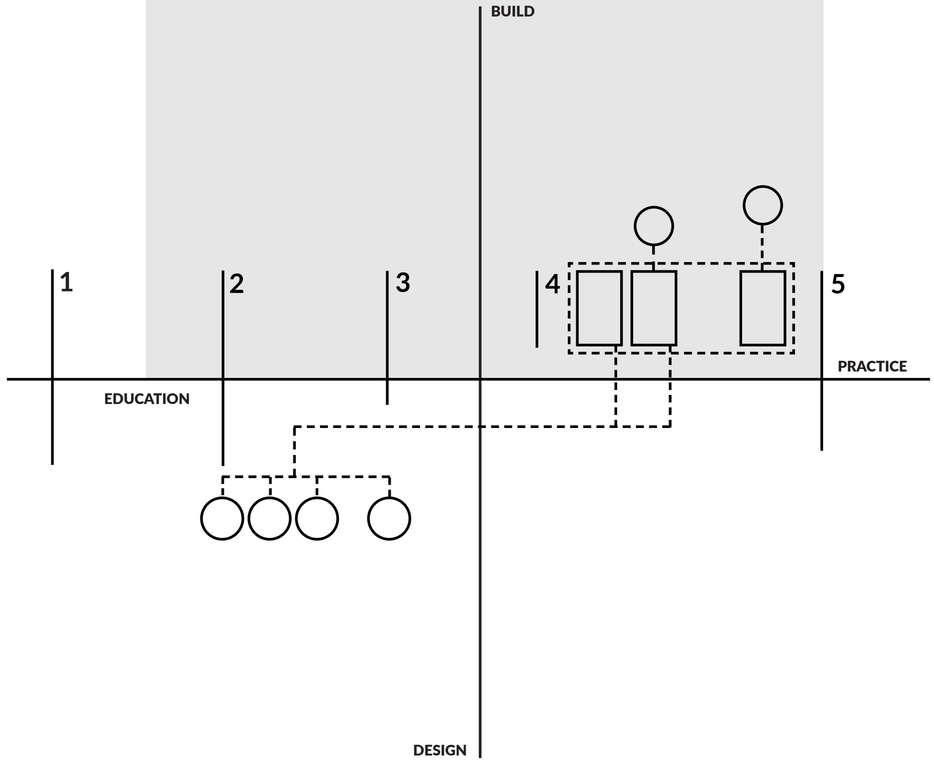


Figure 2.4: Data elements and the relationship to the three explorative windows

[2]Some of this information is repeated in a shortened version in explorative window 2 of Chapter 4.

2.3.1.1 BACKGROUND

Data gathered from the design-build constructions primarily informs the exploration of questions 1 and 2a of this research and is presented in explorative windows 1 and 2 in Chapter 4. The design-build constructions were my first attempt at such constructions in my academic career. I has also not experienced such projects during my own studies. I had no immediate examples to follow and therefore searched for precedent in the literature. The first three constructions were executed at the same school, St Michael's, in Grabouw in the Western Cape. These were followed by an 'unbuilt' construction in Sutherland, and finally a construction in Hangberg.

The first four design-build constructions (St Michael's 1, St Michael's 2, St Michael's 3, Sutherland) were situated in the expansive analytical section of the research (Bachman, 2010). During this time I was still searching for the conceptual idea, or as Bachman explains it, the 'transitional midpoint proposition' (Bachman, 2010: 470). I attempted to explore and familiarise myself with the constructions through active organisation and participation. It is only the very last construction, Hangberg, which I consider to be part of the strategically synthetic, generative methodical section of the research process. In the Hangberg construction I was able to focus specifically on the hypothesis that had emerged through the immersion in the previous constructions and the continuous literature study, hence the four plus one as title.

During the first part of the research process I was also simultaneously attempting to integrate design-build projects into the curriculum of the university of technology where I teach. This process brought along its own opportunities and challenges, most which resonate with the literature as described in Chapter 3.

In presenting the stories of the constructions I view myself, the academic, and the other participating academics as the subjects in the design-build activity system. Pedagogically it is almost easier to explain the approach to the projects from how the design-build constructions differ from conventional studio projects. This idea of juxtaposing the two activity systems is used throughout the thesis to help contextualise the design-build activity. It is not meant as critique of the conventional studio, although it does provide comment on it.

In many ways the conventional studio activity system and the design-build activity system are similar, with a few important exceptions. Some of these exceptions include that in the design-build constructions students are more involved right from the inception of the project. In the design-build constructions, instead of defining the brief for the students, the brief was defined with them.

The design-build process also stretched over a much longer time period than a conventional studio project. Students were still evaluated individually, but worked predominantly in teams.

During each construction, students followed a rigorous conceptual design process, but with the additional constraint that the design would really have to be built. For the different constructions different approaches were followed towards finalising and deciding on the design to be built. This was done mainly to test various methods that were described in the literature. These different approaches will become clearer in the descriptions below.

> Perhaps the primary difficulty faced by design- build programs concerns their reception within their own institution. Programs of all types face purposive and unintentional scrutiny, misunderstanding, mistrust, and marginalization by colleagues, administrators, and students. It is a testament to both luck and will that many of the projects ever see the light of day, much less get built (Canizaro, 2012: 30).

2.3.1.2 DATA IN THE DESIGN-BUILD CONSTRUCTIONS

For the three St Michael's constructions, I was an active participant-observer. Data was gathered mainly through participation in the design and development process and through observations on site, unstructured interviews with students and professionals, students' reflective essays, design and construction drawings and discussions on social media. Many photographs were taken and short videos made. Data gathered from students during each construction is described more specifically below.

In St Michael's 1 written comments from students were extracted from their student blogs (which they were required to keep as part of their second-year experience). Comments on the blogs were unsolicited and not compulsory, but part of their general diary keeping. Similarly, on the Facebook page created specifically for the construction, comments were made by choice. Students were also required to write a reflective essay on the design-build process they experienced. From the essays data was grouped into themes developed from the literature study.

In St Michael's 2 semi-structured interviews with students were held and the data transcribed and grouped into themes developed from the literature study. For St Michael's 3 students received paper-based diaries in which they were required to keep reflective notes and drawings each day. Data from the diaries and comments from social media were first transcribed and then thematically analysed.

In the Sutherland construction comments from social media and informal discussions with students were first transcribed and then thematically analysed. An additional source of data was the combined representational submission students made of the conceptual design, which included a document and models as well as recordings of collaborative design discussions. In the Sutherland construction there was no final built object.

With the Hangberg construction the research moves into the strategic synthetic part of the process. In this construction the data collection was more focused on collaboration and my role changed from participant observer to predominantly being observer and on-site interviewer rather than active participant (although it was not entirely possible not to participate). Semi-structured interviews were held on site with the client and the professionals involved, and students were given a reflective diary to complete. The diary contained structured questions as well as space for open-ended reflection. Drawings and sketches by students, discussions on social media and a professional video of the process served as further data. Data was transcribed into themes according to the collaborative framework proposed in explorative window 1.

2.3.1.3 STORIES OF THE DESIGN-BUILD CONSTRUCTIONS

I will convey the chronological and executive part of each project with an album of photographs for each construction. It is the closest the reader will come to the actual, physical experience on site, and since the physicality of these projects forms an important part of exploring the activity, I found it the best way to describe the constructions. Also, since I was a participant observer in these projects, I found it necessary to convey the stories of each construction.

2.3.1.4 ST MICHAEL'S 1 (STM1)

The first construction was an outdoor classroom at St Michael's. This is a multi-grade rural school in Grabouw. The university was already involved in a number of multi-grade schools throughout the region through a special educational programme. The aim of the St Michael's project from an architectural perspective was to improve the spatial teaching facilities for teaching more than one grade in one class.

Second-year architectural technology students took part in this project as part of their experiential training year. During their second year, students work in architectural offices and visit campus for a number of academic blocks. The second-year students were selected for several reasons. Being on site would take students to a different site of learning (Garaway & Morkel in Bozalek, Ng'ambi, Wood, Herrington, Hardman, *et al.*, 2014), beyond the studio and the office. It was further envisioned that the construction would predominantly be timber frame, as this is part of the second-year curriculum and would also allow for constructing something worthwhile within the two-week span we had for the actual building part of the activity. They were therefore not bound to a timetable, which made organising a 'block' of time possible.

To me, this project represented the first steps into design-build territory. Although I commenced with the preparations on my own, I soon acquired the help of a colleague. During the on-site phase, we were assisted by two professionals, one a local architect-builder and the other a natural-building specialist.

The design-build construction process for the students commenced during their first academic block in February 2011 and lasted until the end of that year. There were 63 students taking part in the entire process, which is quite a large number for a design-build construction. The project was situated within the curriculum and consolidated aspects of design, theory and construction.

Images 2.1 - 2.9: Students at St Michael's 1. Preparation and on-site design

In February 2011 students went on their first site visit. During this site visit students had to familiarise themselves with the context. They met the principal and teachers, with whom they could converse and discuss ideas and were able to observe their actual clients, the Grade R to Grade 7 pupils, in their classrooms and on the school grounds.

In groups the students took photographs, measured the existing site and buildings and gathered a variety of contextually relevant information. This information was consolidated, the necessary drawings prepared and each group submitted a set of base information, which was later used during the design process. Until June students were guided to study and design other conceptual projects involving timber-framed construction in preparation for the design-build project. The actual design exercise commenced with a collaborative brainstorming session during the academic block in August. Design options were discussed, which ranged from creating platforms for group work within the existing classrooms to the idea of an outdoor classroom and gathering space. Students had to take into account various practicalities, such as the idea that they were going to build this themselves, that the building work would be executed while the school was operational and the availability of transport and materials.

These preliminary ideas were consolidated as far as possible during a reflective discussion session, after which students had to individually prepare proposals based on the discussion. The individual proposals were then submitted and evaluated. Students also had to study and analyse precedent relating to design-build projects, to green schools and to multi-grade schools and submit an individual document with the analysis.

Images 2.10 - 2.18: Students at St Michael's 1. During construction

To take the design process forward, the lecturers identified the resonating ideas from the individual proposals and discussed this with the school community to get their input and establish a collaborative path forward. The process now had to step outside the available academic blocks where all students were present to allow the necessary design development that was still needed. A smaller group of about ten students was able to volunteer to take part in the final collaborative design process. This process determined the most important materials that had to be procured and identified materials that had to be sourced through recycling and sponsorships. The rest of the class was divided into groups for sourcing the materials and sponsors and for other organisational aspects. Lecturers sourced the core materials through research funding. The sponsored and recycled materials that students acquired included ready-mixed concrete for the necessary footings, sheeting that could be recycled for the roof and an abundance of local apple crates that were repurposed and made into a deck.

The final academic block for the year was also the block for building the outdoor classroom. The construction took place from Tuesday, 25 October to Friday, 4 November 2011. Students still had to attend to other academic work on campus, therefore half the class group went to site on the first Tuesday, and the other half on the Wednesday. From then on the entire class of 63 students went to site each day, including the Saturday. Students travelled by bus from Cape Town to Grabouw, which took up a lot of time in the morning and afternoon. The core group of students who were part of the final design exercise had found a place to stay near the site, and were the first to arrive early each morning and the last to leave at the end of each day. They took it upon themselves to always do final checks and clean-up of the site in the afternoon and preparation in the morning.

Images 2.19 - 2.27: Students at St Michael's 1. Final stages and handover

As far as the integration of the design process and build process was concerned in this construction, the bulk of the design work was done before going to site. This was to facilitate the buying of the necessary materials, as the procurement process via the institution did not allow for ad hoc buying. Buying in the institution goes through a rigorous process which necessitated pre-buying of most of the materials. The structure of the classroom roof was determined before students went to site. The structure of the recycled deck was determined predominantly on site. On site some impromptu opportunities arose. This included the designing and building of a 'braai[3]' facility by opening up the back of an existing fireplace that was not used at all, the making of an outdoor drinking tap space, the construction of an extra set of stairs to link the outdoor classroom space with the playground, and the installation of planter boxes for the beginning of a food garden. On site students worked in small groups of between five and eight that were allocated specific tasks. During the process, groups changed and students sometimes moved between groups. Strong alliances were formed in some of the teams.

The building part of the activity was finished on time and the site was handed over to the school during a special ceremony. The ceremony included the printing of each participant's hand and each schoolchild's hand on a wall that forms the one edge of the outdoor classroom. The schoolchildren sang for the students and food was shared. As a final part of the activity, students had to individually submit a reflective essay.

Academic input during this construction focused on organisation, keeping all the teams busy, running (driving) around to buy more materials, renting equipment, supplying students with food at every lunch time and liaising with colleagues back on campus. The two on-site professionals acted as construction experts and supervised student work closely.

[3]Barbeque

The object realised during this activity was the physical outdoor classroom. The outcomes that were achieved for my colleague and for me were our first successful endeavour in design-build and learning new strategies for future constructions. For the students the outcomes were also their first design-build project, which was a big accomplishment, and the satisfaction of contributing to the improvement of the lives of the schoolchildren. As outcome the school received an outdoor covered space that they are still using daily for formal and informal gatherings, school plays and shelter from the wind and sun.

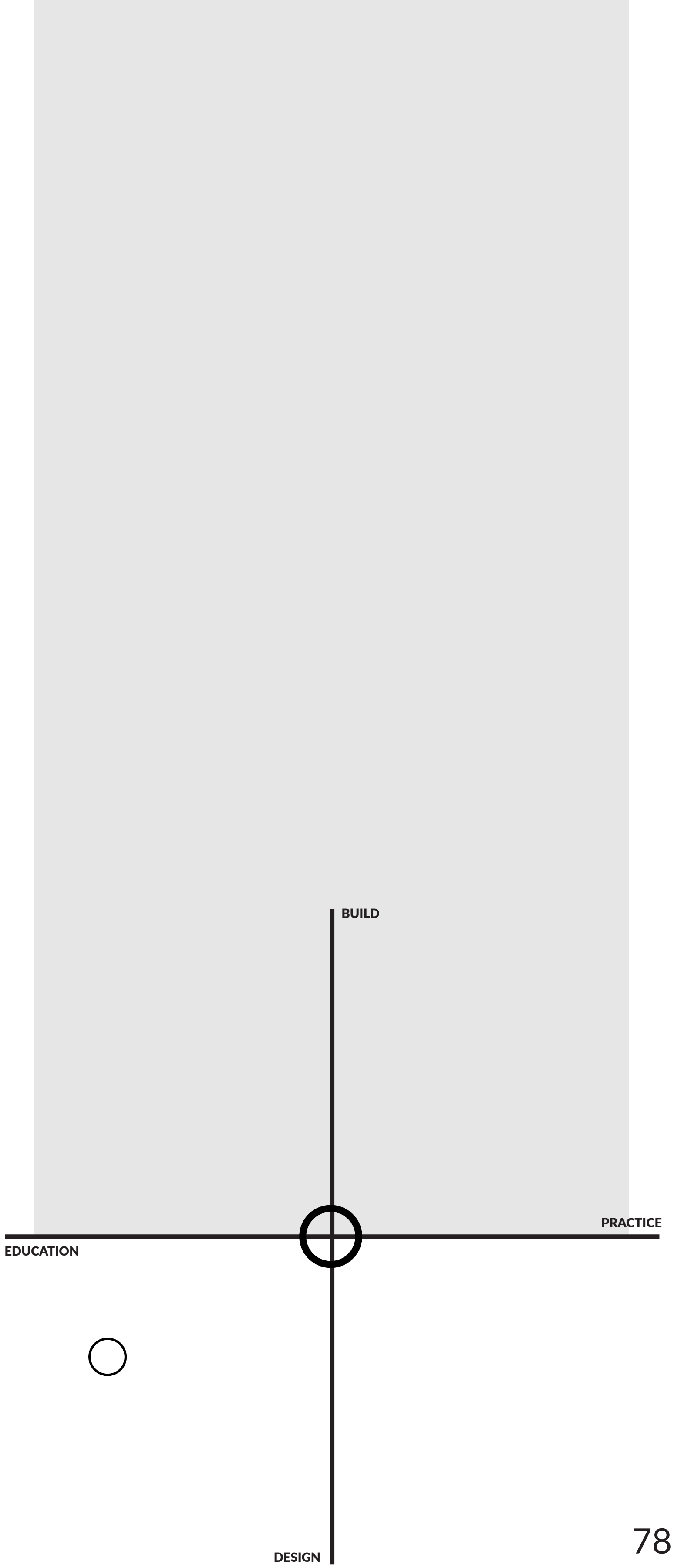


Figure 2.5: St Michaels's 1 design-build construction, the catalyst

Image 2.28: Detail of connection at St Michael's

Image 2.29: Ready to paint at St Michael's 2

2.3.1.5 ST MICHAEL'S 2 (STM2)

In 2012 two further activities were undertaken. The first involved architectural technology students and interior design students of the extended-curriculum programme. They did a small project in which they enlarged the deck started in the 2011 project and made a screen around the steps leading to the outside corridor of the school. The screen served to define a play area for the Grade R learners and to 'hide' the stairs, thereby emphasising the outdoor classroom as a new entrance space. The design for both the deck and the screen had been part of the 2011 design exercise, but that part of the project was not executed as there was not enough time to complete these two aspects as well. The extended-curriculum programme students therefore built what had already been designed and made design technology decisions on site under the supervision of the academics, which again included me and the colleague who had taken part in the St Michael's 1 project. The extended-curriculum students learned about the design process by studying and observing the previous design-build work and by executing their own project on site. This project took place during the school's short April vacation, which provided a different on-site dynamic to the project, with the schoolchildren not being present. It was also a much smaller group of 20 students that took part in the project, which allowed all students to participate equally in all aspects of the project.

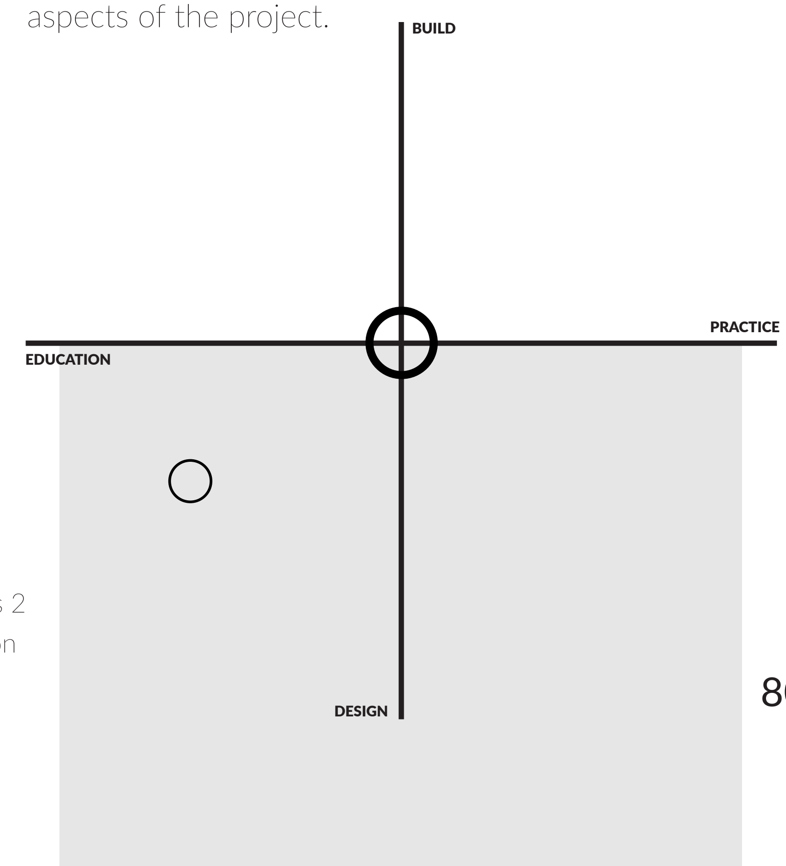


Figure 2.6: St Michaels's 2 design-build construction

Images 2.30 -2.33: Constructing a solar screen over the container library at St Michael's 3

Image 2.34: Making a seating space under the solar screen at St Michael's 3

Image 2.35: At St Michael's 3

2.3.1.6 ST MICHAEL'S 3 (STM3)

The last St Michael's construction involved the second-year architectural technology students and also the third-year interior design students. The architectural technology students constructed a solar protection screen over the shipping container that formed the one edge of the 2011 outdoor classroom space and the interior design students designed and fitted out the interior of the container to become a library for the school. This project was completed during the school holidays in October of 2012.

During the year leading up to September the students did preparation work similar to what the 2011 students had done. However, the actual design process for the architectural technology students differed from the process undertaken the previous year. This time around materials were procured before the design exercise commenced. Students received a list of available material to be used in the project.

The collaborative design exercise started in the studio at the beginning of the two-week academic block during which the build took place. Students were divided into groups of two, they developed ideas together and the groups then had to merge with other groups and combine ideas. This was done a third time, after which there were four proposals on the table. Each step in the process included quick conceptual and detail models and sketches.

The final four proposals were discussed with the entire group in attendance and the main ideas were identified. These were consolidated into a conceptual design that was finally drawn up by three students. This conceptual design proposal was taken to site. On site a scale model was introduced and developed and the design drawings continued on the chalk board in the hall adjacent to the school. Students were able to use the actual materials, mostly timber, to mock up a full-scale design and to modify it on site. This proved to be a very collaborative and involved design process where multiple voices and hands could contribute to every stage of the design and construction process.

Organisationally, during this construction, a different half of the class went to site each day. The other half stayed on campus and did collaborative technological analyses of various precedent studies. On their return to site, students therefore had to take on a different site from the one they had vacated, which was an interesting challenge. Again, students worked in small groups and on different tasks. The smaller number of students on site was easier to manage and keep constructively occupied, although a much smaller project was realised.

The construction was completed during the allocated time, mostly in the rain, and handed over to the school. Since the schoolchildren were on holiday, the handover was not as ceremonious as during the 2011 construction, with no singing, which had previously made for a very special ceremony.

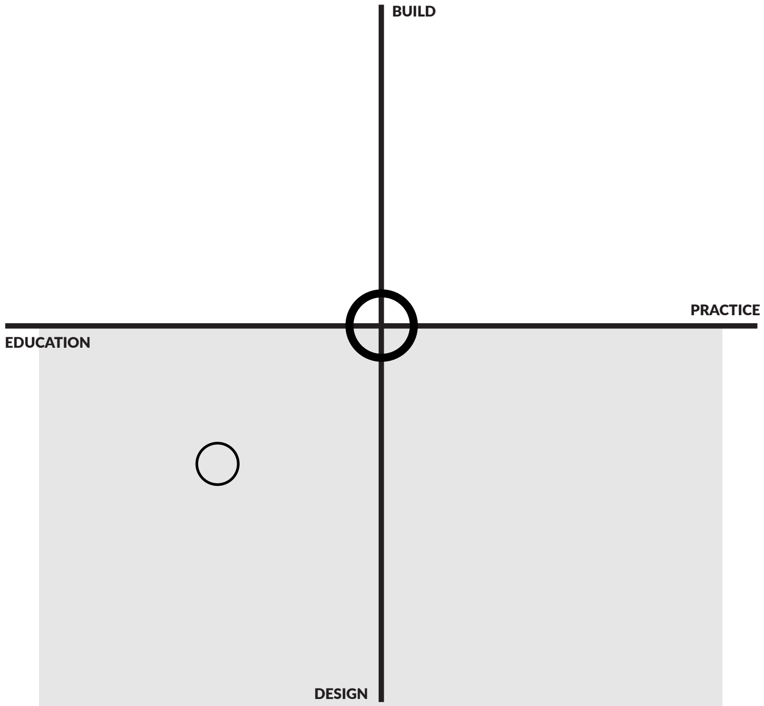


Figure 2.7: St Michaels's 3 design-build construction

Image 2.36: View from the deck extension at St Michael's 3

Image 2.37: View towards outdoor classroom and library with solar screen at St Michael's

2.3.1.7 SUTHERLAND (S)

In 2012, a very busy year for design-build in our department, three design-build projects were introduced to the third-year studio. Each project involved seven to ten students. The students worked on the conceptual and technological development for a period of eight weeks. The intent was to build all three of these projects, and the design process incorporated this intention. Unfortunately, none of these projects was actually built, mainly due to funding constraints, which taught us quite a bit about funding processes. However, these projects proved to be true exercises in intensive collaborative design.

The collaborative design process, stretching over at least eight weeks with seven to ten students, was intense, and because of the allocated time and the small group, allowed each student to participate fully and to share their ideas. The process of bringing together these individual ideas, identifying overlapping intent and then developing the strongest aspects was of great value not only to the students, but also to me and my collaborating academic colleague. This was the first time we fully realised the value of such a collaborative design approach.

One of the 2012 third-year projects is described in more detail below. This project was for a private client and is therefore an exception to the dominant design-build typology studied in this research, which includes a definite community*-oriented aspect. However, the process followed in this third-year project was similar to the process for the two other third-year projects, which did fit the profile of the typology. Data gathering for this project was, however, more reliable than for the other projects, and the decision was made to include this project in the research for the lessons inherent in the collaborative process.

The design of the 4x4 Route Overnight Retreat, also referred to as the Sutherland project, took place during April and May of 2012.

Students could apply to take part in the construction and had to be prepared to sacrifice their Easter holiday to travel to the site. The site was situated in the Sutherland region, a remote, rural and climatically extreme part of the Western Cape.

The client provided accommodation for the students and would also provide funding for the building of the project, which would possibly be in September that year. Students had to organise their own transport to site and most of their meals for the three-night stay. Once there, we hiked the farm, searching for a suitable site for an overnight retreat for tourist use. Near the bottom of a small valley students discovered a fountain that provides a constant supply of water. Students used their bodies as visual height markers for photographs and to establish reference points for views and pedestrian routes. Discussions, which included the client, focused on reasons for site selection and trying to establish a range of criteria to guide the selection and the brief development.

After the physical, full-time immersion on site the students went back to an academic studio space. Two additional students joined the team at this stage. It was a bit of a challenge to get the new group members to understand the physical experience of the site, but it did provide an opportunity for good group discussion where the on-site students had to verbally and with gathered visual information explain the site clearly, which became a site re-visit of sorts.

Being back in an academic environment allowed the students to consolidate the site research and to make sure they fully understood the problem they were faced with. Students had to put together the material they had collected on site to form a document they could all refer to. For this they had to discuss and collate information that had been collected by individuals, such as the photographs and sketches made.

The programme now allowed for two interactive sessions per week, where the lecturers acted as facilitators and soundboards to the unfolding process. Some key physical outcomes to attain were established as a group. These included a shared document, a visual pin-up presentation and a series of working models, plus a detailed final model. A big emphasis was placed on collaborative physical models as a strengthening of the concept of design-build and learning-by-doing.

Students researched appropriate precedent and aspects such as material availability, suitable technology and services options. This exploration showed an unexpectedly rich variety of materials available in close proximity to the project site, including stone, clay, sand, reeds, wool, straw bales, thicket, steel wire, blue gum and pine, bricks and steel sheeting.

The students had to consider the fact that they were going to physically build what they proposed, and as a result the bulk of the ideas proposed were practical and executable. Questions were sent back to the owner to establish buildability, available workshop possibilities and existing artisan skills. The students first developed individual design models based on the collective concept statement. Students had to reflect on the statement and interpret it individually by means of sketches, drawings and at least one working model, before discussing their findings with the group. The pooling of design ideas with fellow students was initially met with apprehension, but the potential for a multitude of creative design solutions soon became clear. Individual idea models were discussed, strong and overlapping ideas identified and then formalised into an expanded concept statement to inform subsequent collaborative design work and collaborative idea models.

Lecturers facilitated the establishment of guiding principles by asking questions and emphasising reflection and allowing each student to voice their opinion about all the aspects of the design. Various iterations of the collaborative design were built on the same working model basis and each stage documented photographically, with each subsequent iteration progressively gaining complexity and detail. As the intention was to eventually build the project, the strong focus on modelling and large-scale technological development was also seen as preparation for the building work on site.

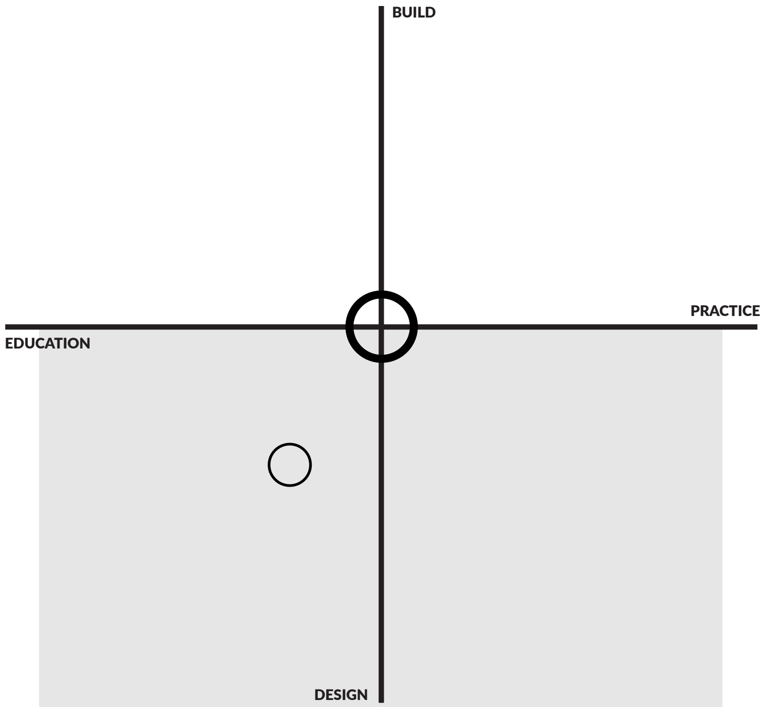


Figure 2.8: Sutherland design-build construction

2.3.1.8 HANGBERG (H)

The Hangberg project introduced design-build to the second-year experiential students during their last academic block in November 2014. This project was executed in collaboration with design activists Stephen Lamb and Andrew Lord [4], and it entailed an access deck and a vertical food garden as an addition to the Light House. The Light House is an alternative form of relocation housing that Stephen Lamb and Andrew Lord had designed for their client, Mr Xoma Ayob (Hoffman, 2014).

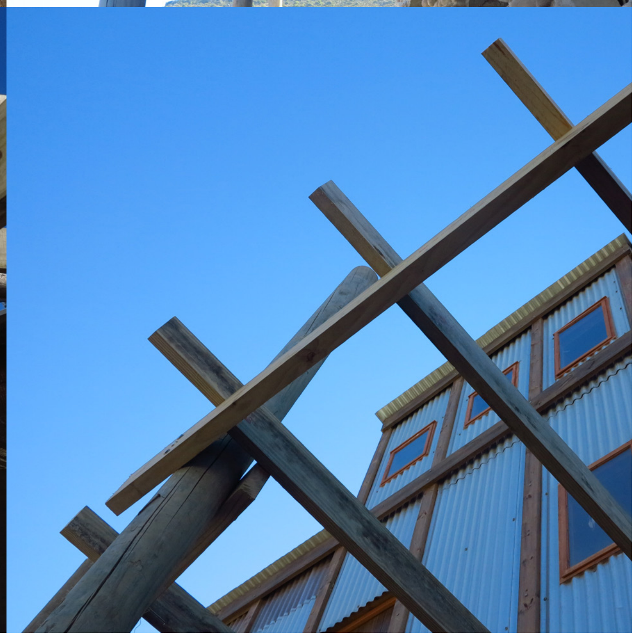
Xoma Ayob had to move from his original informal dwelling to make way for development. The City of Cape Town provides temporary relocation homes for people displaced like this. Such a temporary relocation home would displace Xoma Ayob and not allow him to keep his livestock or continue with his productive food garden. Stephen Lamb was approached by the City to assist with an alternative solution. Stephen Lamb used the budget allowed for temporary relocation homes to design and build a properly insulated dwelling with a vertical food garden and place for livestock.

This intense project, only a week long, was orchestrated in part by the academics to enable the execution in such a short period. The academics were responsible for preliminary consultation with the client, the funding and the sourcing of materials. The construction had as its main academic objectives the collaborative design (Erdman, Weddle & Mical, 2002) of technology (Abdullah, 2011), collaborative construction (Rice-Woytowick, 2011) and learning about alternative practice (Tovivich, 2009), as 'based in an ethical commitment to others' (Canizaro, 2012: 24).

To facilitate these outcomes, only a very specific palette and quantity of materials were made available and students concentrated on the design of technological solutions. Also, the completion of what was intended to be built would not be the main priority. Rather, the focus would be on the quality of technical design

[4] Stephan Lamb and Andrew Lord are artists-activists of Design-Change (previously of Touching the Earth Lightly) and have extensive experience in hands-on sustainable community work.



Images 2.38 -2.41: Constructing a deck at Hangberg

Images 2.42 -2.45: Constructing the vertical food garden at Hangberg

Images 2.46 -2.48: Hard at work at Hangberg

resolution, participation and collaboration and, should some aspect not be completed, the client, along with Stephen Lamb and possibly the students in their own time, would do so. This resonates with Foote (2012: 52), who writes that 'once the notion of completion is removed from its customary ties with the end of a project, the typical linearity from idea to execution is thrown open for chiasmic revisions and reconsiderations'.

Day 1 saw the group of 20 students meeting Xoma Ayob and Stephen Lamb on site. The students also did an off-site in-studio collaborative design exercise, facilitated by the participating academics. The exercise focused on the technical design of the timber-framed deck and vertical garden through drawing and model making.

On day 2 students went directly to site and organised themselves into groups. Two additional projects were identified in conversation with the client. These were the construction of exterior concrete stairs and interior timber shelving. Found and recycled materials were to be used. Each group took control of the design of their building component. There was constant interaction with the client, who was a knowledgeable builder and maker himself.

On day 3 teams were well established and only the shelving team was experiencing difficulty in communicating and finding a working rhythm. The concrete team had the most difficult physical work, as the wind was blowing and the mixed concrete had to be carried up a steep slope to the stair team.

Day 4 was originally intended to be the final day, but progress was sluggish. On this Thursday the temperatures soared to over 30 °C, which slowed down work a little. The decking team was moving steadily forward and the long-awaited large diameter pipes for the vertical food garden were delivered. All teams were convinced that they would complete their tasks by lunch on Friday.

Day 5, Friday, turned out to be even hotter.

However, progress was so good that an additional small chicken coop was designed, detailed and built before lunch. The local brass band gave a performance to thank the students. After a rather reluctant final clean-up of the site, a traditional South African ‘worsbraai’ (sausage barbeque) was held for all the participants.

Most of the originally intended work was completed. The deck had been increased in size after consultation with the client, who accepted that with the available materials it would remain 80% complete. The scope of the work had also been extended, with the addition of the concrete stairs and the shelving, both of which were completed in the available time. An additional chicken coop on the final day completed the list of small building projects.

Most of the originally intended work was completed. The deck had been increased in size after consultation with the client, who accepted that with the available materials it would remain 80% complete. The scope of the work had also been extended, with the addition of the concrete stairs and the shelving, both of which were completed in the available time. An additional chicken coop on the final day completed the list of small building projects.

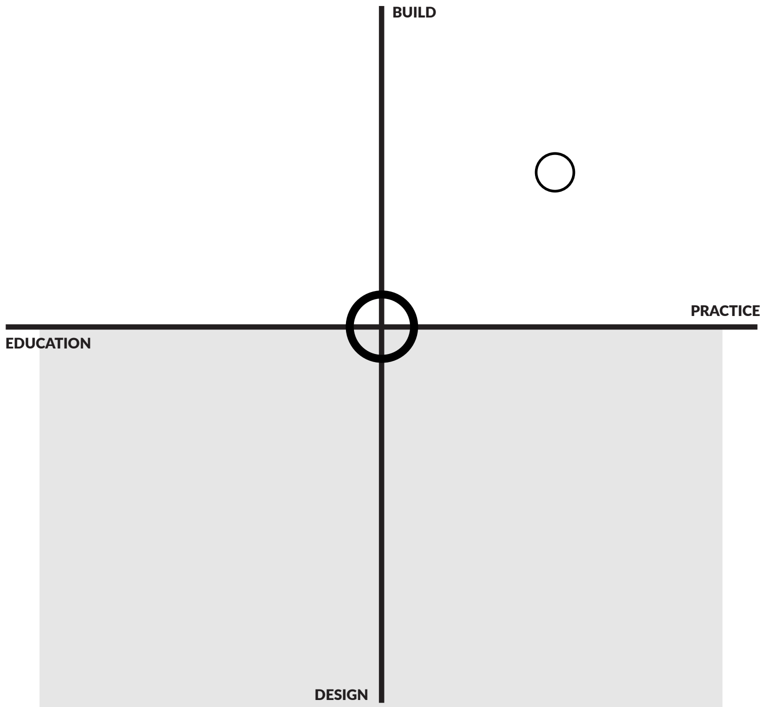


Figure 2.9: Hangberg design-build construction

2.3.1.9 ANALYSING AND USING THE DATA OF THE DESIGN-BUILD CONSTRUCTIONS

The constructions enriched my understanding of what the design-build project as educational activity could entail. The various iterations of method, student participation, timeline and complexity, among other factors, helped me to internalise the design-build process that had been known to me only through the literature before the commencement of this research. I could now contextualise the literature from my own experience and read it from a different perspective. I view this data as lived data that is complex, rich and very detailed. The lived data, together with the literature study data, informed emerging patterns that led to the midpoint or the propositional threshold between the two sections of the research.

The data from the constructions was also used to inform the development of explorative windows 1 and 2 in the strategic synthetic part of this research. The aspects of the data that was used for each specific explorative window are explained under 2.4.4 in this chapter.

2.3.2 THE INTERVIEW WITH PRACTICE (IP)

Data gathered from the interview with practice primarily informs the exploration of question 2b of this research and is presented in explorative window 3 in Chapter 4. During the strategic synthetic part of the research the practitioners of the architectural practice *Change Practice*[5] were interviewed. Change Practice was specifically identified for their design-build work in underprivileged communities*. The practice is one of the first if not the only architectural practice in South Africa that created their practice with the predominant focus of doing design-build work within communities. I travelled to another city in South Africa to meet the practitioners at their workshop. At the workshop they did most of their prototyping and off-site construction. Semi-structured interviews (Drever, 1995; Wengraf, 2001) with the three partners were conducted. The interviews were transcribed. The transcriptions were pulled into ATLAS.ti and deductively coded using principles of activity theory. Following this coding exercise some further questions were emailed to the practitioners for clarification and confirmation.

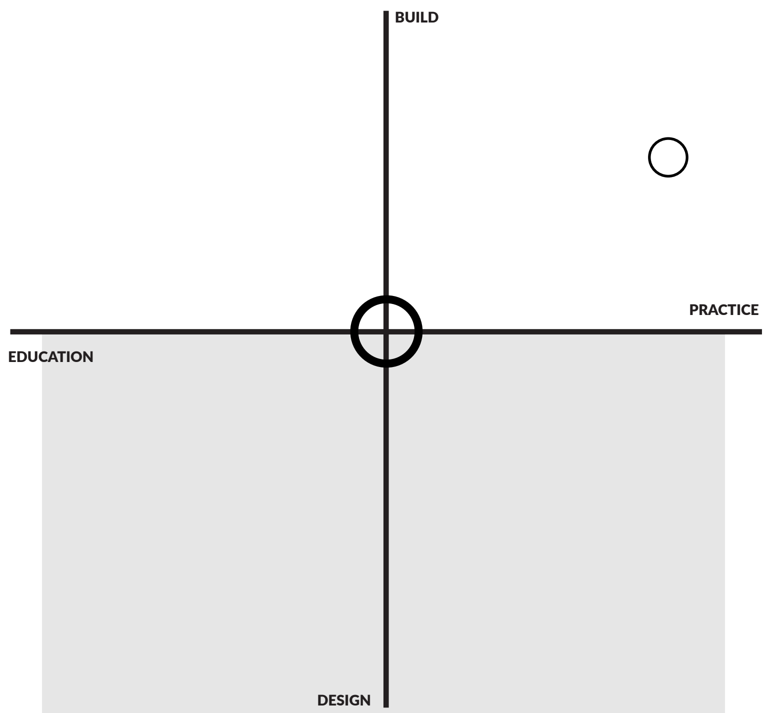


Figure 2.10: The interview with practice

[5]Name has been changed.

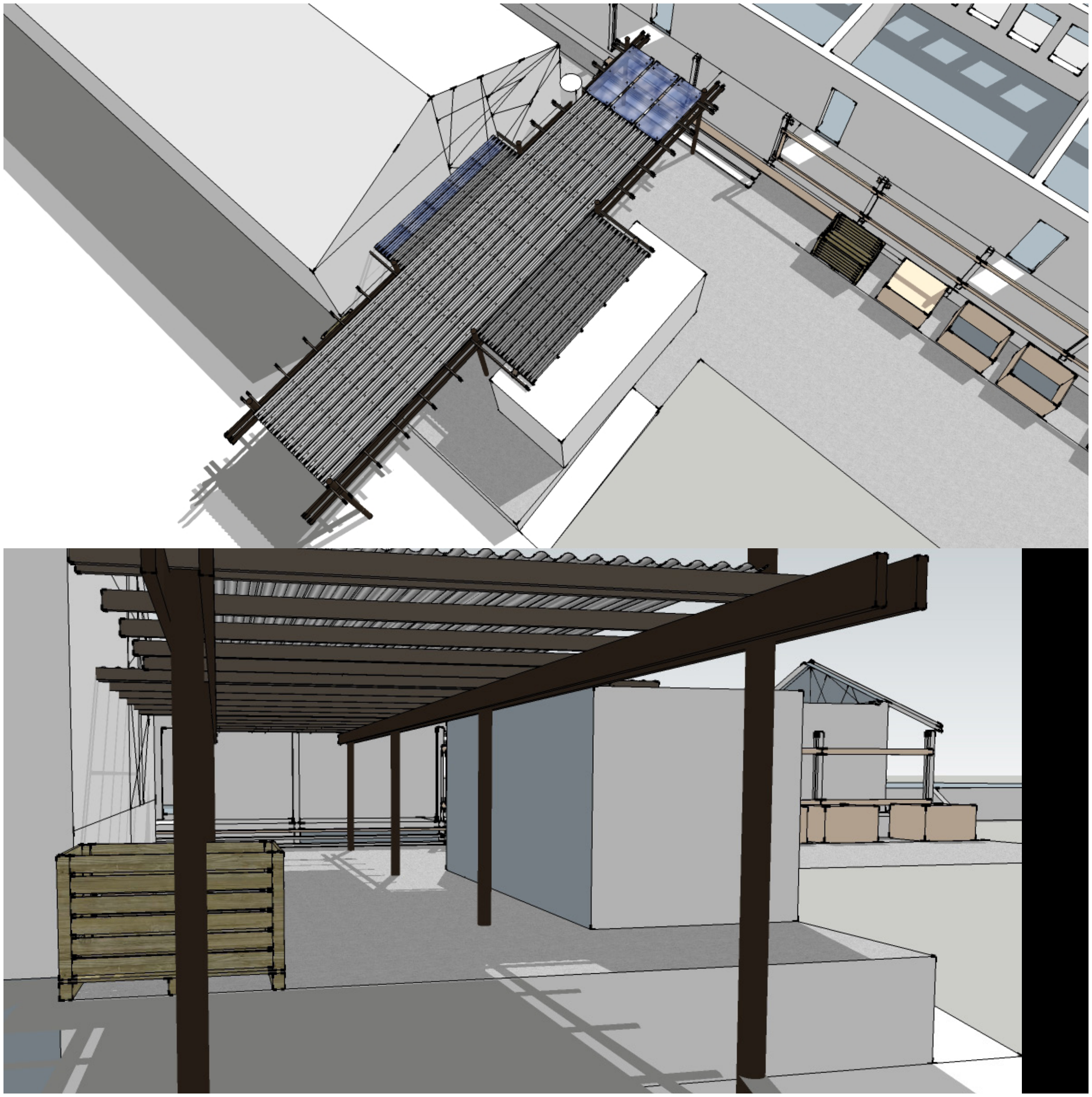


Image 2.49: Student design idea for St Michael's

2.4 RESEARCH METHODS

This section on research methods introduces the graphic development of this document, the approach to the underpinning literature study, the threshold between the two sections of the research and the approach to the three explorative windows.

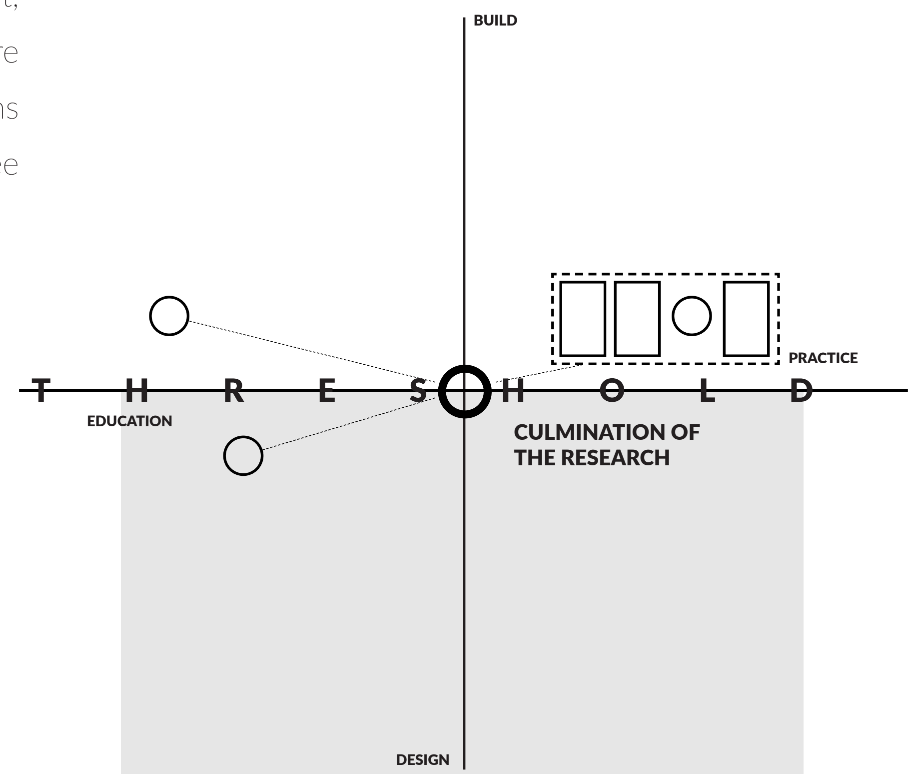


Figure 2.11: The research methods

2.4.1 THE GRAPHIC DEVELOPMENT OF THIS DOCUMENT

The graphic development of this document is meant to reflect the research design and process and to invite the reader into the physical and mental research experience in line with the underpinning epistemological position. In a sense I want the reader to be involved in their own process of exploration, as one would in a learning experience where constructionism is the underpinning educational approach.

Here I took much inspiration from Grocott (2010). She explains that the design of her diagrams and dissertation (with specific reference to the physical document) was executed to allow the reader to focus on particular elements of the research and to allow the process of design to maintain 'its conversation with the research discussion right up until the end of the PhD' (Grocott, 2010: 42).

To me the graphic development and layout represent the final accumulation of the research process, a presentation of a journey. The graphic and document design was developed by combining a hands-on digital and an analogue approach. Physical immersion in this process was as important as taking part in the design-build constructions. This last stretch of the journey revealed opportunities discovered in the process of making, to express certain findings and underlying themes within the physical object that becomes the research output.

I purposefully explain only some of what the reader must look for in the layout and graphics that informed the graphic process and that support the research design and findings. Papert (1991: 3) wrote that 'constructionism boils down to demanding that everything be understood by being constructed'. I hope the visual journey of exploration and discovery will allow the reader to deduct even more meaning than is explained.

2.4.2 THE UNDERPINNING LITERATURE STUDY

(The underpinning literature study can be read in Chapter 3 of this thesis.)

Design-build education is a relatively new academic field and the past five years have seen an accelerated growth in published literature, but there is still much potential for development. At the commencement of my studies in 2010 there had been one international conference (Erdman et al., 2002) focusing exclusively on design-build in both education and practice. This conference became a seminal starting point towards a more theoretical discussion on design-build education amongst architectural educators. In 2010 there were a small number of architectural schools implementing design-build work, and that number has since 2010 grown so much that at least 70% of all USA schools now offer some kind of design-build project (ACSA, 2014). In the past few years a series of three design-build education conferences was held, the first in Berlin in 2012, the second in Mexico in 2013 and the third in Halifax in 2014. The 2014 conference was hosted by ACSA (Association of Collegiate Schools of Architecture) and considered 'the potential of design/build in post-secondary education' and was 'interested in expanding this potential, developing ideas to improve delivery and efficacy, and reflecting on design/build as pedagogy and practice' (ACSA, 2014: 1).

This thesis aims to explore embedded pedagogic and professional opportunities in design-build projects, which resonates with the current international interest for expanding knowledge and research around design-build project education. The literature study contributes to this exploration by:

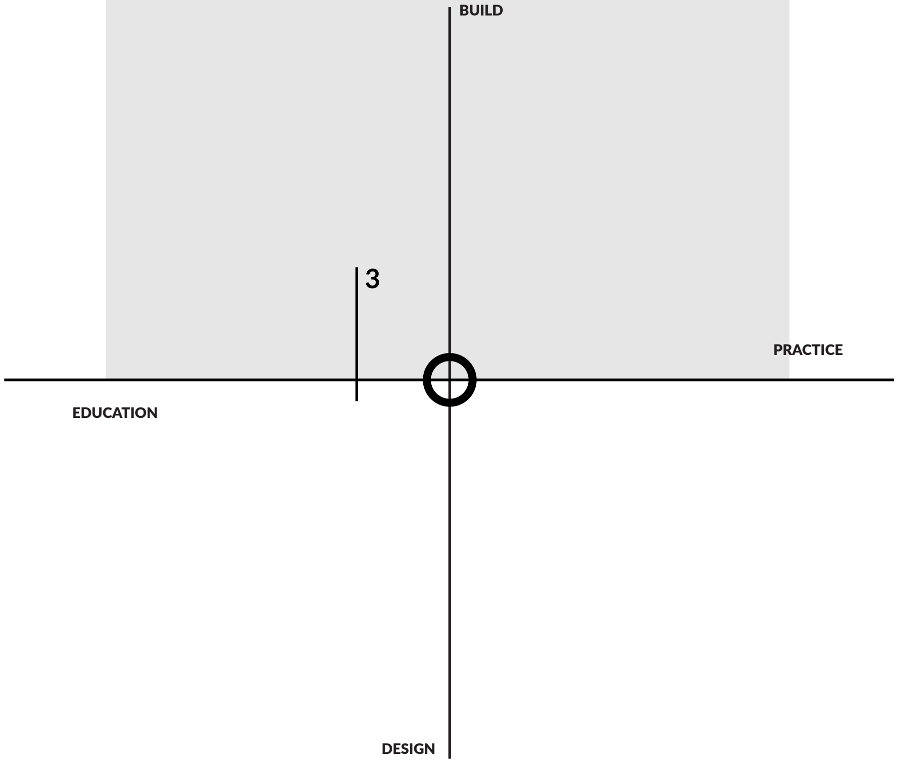
- Functioning as context, rationale and also becoming data from which questions and findings are drawn (Roome, 2014: 11) and informing the threshold or 'midpoint' as Bachman describes the underpinning concept (2010).

- Reviewing existing definitions of the design-build project and proposing six design-build typologies arrived from the literature.

- Introducing the use of activity theory as a framework for exploring existing design-build literature, predominantly from the perspective of the architectural educator as subject. Using activity theory allowed for the transfer of concepts to other parts of the study.

- Foregrounding patterns, mediation, tensions and motivations within the design-build activity system. This guided the development of the overall research.

Figure 2.12: The underpinning literature study



2.4.2.1 HOW THE LITERATURE WAS SOURCED

The literature was mainly sourced from articles, conference proceedings, books and design-build programmes' web pages. Databases available through my university and through open sources were used. The databases included EBSCHO host, ProQuest, Art and Architecture Complete and Google Scholar. A standing Google Scholar alert with the keywords 'design-build architecture education' has been in operation since 2011 and has provided many good leads. Keywords used in other searches included, but were not limited to, design-build, architectural education, hands-on, live projects, full-scale, community work, design activist, on-site, alternative practice, alternative practitioner.

Some of the important works that I considered that also provided useful bibliographies to further the literature investigation include but are not limited to:

- For design-build education I considered the seminal work of Carpenter (1997), a PhD thesis by Abdullah (2014), a comprehensive article by Canizaro (2012) and research work by attendees of the aforementioned few design-build conferences.
- For live projects education a PhD thesis by Brown (2012) and the book Architecture Live Projects: Pedagogy into Practice by Harris and Widder (2014).
- For broader architectural education various works by Salama (1995, 2015, 2007), the important book by Nicol and Pilling (2000), and locally a PhD by Finzi (2005).
- For literature on alternative and activist practitioner the work of Tovivich (2010), of course Cuff (1991), and locally the work of Osman and Bennett (2013).

2.4.2.2 DEVELOPMENT OF AN ANALYTICAL APPROACH TO THE LITERATURE STUDY

The literature study went through several stages as I simultaneously immersed myself in both the continuous literature study and the live data events. The existing and available literature concerned itself predominantly with the how, what and why of design-build projects, with attempts to define design-build projects and with project descriptions of successfully completed design-build projects. A good example of the how, what and why is Canizaro (2012), who foregrounds reasons for doing the projects, strategic tactics for implementation and issues or challenges faced in executing the projects. Descriptions of projects range from narration of the project implementation with some reflection (Huge, 2008; Cook & Stephenson, 2014) to case studies described with a more analytical and conceptual approach (Corser & Gore, 2008; Nepveux, 2010). The various attempts at definitions of design-build projects are explored in the next chapter.

My first attempts at structuring the literature reviewed how previous authors captured and categorised all the concerns relating to the design-build educational project. A process of open coding followed by axial coding was used (Creswell, 2009: 196). Open coding defined five broad categories: organisational aspects, academic aspects, project typology, practice impact and possibilities, and social impact and possibilities. The literature was then pulled into ATLAS.ti, where the five categories were further fine coded and the literature organised to explore 'the conditions of the project before, during, and after construction' (Cavanagh, Hartig & Palleroni, 2014: 6). However, the complexity of the relationship between the various categories and codes was not provided for in this system of open coding. Axial coding was used to position the data in the theoretical framework of activity theory.

2.4.2.3 ACTIVITY THEORY AS A FRAMEWORK FOR DISCUSSING THE LITERATURE

By using activity theory it was possible study the complex relationships and take cognisance of the contextual, historical and cultural aspects of design-build projects. Brown (2012) writes that we cannot see ways of gaining knowledge as separate from the context of live projects. Ellis (2011: 191) argues 'that by seeing knowledge and history in practice … (activity theory) … offers a distinctive set of tools that might stimulate and re-energise practitioners' creativity, a human capacity that is at the same time conceptual, practical and future-oriented.' Activity theory provides a heuristic lens to organise the concerns in the literature and to view the design-build activity as a changing practice. I view the design-build activity system as a transformation of the conventional design studio activity system. The literature discussion takes into account this transformation.

The activity theory system was not merely used as an organisational framework to put the literature in different categories. This would be simplifying activity theory into a structural device. The essence of activity theory is to allow us to explore complex collective activities and the contradictions, tensions, meanings and motivations that drive the activity. The concept of being object-oriented, which grounds the activity becomes

> a promising analytical tool providing the possibility of understanding not only what people are doing, but also why they are doing it. The object of activity can be considered the 'ultimate reason' behind various behaviors of individuals, groups, or organizations. In other words, the object of activity can be defined as 'the sense-maker', which gives meaning to and determines values of various entities and phenomena. Identifying the object of activity and its development over time can serve as a basis for reaching a deeper and more structured understanding of otherwise fragmented pieces of evidence
> (Kaptelinin, 2005: 5).

2.4.2.4 CURRENT LITERATURE FOCUS AND POTENTIAL GAP(S)

There is a strong focus on the narration of successful design-build projects. This links directly to the first perceived gap in the literature: the lack of theoretical grounding in the research of design-build projects. This is slowly being addressed, with a few master's-degree (Kellum, 2010; Rosenthal, 2013; Sutter, 2014) and PhD (Abdullah, 2014) studies that take an interest beyond story telling. The second gap is the lack of the development of specific pedagogic theory, and the third is the lack of research on the relationship between design-build education and design-build professional practice.

The available design-build narrations tend to be predominantly positive about pedagogic aspects, student participation and the object that is a result of a design-build project. In these narrations challenges that were experienced that are highlighted include aspects like the lack of funding and institutional support, mostly aspects that have an impact on the operational success of a project. Very few if any narrations that are available tell the story of unsuccessful or unfinished design-build projects or even unsuccessful attempts at starting or initiating such projects. We learn as much from our mistakes as from our successes (Buthelezi, 2014), and there certainly is a place in the literature for more reflective analysis on projects that did not make for good final photographs. That being said, the many available stories of design-build projects did become both precedent for my design-build constructions and a rich source of data for this thesis.

The lack of theoretical grounding that was evident both in the initial part of my research process and in the literature consulted is addressed by the introduction of activity theory. Activity theory works from a 'perspective (that) expands the unit of analysis from the mind of the individual … to the entire activity system' and is concerned with 'how participants transform objects, and how the various system components mediate this transformation' (Barab, Barnett, Yamagata-Lynch, Squire & Keating, 2002: 79). Activity theory introduces a theoretical framework that aids the exploration of the complex design-build activity system. I hope that activity theory will be used in future for more extensive design-build research.

There are many pedagogic approaches and learning theories that can find application in the design-build project. However, many of these are also applicable to conventional studio teaching (some of these are explored in explorative window 1 in Chapter 4). Part of the intent of this thesis was to see if further exploration of design-build projects could reveal if there is something unique in terms of design-build pedagogy.

The link with professional practice and how students transcend from the academic project to the professional world remain to be investigated. Design-build projects have become an accepted pedagogical approach, but it is not clear whether this is influencing the development of professional practices that focus on projects that are similar to those experienced in educational design-build constructions.

Figure 2.3 Incorporating ideas of Bachman and Har

2.4.3 THE THRESHOLD

The threshold, as understood from a methodological perspective, introduces the midpoint as described by Bachman (2010: 470):

> At the midpoint the … emphasis is on identifying a propositional goal that is, hypothetically at least, something unique, situated, and provocative. This midpoint is critical in that it reveals the rich and complex essence of what was at first just a problem statement but becomes the "big idea" … this midpoint is where the pregnant ambiguity of the situation has been identified and distilled.

The threshold can be read after Chapter 3.

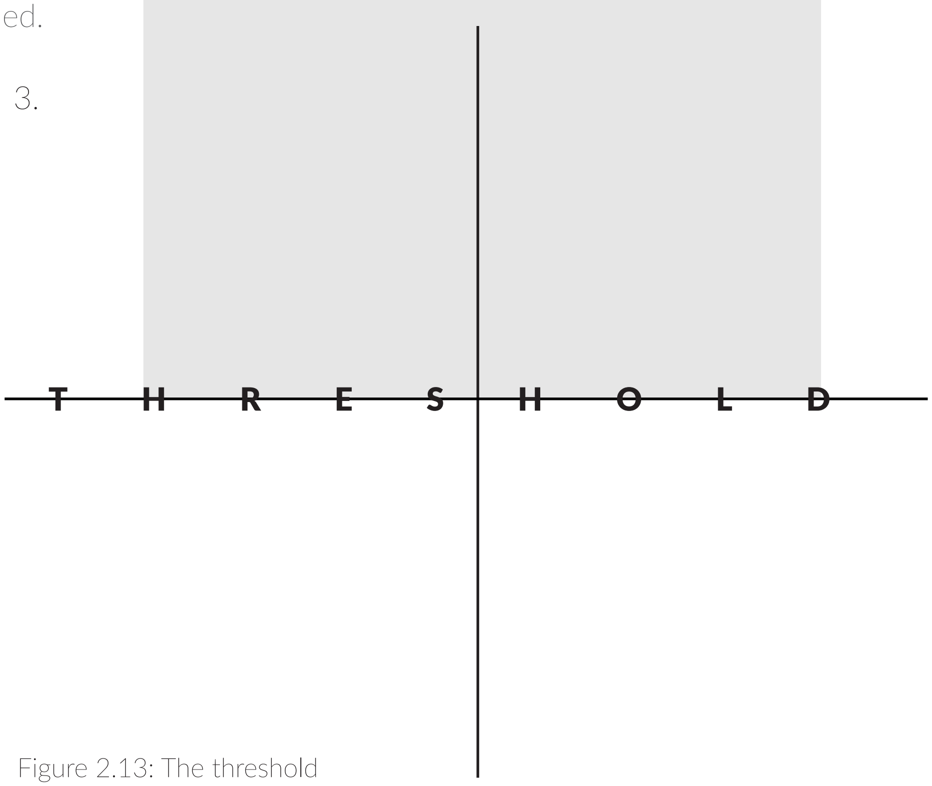


Figure 2.13: The threshold

2.4.4 THREE EXPLORATIVE WINDOWS IN THE LANDSCAPE

The three windows are positioned in Chapter 4. The three windows are the culmination of the research journey and are presented in two parts. Collaboration was identified as one of the unique and inherent aspects of design-build projects and is explored in the first two windows. The design-build constructions are the prime source of data for these windows. The first of the two windows opens onto collaboration as a theoretical background and explores a framework for design-build collaboration through a focused literature study. The second window frames existing collaborative opportunities within the design-build constructions that are the data elements of this research.

Window 3 relies on data generated from the interview with practice. It explores a path that the practitioners travelled from being students in a conventional studio to establishing their own design-build professional practice. It seeks lessons to transfer from their experience and knowledge into architectural education.

All three of these windows are presented as free-standing structures, each with its own literature study and method, and can be read as independent constructs.

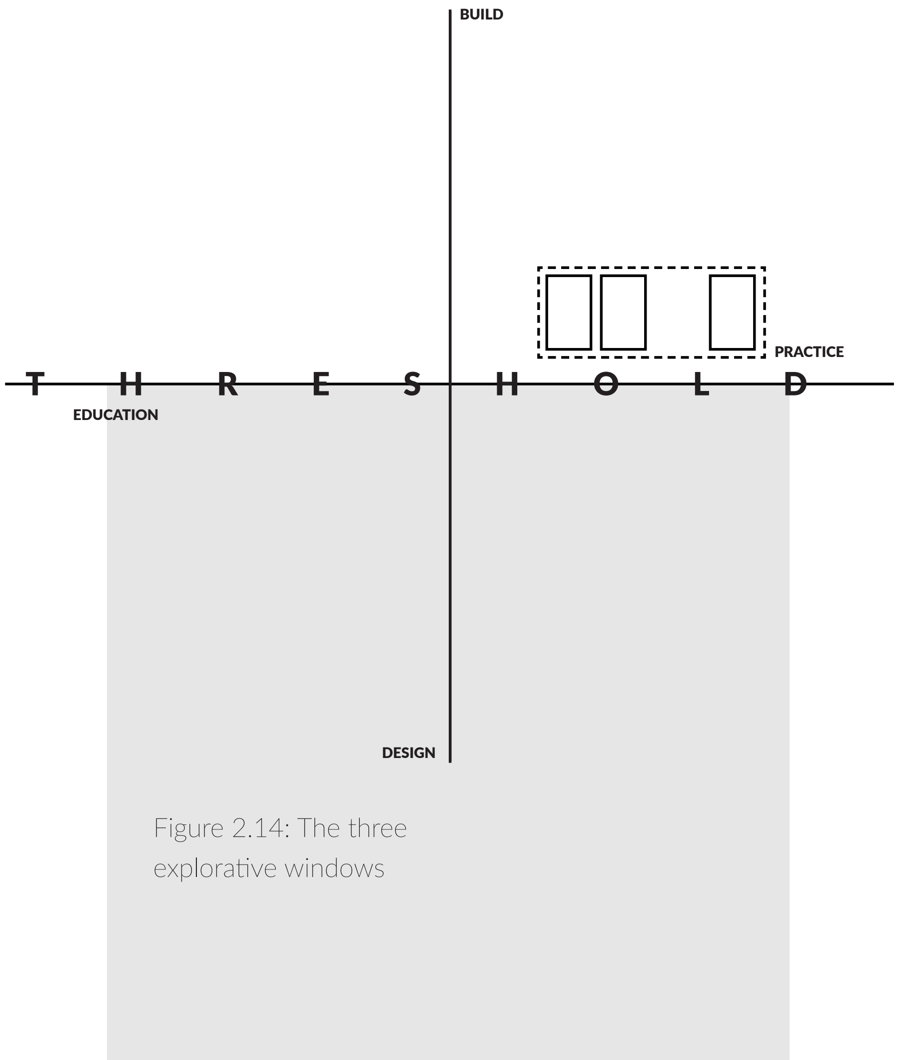


Figure 2.14: The three explorative windows

2.5 LIMITATIONS AND DELIMITATIONS OF THE RESEARCH

The limitations of this research stem predominately from the researcher's position in terms of the context of the research. The context is simultaneously the work environment of the researcher and the research space. This position immediately gives a particular viewpoint from which the research is observed. At the same time the context provided the support and space for the research to be executed. During the design-build constructions I also acted as participant-observer, having had to organise and execute many of the related academic tasks, such as generating marks for the students. I therefore recognise that this research has been conducted from a subjective position. That being said, most of the reported research on design-build projects is by researchers who are also academics and find themselves embedded within projects in their work environment. This specific stance is also recognised in the literature study (Chapter 3), where the academic becomes the subject from whose viewpoint the literature is reported.

The limitations of the design-build constructions include the selection of students. The selection was solely dependent on who was in the class group where the project could be accommodated within the curriculum. Some of the standard student responses resonate with many similar reports read from other design-build projects. Logistically, some of the organisation of the project had to happen without the participation of the students, such as buying some of the materials up front due to restraints placed on the buying procedure. Where possible these instances were included in the projects in such a manner that they informed rather than detracted from the project process. The availability of funding also prohibited the one design-build construction (Sutherland) from being fully executed. This again provided a learning experience in itself.

The inclusion of the professional practice for the interview was very specific and there was no real choice, as this kind of architectural practice is not yet established in South Africa. In this research I give a snapshot of the practice at a particular time. I have not followed up on whether their intent is still the same a year and a half after the interview. Some of the lessons learned are transferrable to education and to professional practice, some lessons are not. The literature selection was specifically chosen to present an academic viewpoint. The viewpoint of the community* was not taken into account in this study. That was not to discount the community*, but to focus specifically on academic processes and procedures and on student learning within the design-build activity system. What is also not addressed in this research is the quality of the design and the technological processes and solutions within the academic design-build project.

All students that took part in the design-build constructions did so voluntarily and gave permission for the anonymous use of their personal, reflective data. The design-build practitioners gave full consent for the semi-structured interviews and for their story to be part of the research.

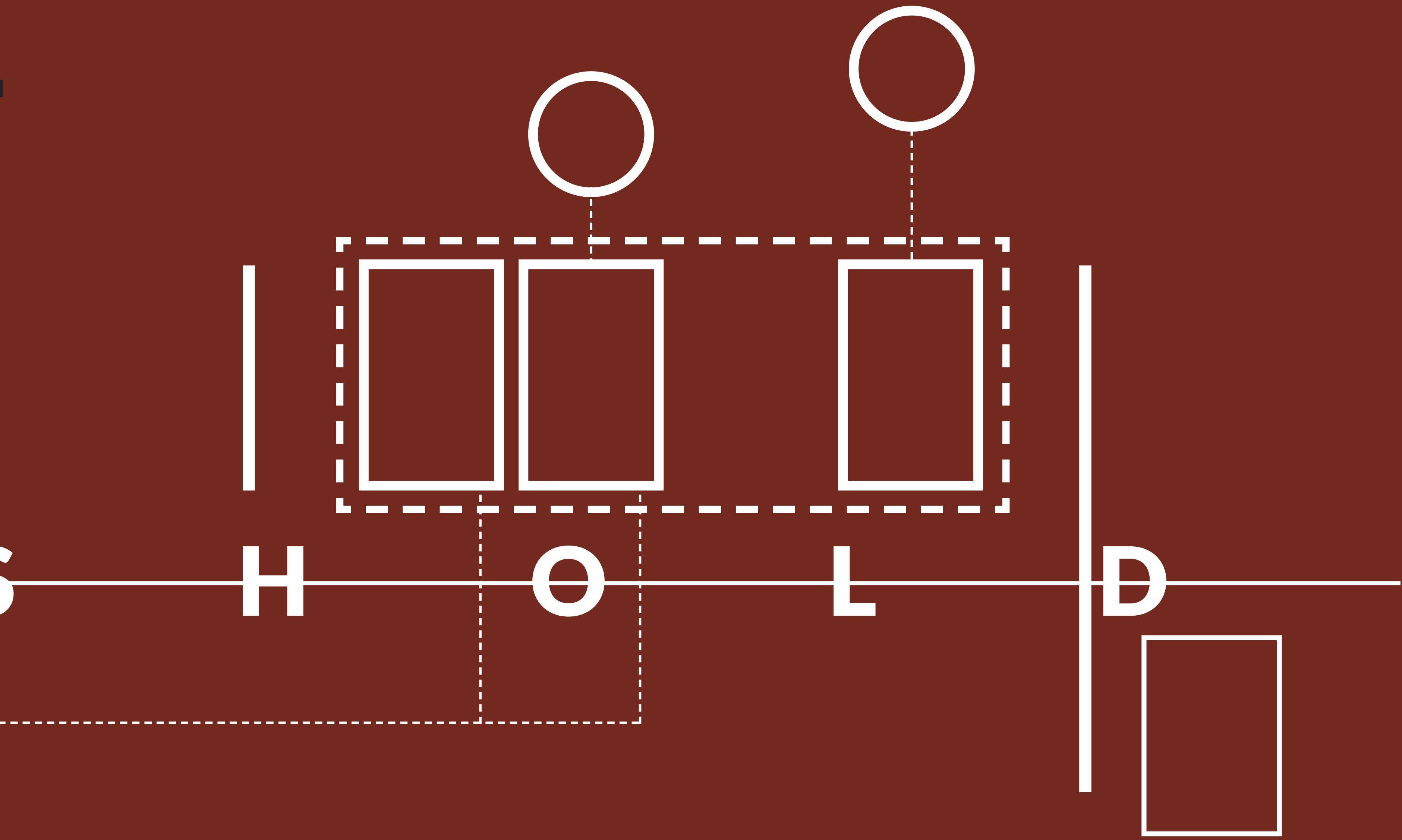
2.6 SUMMARY

Chapter 2 introduced the research design, the data elements, the research methods and limitations and delimitations of the research. The next chapter, Chapter 3, presents the underpinning literature study where the object of the thesis is defined and activity theory is used to explore the educational design-build project. The literature study is part of the research methods and together with the data elements become a journey of intertwined exploration that leads across a threshold to the opening of three explorative windows in Chapter 4.

Image 2.50: Deck completed from re-cycled apple crates at St Michael's

3

T H R E S



CHAPTER 3

LOCATION

3.1 INTRODUCTION

Chapter 2 presented the research design, the data elements, the research methods and limitations and delimitations of the research. Chapter 3 introduces a literature study to locate the research. The aim of this research is to explore embedded pedagogic and professional opportunities in educational design-build projects. The literature study supports this aim by serving as:

- Context, rationale and data that inform both the midpoint threshold and the research findings.
- A review of current design-build definitions.
- An introduction of activity theory to study design-build projects.
- An exploration of patterns, mediation, contradictions and motivations within the design-build activity system and between related systems. Emphasis is placed on what distinguishes the design-build activity system from the conventional studio activity system.

The literature study was not limited to a specific stage of the research process, but developed and was built and rebuilt from the inception to the completion of the research. The design and methodology of the literature study can be read in Chapter 2.

The literature presented here was deliberately selected to represent the perspective of the architectural educator. A limitation of this selection is that reported current design-build research and literature focus predominantly on successful projects and not on incomplete, unsuccessful or possibly poorly executed design-build projects. This omission presents a gap in the existing literature, which could have given a different perspective and provided different learning opportunities from the literature.

The chapter is organised by foregrounding the findings. The literature is then presented according to the different aspects of the activity theory framework (Engeström, 2000; Ryder, 2015). Within the design-build activity system, the architectural educator as the subject of the activity is introduced, and then the design-build project is explored and defined as object of the activity.

The outcomes of the design-build activity system are presented just after the section on the object. The chapter then reviews the tools or artefacts at the disposal of the educator in this activity system. The rules that underpin the activity are discussed next, with the next section exploring the community of the activity system and the division of labour within the activity system.

3.2 SUMMARY OF CONSTRUCTIVE LITERATURE FINDINGS

This section summarises the main findings in this literature study. These findings informed the development of the midpoint threshold. The midpoint threshold is presented after Chapter 3 and before Chapter 4.

3.2.1 SIX EDUCATIONAL DESIGN-BUILD TYPOLOGIES

A study of the definitions of educational design-build projects revealed six educational design-build typologies. These typologies are discussed and proposed as a comprehensive range of typologies for exploring design-build educational projects. The first four typologies are presented as originally defined by Christenson and Srivastava (2005), and two additional typologies are included from a further exploration of the literature. The six typologies are:

- Experimental full-scale investigations
- Prototypical full-scale investigations
- Inhabitable full-scale investigations
- Generative full-scale investigations
- Explorative full-scale investigations
- Programmatic full-scale investigations

Inhabitable full-scale investigations are foregrounded as the design-build typology that is the object of this thesis, where object is defined from an activity theory perspective.

3.2.2 FOREGROUNDED BY ACTIVITY THEORY

• Four outcomes of inhabitable full-scale investigations are revealed.

Four outcomes of inhabitable full-scale investigations are defined and two these are of concern in this thesis. These are the creation of sustained and improved design-build educational practice and the creation of the possibility of an alternative form of professional practice.

• Educational design-build projects are positioned as a boundary activity system.

Activity theory revealed educational design-build as an activity system that in effect acts as a boundary system. This resonates with Sara(2011: 1) who describes the design-build studio as sitting 'between the binaries of Theory/ Practice, University/Community, Drawing/ Making, Head/Hand which could be readily used to compare the traditional studio to the design-build'. Third-generation activity theory is often used analytically to understand current activity systems, to identify tensions or contradictions between and within the systems and to then propose an intervention to create new patterns of activity. The intervention can act as a boundary activity and can develop into a new activity system with its own tools and actions. This is part of Engeström's expansive learning concept within activity theory (Engeström, 2001). The design-build activity system similarly acts as an intervention, and in this literature study the change from the conventional becomes evident. Contextually the design-build activity system developed in response to current architectural educational and professional practice. The design-build system is more complex and situated in reality than the conventional studio system. It differs from professional practice because it is still academic, which influences the relationships within the community of the system.

It is further different from professional practice in that it engages with actual physical building, where conventional practice is similar to conventional studio, as they share the same type of object: documentation. The educational design-build activity system adapts the existing conventional studio and proposes new paths of professional practice.

- The tools of the conventional studio systems are still applicable in the design-build activity system but need to be expanded, and representational documentation changes from an object in the conventional studio system towards a tool in the design-build activity system (Maistre & Paré, 2004; Abdullah, 2011).

Both academics and students would have at their disposal the tools developed for and in the conventional studio system with which they can negotiate within the design-build activity system. The literature study explores conventional studio tools as well as a variety of further tools, predominantly pedagogic tools, which can be used to negotiate within the rules of the design-build activity system. The complexity and authentic wholeness of the system (Christenson & Srivastava, 2005; Doan & Seavy, 2014) and students working together are distinct as pedagogic tools within the design-build system (Sokol, 2008; Canizaro, 2012).

The object of the conventional system, representational documentation, becomes a tool in the design-build system. Similarly, learning the knowledge and skills required to produce representational documentation is not the focus of the design-build activity any more – the knowledge and skills are now applied. This change from object to tool positions the design-build activity system closer to the professional practice activity system. Maistre and Paré explain that where objects are transformed into artefacts and where 'the focus of learning becomes the means of practice ... is the critical distinction between school and work' (Maistre & Paré, 2004: 45).

3.2.3 COLLABORATION IN THE EDUCATIONAL DESIGN-BUILD

Collaboration is not inherent in the conventional-studio activity system. The literature shows that collaboration within the design-build activity system is a pedagogic tool, an intrinsic rule and inherently present within the relationship and division of labour of the community.

3.3 ACTIVITY THEORY TO EXPLORE THE LITERATURE

This section explores the body of literature by using activity theory as a heuristic and analytical framework. According to Arnseth (2008: 294) the epistemological focus of activity theory 'on praxis means that learning and teaching – the primary objects of educational research – is seen as being constituted in object-oriented activity. It is a result of individuals' and collectives' conscious transformation of objects in and through activity'. In the design-build activity system that is the object of this study, the architectural educator as the subject engages with artefacts or tools and mediates towards the object and ultimately towards the outcomes brought about as a result of the activity centred on the object.

3.3.1 SUBJECT

In activity theory the subject 'is the person (or persons, defined by Engeström, 1987, as a 'collective subject'), i.e. a primary actor/agent, who is the source of an activity and the starting point for the analysis (Torres, Buchem & Attwell, 2011: 8).

The subject in this literature review is the architectural academic interested in developing academic design-build practice. This academic could at the same time be researcher and tutor, and most often is an active organiser and participant in design-build courses and projects.

Subjects are motivated in their work to create meaningful change in both educational practice and society at large. This motivation is not something that can be necessarily passed on from person to person, which quite frequently sees the development and continued operation of design-build programmes quite closely linked to their original founder. As original founders leave programmes, some programmes survive, others do not (Ockman & Williamson, 2012: 256).

James Benedict Brown (2012: 10) published a seminal PhD study focused on 'theoretically contextualising live project pedagogies', which he investigated through the experiences and perceptions of academics in live projects in the United Kingdom. However, not much is known about the personal profile and characteristics of design-build academics. What is known about the person of the academics engaging in design-build projects is mostly from anecdotal and circumstantial evidence.

We do know that in the past two to three years strong supportive communities of project academics have emerged internationally with the aim of sharing and discussing their work in design-build and live education.

These communities include the Live Projects Network that is focused on 'enabling new collaborations and stimulating discourse and best practice' (Harriss & Widder, 2014a: 49), and the designbuildXchange, which is an 'open access platform [that] provides tools for communication, collaboration and the exchange of knowledge offered by its members' (Anderson & Priest, 2015: 4).

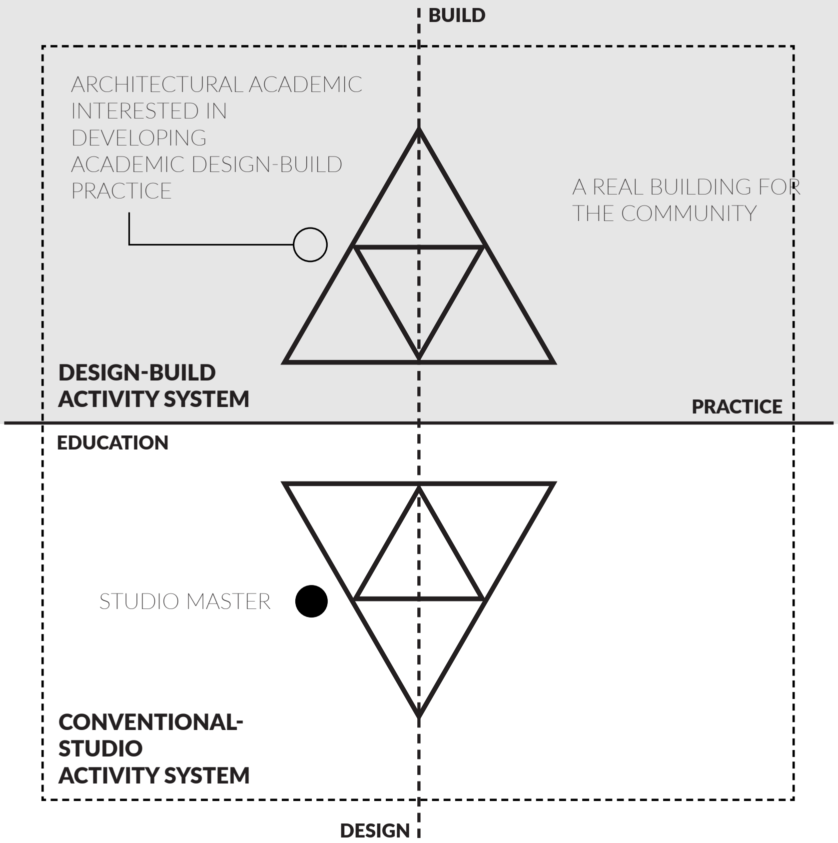


Figure 3.1: The subject

These communities are contributing to the practical and theoretical discourse on design-build projects. Design-build academics face several challenges. Preparation and facilitation of these projects take more time than ordinary studio projects (Vlahos, 2000), although colleagues might think it takes less teaching input than conventional studio teaching (Brown, 2012). Canizaro (2012) writes that

> organization and financing of a design/build endeavour discourage many administrators and department heads who would otherwise be sympathetic to the educational benefits. Most faculty that engage in these types of projects over a period of time face burn out if the institution is not structured to facilitate and encourage these types of experiences. The fact remains that … ongoing administrative and institutional support for this type of undertaking remains the exception rather than the norm
>
> (Canizaro, 2012: 29).

It would seem that the design-build academic as subject in this study has social agency (Garraway & Morkel in Bozalek et al., 2014), academic agency, carries responsibility, is a 'mediator' (Brown, 2012: 238), has 'pedagogical authority' (Brown, 2012: 237), is instinctive first, then reflective (Brown, 2012: 245), is not scared of encountering resistance, is open to new ideas and is essentially critiquing existing practice and pedagogy (Canizaro, 2012).

3.3.2 OBJECT: DEFINING THE DESIGN-BUILD PROJECT

> The object of an activity is a physical or symbolic object towards which a subject moves with the purpose of attaining particular outcomes (Torres et al., 2011: 15).

The object (Figure 3.2) in this research is the concept of the design-build project. It is not with a specific design-build project that we concern ourselves, but with the theoretical concept of these particular projects. The design-build project as generic activity system is in constant development and as we as educators learn more about these projects we also move towards transforming our own educational practice.

To get a more thorough understanding of the object that is explored in this study and that is the reason for the activity, this section reviews various definitions of the design-build projects and concludes with a synthesis and expansion of these definitions. Emphasis is placed on one of the definitions as specifically relevant to this thesis, and this definition of the object is linked to a number of related outcomes. This definition also aids in the identification of values and characteristics or, in activity theory terminology, the rules, which are explored in the further discussion of the broader literature.

> Design-Build can be as big as the entire curriculum or as small as an elective; it can take place in a school's courtyard or halfway across the world; it can be demolished at the end of the semester or become a permanent part of a community*; and it can innovate in all imaginable ways (Cavanagh, Hartig & Palleroni, 2014: 6).

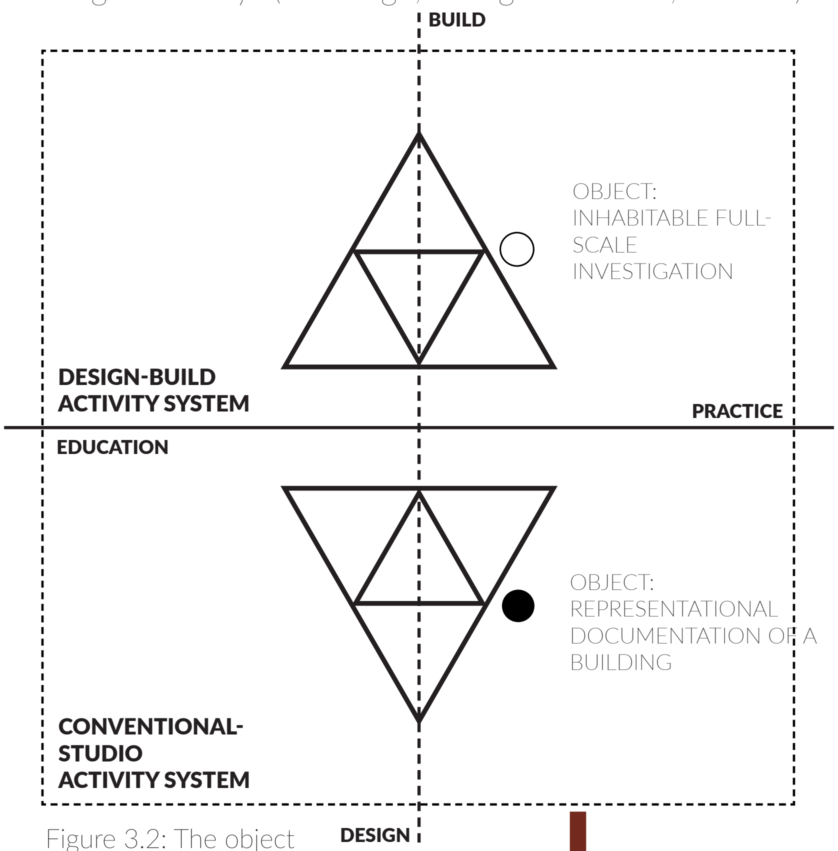


Figure 3.2: The object

3.3.2.1 SITUATED WITHIN LIVE PROJECTS

From a broader perspective, we start by looking at the typology of live projects. In the United Kingdom the term live projects has been used to describe projects that are real, but that do not necessarily have a built outcome. Live projects is a more encompassing term than design-build projects, and these projects are defined by Brown as projects where students experience 'not actual construction but a working relationship with an external client' (in Harriss & Widder, 2014: 52). In an even broader definition by Sara (2006), live projects are described as a contrast to the traditional studio by being real, with a usable outcome that could include ideas and various types of architectural documentation, which could include an architectural construction. Furthermore, the project is developed in collaboration with the external client and not the tutor.

Anderson and Priest, who initiated a network, the live projects network, which documents live projects and aims to share good practice, define live projects as comprising the

> negotiation of a brief, timescale, budget and product between an educational organisation and an external collaborator for their mutual benefit. The project must be structured to ensure that students gain learning that is relevant to their educational development (Anderson & Priest, 2015: 2).

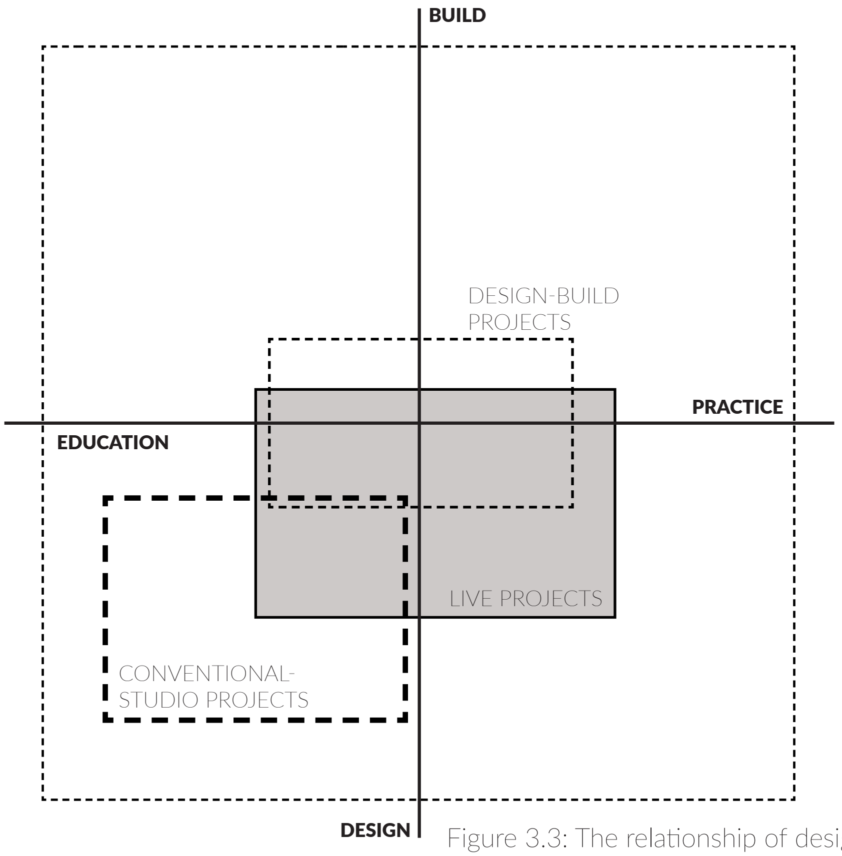


Figure 3.3: The relationship of design-build projects, live projects and conventional-studio projects

Live projects then have real outcomes, but do not necessarily include a built structure as part of the outcomes. A design-build project could therefore also be a live project, but not necessarily always, as the upcoming definitions will indicate. In the United States the term design-build projects is used to describe real projects with a construction outcome as well as real projects without a construction outcome. This practice causes some confusion in the literature. The following section aims to clarify and distinctly define design-build project typologies and to position these in relation to live projects.

3.3.2.2 BASIC DEFINITIONS AND ATTRIBUTES

A very basic design-build definition would describe projects in which 'students engage in both the design and construction' (Canizaro, 2012: 20), or projects where students get involved with an 'exploration of technology and its spatial implications' (Taylor, 2014a: 42). Other terms used for design-build projects are 'live build projects' (Anderson & Priest, 2015: 1); 'hands-on learning, learning-by-making, learning by building, 1:1' (Canizaro, 2012: 21); 'full-scale final spatial product' (Van der Wath, 2013: 181); 'full scale design' (Abdullah, 2011: 5) and LBM or 'learning by making' (Salama & Wilkinson, 2007: 191).

Canizaro (2012: 20) writes that the 'set of practices and pedagogical activities collectively known as design-build are diverse, but share commons threads, assumptions, and challenge[s]'. Wu (2007: 9) refers to these commonalities as the 'spirit of design/build programs' and summarises it as 'vernacular, technically sustainable, and community*-empowered ... [which] ... together form the soul of a design/build program, making it a pioneer in sustainable discourse' (Wu, 2007: 9). Joseph Bilello writes that design-build projects 'encourage students to work as part of collaborative teams, resolving conflicts, managing finances, and communicating with clients' (in Nepveux, 2010: 77). Wu's description attributes aspects of context, sustainability and social responsibility to a general definition; Bilello's adds collaboration and communication.

Other descriptions attribute the clear connection between design and construction to design-build projects. Fundamentally, design-build projects allow students the opportunity to participate and not just spectate, and to understand the integrated process of design and construction by considering material (Luescher in Van der Wath, 2013). Canizaro (2012) refers to the connection between design and construction as the 'art of building' where the hands-on experience becomes a 'renewed medium for ... creativity' (Canizaro, 2012: 22).

Design-build projects are also posited as a reaction or critique against the conventional education studio and professional practice. Nepveux says design-build projects provide an opportunity to 'remove ... projects from the studio vacuum' (Nepveux, 2010: 77). Carter (2013) attributes utopian, community*-based ideals to these projects and says that it often has an explicit anti-professional ideology. Canizaro describes it as an alternative pedagogy to the 'theoretical, desk-based, and media-driven (drawings, models, digital models) design process' (Canizaro, 2012: 20). However, Brown (2012) describes live projects as complementary to conventional studio projects. These opinions allude to the fact that design-build projects do not have to replace the existing studio but could be a parallel alternative to be considered and designed as and when appropriate as a teaching and learning tool.

Erdman (in Oakley & Smith, 2006) describes design-build projects based on the physical, functional and technological outcomes. She says design-build projects range from temporary installations to permanent constructions and can have a service function for a community* or be done 'simply for their own sake' (Erdman in Oakley & Smith, 2006: 82). The projects can be executed with low-tech, hand-made technologies or use digital methods. Design-build projects can include any imagined (conventional) studio project, or aspects of such projects. They are flexible and open to interpretation.

3.3.2.3 MOVING TOWARDS A MORE THEORETICAL DEFINITION

Attempts to arrive at more theoretical definitions of design-build projects include the purposeful categorisation of common characteristics, values, norms as well as organisational classifications, or to put it simply, the who, how, what and why of these projects.

Canizaro (2012) lists reasons (mostly whys) for doing design-build programmes. According to him, the main reasons include the pedagogical value, the construction experience, the value of the projects as a form of community service, broadened views of professional practice, a critique of academia, an enhanced awareness of place, enhanced collaborative skills and the exploration of new methods of project delivery and materials and materiality.

Anderson and Priest (in Harriss & Widder, 2014) provide us with an understanding of the mainly organisational aspects (mostly the how) of the live project. They identified eight 'spectra' against which one could measure a live project. These are the student level (foundation, undergraduate, postgraduate, research); group size (0–10, 11–50, 51–100, 101+); brief (students and tutor, students and researcher, research students and tutor, students only); external collaborator (self-initiated, collaboration, commissioned); product (analytical, propositional, temporary, semi-permanent, permanent); timescale (days, weeks, months, years); budget (self-funded, sponsorship, client-funded), and educational organisation (extra-curricular, curricular).

Cocoon Contextual Construction focuses specifically on design-build projects and provides a rather broad definition:

> DesignBuild [projects] are components of higher education in the field of build environment that allow students to be physically involved in the materialisation of their design. DesignBuild projects must: Be based in higher education / Have a brief, budget and timeframe / Be built / Have students involved in the design AND construction of the project / Be of architectural, social, cultural, scientific, technical or artistic relevance (Hartig, 2014: 1).

Abdullah (2014) again engages with the classification of design-build projects as course or curriculum-based models and he defines four of these. These are 'a simulation of an architectural firm'; 'elective summer program – community* outreach'; 'workshop or seminar-based courses'; and lastly 'research and experimentation projects' (Abdullah, 2014: 88). He gives examples of each model but does not necessarily explain the differences or shared characteristics.

Taylor (2014) defines two principal project typologies, firstly community*-based projects as typically involving 'a community* partner or non-profit, a programme, budget, and interaction with a client/collaborator' (Taylor, 2014: 42), which has as outcome 'a permanent structure built at full scale' (Taylor, 2014: 42) . Secondly, Taylor further describes projects as 'typically explorations in the opportunities embedded in technology, and often result in provocative installations with a range of scale and temporality' (Taylor, 2014: 42). Wallis (in Salama & Wilkinson, 2007) defined design-build practices on the basis of the development of the design process. One was a competitive basis where students worked individually, after which a winning design was chosen to be developed, and the other a collaborative model where students worked together from the start in developing the design. What is not clear from the literature is the possibility of various clear, theoretical typologies of design-build projects, and how and where the various typologies might be appropriate or useful to include in a curriculum or architectural programme. It seems that new design-build studios learn from previous design-build studios as one would study architectural precedent. It also becomes clear that design-build projects are not always live projects, as in some cases design-build projects do not engage with external clients at all, which is a prerequisite for live projects. If it is possible to arrive at a set of typologies where it is known what each contributes to both teaching and learning, it might help to inform new programmes and projects. The next section attempts to do that.

3.3.2.4 DESIGN-BUILD TYPOLOGIES

The design-build product as physical entity is the object of this research and it was imperative to define it from that perspective. Christenson and Srivastava (2005) propose four different design-build typologies. In my opinion, their classification currently provides the most critical theoretical definition of different design-build approaches. Their classification serves as departure point for defining the design-build project as the activity theory object of this study.

Christenson and Srivastava posit 'four distinct approaches to full-scale investigations in architectural education' (Christenson & Srivastava, 2005: 231). The approaches have in common that they are full-scale, in other words real-sized buildings, and the four typologies proposed are 'experimental, inhabitable, prototypical, and generative' (Christenson & Srivastava, 2005: 231) . Each of these typologies is described and discussed in the following section after which two more typologies from the literature are proposed. Figure 3.4 indicates all six of these typologies.

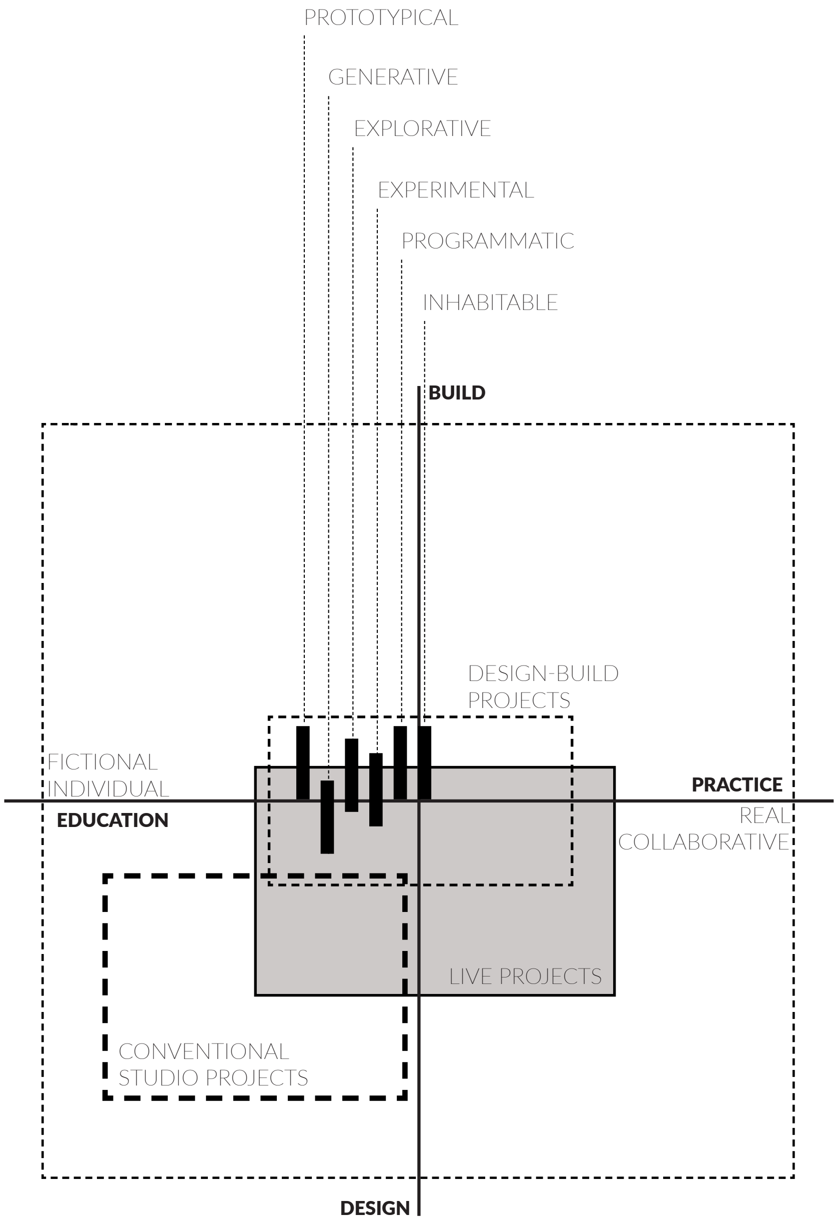


Figure 3.4: Six design-build typologies

i EXPERIMENTAL FULL-SCALE INVESTIGATIONS

Christenson and Srivastava (2005) define experimental full-scale investigations as the experimental and comprehensive study of the nature of materials, assemblies and systems. The investigations involve hypotheses that 'are explicitly or implicitly made, experiments are designed, results are observed and original hypotheses modified and reconsidered as needed' (Christenson & Srivastava, 2005: 232). These investigations are executed within a more controlled environment, relying on reliable data to be generated to inform future decisions about the use of materials in terms of energy savings, performance, cost efficiency, etc. Experimental full-scale investigations do not require the presence of an external community* or client or solutions to social problems.

An example that could be attributed to this definition is described by Lutz Paddicombe and Schmeckpeper (2014), whose students annually take part in the Solar Decathlon where they 'explore the challenges, potentials, and meaning of making strictly measured performance-driven architecture' (Lutz, Paddicombe & Schmeckpeper, 2014: 52). Another example is given by Canizaro (2012), who describes the EcoMOD programme of the University of Virginia, where design-build projects are focused on modular housing that is

> designed and built as operating hypotheses … about the future potential of modular housing … their mantra, 'design/build/ evaluate,' links design to experimental science in very productive ways. Upon completion, as in science, each evaluation feeds the subsequent design parameters of the next project (Canizaro, 2012: 26).

Taylor (2014: 42) mentions the 'agenda of a technology-driven investigation', which resonates with the experimental full-scale investigations by Christenson and Srivastava (2005). Experimental investigations have the potential for relatively seamless integration into the existing curriculum and to stimulate critical enquiry and thinking in students. Experimental full-scale investigations could generate reliable scientific results and data that are transferable as technological and material solutions.

ii PROTOTYPICAL FULL-SCALE INVESTIGATIONS

Prototypical full-scale investigations are more demonstration based, with the experimental aspect being replaced by standard procedure. A typical example would be students learning how to make mudbricks or build a cavity wall simply as part of a standard material investigation.

Prototypical full-scale investigations are described by the Christenson and Srivastava (2005) as

> of limited promise in architectural education: they serve a didactic, demonstrative purpose, often enabled by strong, almost choreographed conditions; having engaged in the demonstration, students move on, possibly possessed of a greater inclination to employ the newly learned technique in their own projects, but significantly without the heightened sense of scepticism and inquiry they might have had in an investigation more deliberately experimental and open-minded
>
> (Christenson & Srivastava, 2005: 233).

Although the authors see these investigations as not having much value in promoting experimental thought and creativity, they do see the value as partly developing a sense of material and possibly sustainable consciousness. I believe that in the right circumstances and incorporated into the curriculum and specific projects, prototypical full-scale investigations could serve as valuable lessons about standard practice and learning basic rules of construction and material behaviour.

iii INHABITABLE FULL-SCALE INVESTIGATIONS

Christenson and Srivastava (2005) describe inhabitable full-scale investigations as usually being on a larger scale than experimental investigations and being useful and inhabitable after the completion of the project. These projects are executed predominantly for communities and to fulfil a specific functional and societal need. The investigation into the possibilities and probabilities of the technology and material is not the principal design generator.

Examples of these projects would include the work by Rural Studio in Auburn, Alabama and in South Africa the work of the University of Cape Town in Imizamo Yethu. In general, this type of investigation is probably the most widely-known example of design-build projects.

With reference to community*-driven work, Corser and Gore (2009) note that

> these practices are note-worthy for both their high quality design and community* service, but because of the overriding demands of constructing complex structures in short time frames, they cannot devote too much attention to more open-ended speculation. (Corser & Gore, 2009: 32).

Whether open-ended speculation is limiting in terms of pedagogy and learning outcome and totally impossible to achieve in inhabitable investigations are questions to still be answered. Inhabitable full-scale investigations as educational projects address architectural concerns with the emphasis on finding an architectural solution for addressing immediate societal concerns.

iv GENERATIVE FULL-SCALE INVESTIGATIONS

Christenson and Srivastava (2005) propose a fourth definition, that of generative full-scale investigations. They describe these as the almost open-ended investigation, manipulation and exploration of materials. It is about discovery,

> to recognize and define regions, separations, overlaps, and conceptual strengths and weaknesses within a specific iteration or configuration … questions surrounding this investigation are deliberately open-ended and not specifically testable or verifiable (Christenson & Srivastava, 2005: 236).

The authors posit generative full-scale investigations as distinct from experimental full-scale investigations with respect to several aspects. The investigations are possible with simple materials such as sand and paper. Generative investigations do not start out with a specific hypothesis, goal, intended procedure or outcome and it is not possible to test if it is successful by any material or physical outcome. Instead, success is judged by each student's ability 'to discern value in their own work and to productively act upon that value' (ibid). Generative full-scale investigations depend on creative enquiry; do not have to lead to an architectural solution and do not have to depend on completion or collaboration to succeed.

To contribute to and expand the four definitions of the design-build project by Christenson and Srivastava (2005), this section introduces two further definitions. These two definitions are explorative full-scale investigations and programmatic full-scale investigations.

v EXPLORATIVE FULL-SCALE INVESTIGATIONS

To define explorative full-scale investigations I want to refer primarily to Foote (2012: 55), who describes 'a sustained materially driven exploration into the means of construction as a source of invention'. He argues for a continuous to and fro between design and construction, where these two concepts are not separated by linear execution but become a conversation. This conversation is left open-ended and not bound to 'an over emphasis on arbitrary completion in the validation of the work (which) may have unintended consequences for education, as well as for the work itself' (Foote, 2012: 55).

Unlike inhabitable full-scale investigations, explorative investigations are not bound by time of completion. Foote (2012) argues for the notion of reflection, open-endedness and non-linearity where it is not necessarily clear what the end product will be, and the discovery of possible solutions happens within and during the building process. Explorative does not need a client or a site to succeed. The investigations can be completed simply as explorations of technology. Fisher (in Mackay-Lyons & Buchanan, 2008) writes of something similar when he describes building at the Ghost Lab:

> to build and illuminate structures without concern for client programs, code requirements, or change orders … to embrace the essence of architecture, the collective bringing together of materials to make space and form, free of all the factors that affect architecture
> (Fisher in Mackay-Lyons & Buchanan, 2008: 123).

An explorative investigation differs from experimental investigations in that it does not rely on quantitative hypotheses or outcomes, but on experimentation with materials and technology of any type, including incidental or found materials. There is no clear starting point, as the start and end are discovered in the process.

Explorative full-scale investigations share this focus on discovery within the process with generative investigations, but unlike generative investigation they work towards architectural solutions, not open-ended material manipulation. Other examples that could be considered as part of the explorative investigations are described by Erdman (2002) in a project where they used found objects to collaboratively design and make a structure that unfolded in what she describes as a 'visceral and haptic process of full-scale constructions (of subconscious desires) with abandoned materials' (Erdman, Weddle & Mical, 2002: 176). Doan and Seavy (2014) also describe a project that stretched over four years and in which various students took part. They write that

> the cube's intent was not so much about the completion of a 'project' as it was to provide a place and opportunity for students to be immersed into the constructive nature of architecture; to inhabit their work through the construction site (Doan & Seavy, 2014: 38).

These examples resonate with Foote (2012), whose arguments were introduced at the beginning of this section. His reasoning refers to Virginia Tech's Washington-Alexandria Architecture Center (WAAC), where the building in which the College of Architecture and Urban Studies is located is the prime explorative place for ongoing design-build exploration. In their own academic habitat, students completed, among other projects, a famous spiral staircase in the library, making full-sized inquiry mock-ups until they were happy with the result. Explorative full-scale investigations can stretch over years, do not need an external client to succeed and, as in the WAAC, can even possibly sit outside of the formal curriculum, leaving students in charge of an explorative open-ended process.

vi PROGRAMMATIC FULL-SCALE INVESTIGATIONS

I want to include a sixth definition, which is inspired by Lily H Chi. She describes what I would term 'programmatic full-scale investigations'. Programmatic full-scale investigations are full-scale studies of habitable function, either permanent or, more probably, temporary, including theoretical investigation about habitus, occupation and the effects of 'culturally constructed conditions; architecture as spectacle versus used, background setting; the effect of time, duration, and the "distracted gaze"' (Chi, 2002: 162).

Programmatic full-scale investigations can be executed without 'real' construction; spaces can be mocked up with whatever material is available, as it is the dimensional experience that is of concern. Besides experiments in spatial experience, where we can refer to the example of the Vienna Wallensteinplatz project led by Fattinger, Orso and Rieper (Werner & Mayer, 2005), programmatic full-scale investigations can also serve in participatory design exercises to help with the understanding of spaces.

Hamdi describes just such a participatory process:

> We ... set up an office on site with a large model and met with each family to test ideas and make sure it would all work and to budget. Then we would step out into the empty structure and chalk it all out to get a sense of scale. Families would meet and exchange ideas and socialize – a sense of community* and belonging began to develop well before occupation (Hamdi, 2010: xv).

Programmatic full-scale investigations are temporary structures made with the intention of creating a spatial experience of habitable function. The intent is to either give the experience or be able to observe human reaction towards light, height, width, texture and ways of occupying a space or spaces. The technological and material are more incidental and primarily intended to make the space. Of course, the more accurate the material and technology become, the more real the experience would be.

3.3.2.5 SUMMARY OF THE SIX TYPOLOGIES

These six typologies describe the rich variety of design-build projects as full-scale, hands-on investigations in architectural education. This concept resonates with Erdman (2002: 174), who posits that design-build 'has come to denote … integrative approaches to architecture whereby the act of building becomes an essential critical and pedagogical tool'. Each typology could underpin an approach to the conceptualisation of a design-build project, or within one project two or more typologies could overlap. In an unpublished manuscript Christenson and Srivastava (2016) reflects on their four definitions and write that 'many full-scale architectural investigations demonstrate qualities of more than one of the categories' (Christenson & Srivastava, 2016: 5). Being aware of the variety of possible approaches and combinations could provide guidance for setting up a deliberate hands-on curriculum.

These six approaches of design-build investigations are distinguished from live projects in that these six approaches always have a physical outcome. Not all of these investigations necessarily involve either a specific physical context or social responsibility, and in that sense they are different from the live project, where there always is an external collaborator and specific context.

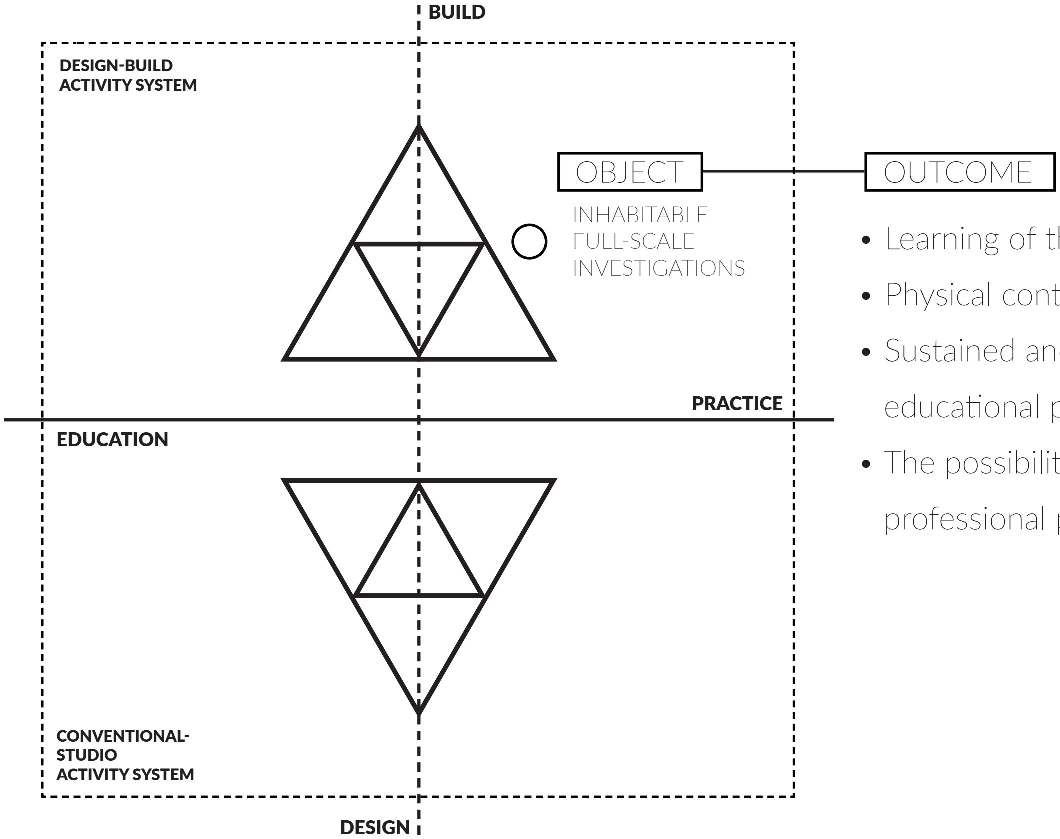
I would agree with Foote (2012) that, if completion of a project is a priority, it does have an influence on the pedagogic approach and on the outcome of a design-build project. The same would be true for a reduction or a restriction of time. The idea of completion does not, however, need to negatively influence the process or object. As Van der Wath (2013) says, design/build projects are typically smaller in scale and should have manageable levels of liability and structural complexity. This may seem restrictive to educators, however [and here she quotes Thomas] '...a reduction in building scale, at times, is balanced by an increase in creative liberation, encouraging experimentation with materials, texture and proportion while stressing play and whimsical exploration (Van der Wath, 2013: 182).

In my opinion these six approaches describe the full spectrum of possible design-build projects. Aspects that these typologies share or relate to are described variously through these six definitions and by descriptions of design-build project definitions that preceded the introduction to these typologies.

In this research the focus is primarily on inhabitable full-scale investigations. Therefore, for the rest of this thesis the term design-build refers to socially responsive, inhabitable full-scale investigations.

3.3.2.6 INHABITABLE FULL-SCALE INVESTIGATIONS AS OBJECT WITH FOUR OUTCOMES

In this thesis the design-build project is also conceptualised as the object of a design-build activity system from an activity theory perspective (Figure 3.5). The design-build activity system with inhabitable full-scale investigations as object has four broad outcomes.



- Learning of the students
- Physical contribution to the community*
- Sustained and improved design-build educational practice
- The possibility of an alternative form of professional practice.

Figure 3.5: Four main outcomes of the design-build activity system

The first two outcomes are more immediate and bound in time to the completion of a specific design-build project. These two outcomes are the learning of the students while taking part in the project and the physical contribution made to the community*. The learning and knowledge acquisition of the students, where the design-build project is 'a vehicle for students to explore the uses, characteristics, and potential within building materials, their assembly and tectonic/ spatial possibilities' (Canizaro, 2012: 26), allow students to leave these projects 'as skilled and creative problem solvers' (Cook & Stephenson, 2014: 18) and with 'skills in communication, negotiation, team dynamics, project management, dealing with contingency, cost, participatory skills that are otherwise hard to simulate within the academic curriculum' (Sara in Hands-on-Bristol, 2015: 4).

The contribution to the community* can take on a variety of inhabitable built forms. These vary from small outdoor structures to public buildings and are dependent on, among other aspects, the history of the specific programme, how the project fits within the curriculum and an academic cycle and the possible complexity of construction technology (Canizaro, 2012: 27). Limitations that could determine the scope of the projects include the available funding and the management of the risks involved (Van der Wath, 2013: 182).

Although all four outcomes need to be considered as they are interdependent, it is the third outcome that is the primary concern and the fourth outcome that is the secondary concern of this research. The third and fourth outcomes are considered more long-term, durable outcomes, which envelop the first and second outcomes. The third is the creation of sustained and improved design-build educational practice and the fourth is the creation of the possibility of an alternative form of professional practice.

Sustained and improved design-build educational practice as the third outcome leads to improved practice in terms of the execution of the projects in the academic and community* environment. Cook and Stephenson (2014) describe design-build projects as a vehicle for research. Shared practice and research can lead to better programmes and improved pedagogy.

Whether students will consider design-build as an alternative form of professional practice is ultimately up to them, and it may be dependent on the experience of the students within the activity system. Doan and Seavy (2014: 38) write that 'a student must develop an approach to the practice of architecture'. Being within this academic system could influence their way of being, seeing and knowing in this world.

3.3.3 TOOLS

Some means is necessary to bring the prior experience of history into the current activity … tools usually reflect the experiences of other people who have tried to solve similar problems at an earlier time and invented/modified the tool to make it more efficient (Ryder, 2015: 2).

This section on tools attempts to identify existing conceptual, cultural and physical tools, also referred to as artefacts in activity theory. The definition of the various tools is based on the reported research, observations and experiences of design-build practitioners. Rice-Woytowick (2011: 3) states that the development of the 'pedagogy and organizational structure' of the design-build project is still 'emerging', and Van der Wath (2013: 182) points out that design-build projects 'offer learning opportunities that go beyond a purely conceptual and intellectual understanding of the student's surrounding environment'.

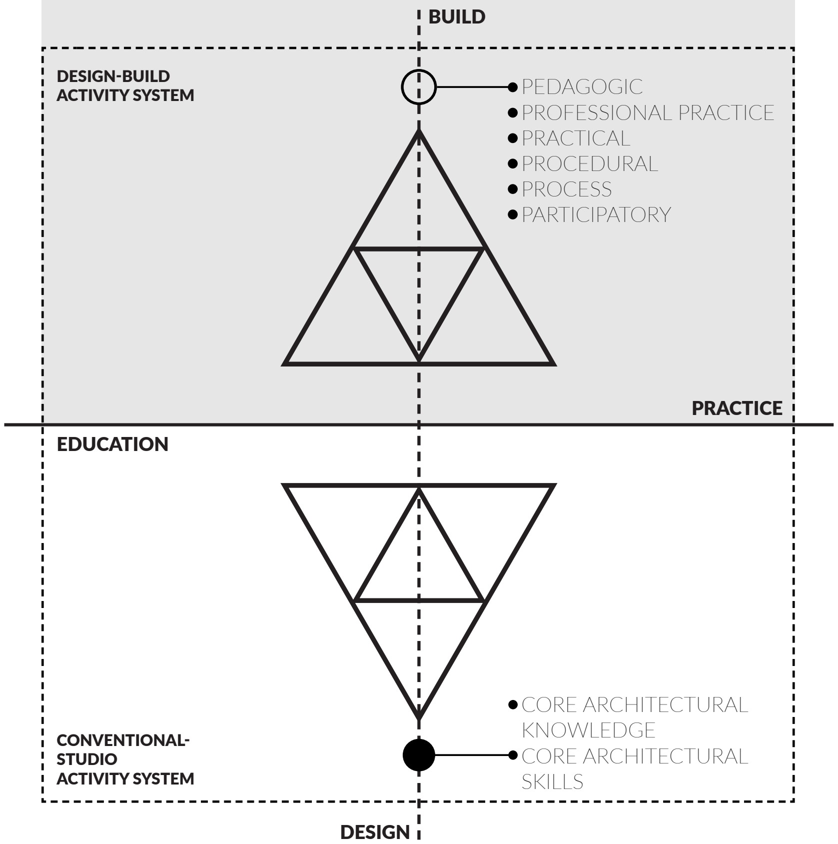


Figure 3.6: Tools the design-build activity system has in addition to the tools of the conventional-studio activity system

3.3.3.1 PEDAGOGIC TOOLS

Pedagogic tools are the most complex and comprehensive of the tools presented here. Below is an overview of applicable teaching and learning theories, followed by a section that discusses the various pedagogic tools.

i PEDAGOGY – APPLICABLE THEORIES

Pedagogic tools rely heavily on research by Brown, who completed his PhD, A critique of the live project, in 2012. He interviewed 'twenty-one architectural educators at seventeen Higher Education institutions … to solicit their opinions regarding the live project' (Brown, 2013: 2). Brown describes the pedagogies of these projects as complex. Although there are differences between live and design-build projects, it is their commonalities that make most of the pedagogic lessons of live projects transferrable to design-build projects. According to Brown, complicated pedagogies are limited in their scope of explaining the learning that happens in the live project.

Brown also reviews Schön's theory of reflective learning and Kolb's experiential learning model and states that both these

> are highly suited to the study of Live Project learning since they propose sequential frameworks that theorize the process by which an individual learns, examining the role of personal experience and personal reflection in a sequence of experience, reflection, and action (Brown in Harriss & Widder, 2014: 54).

However, he argues further that both these theories focus only on internalised individual learning, do not use the 'potential of the design studio to be theorized as a holistic learning environment' and do not 'provide practical tools for theorizing either the inter-disciplinary practice of the architect or the collaborative learning of the Live Project'. He posists for the use of pedagogies of complexity that recognise and consider context and the 'interrelationship and interdependency' between learners and teachers (Brown, 2012: 132).

Authors also use the notion of the reflective practitioner by Schön (1983) to describe the possibility of reflective learning embedded in these projects. Brillhart (2014) writes that these projects have 'lessons that can only be experienced while making, through real-time reflection or "reflection in action" and can only be made after the experience of doing, through "reflection on action"' (Brillhart, 2014: 8).

Various other authors have discussed a variety of applicable learning theories. Harris refers to a number of these, including situated learning, whole-person learning, problem-based learning, student-centred learning, knowledge creation, engaged scholarship and service learning (Harriss, 2012). Anderson and Priest (in Harriss & Widder, 2014) attribute aspects of learning in communities of practice (Wenger, 2010) to learning in live projects.

They write also that live projects ‘create ideal conditions for situated learning through legitimate peripheral participation and for new relationships between tutor, student and community*’ (Anderson & Priest in Harriss & Widder, 2014: 50). A number of authors write about design-build projects as opportunities for experiential learning, with reference to Dewey and Kolb (Canizaro, 2012; Van der Wath, 2013). In the call for conference papers for the ACSA 2014 Fall Conference entitled Working Out: Thinking while Building (ACSA, 2014), the question ‘how might design/build be explored as distinct pedagogic practice?’ was asked. My thesis positions itself to contribute to the exploration on what makes design-build education distinct and resonates with Brown in purposefully exploring the interrelationship and interdependency that ground these projects.

Image 3.1: Physical tools at St Michael’s

ii PEDAGOGIC TOOL – COMPLEXITY AND THE WHOLENESS OF THE PROBLEM

The simple complexity of the design-build project offers a rich pedagogic tool that allows students to engage with a whole and holistic problem. Doan and Seavy (2014: 38) call it the 'multifarious characteristics of a project' and continue that this 'forces a student to develop a way of working'. Christenson and Srivastava (2005: 235) write that the 'obvious and important educational value of inhabitable full-scale investigations such as the Rural Studio emerges because students achieve direct exposure to multiple aspects of practice'. Broadbent argued that 'architects need a profound understanding of physiological, psychological and social human values in the resolution of complex problems' (in Abdullah, 2011: 6). Other aspects that are introduced into the process are budget, schedule, safety, and modularity (Cricchio & Butko, 2014).

Comments are made on the positive aspects that dealing with the entire process attributes to the learning. Van der Wath (2013) explains that students are introduced to whole-process complexities and continues to quote Luescher, who writes that students become 'participants, not merely spectators, and (in theory, at any rate) understand design and construction as an integrated process that begins with the consideration of material' (Luescher in Van der Wath, 2013: 193). Erdman et al. contribute by saying that the design-build process is an integrated process with a 'more synthetic relationship between design and building [with a] very clearly delineated process of making and reflecting' and not a 'traditional process whereby design is a first and separate act leading to an eventual construction' (Erdman et al., 2002: 174).

Part of dealing with the problem in a holistic manner is the increased interaction with others, which ties to the notion of working collaboratively, which has become the focus of this study.

iii PEDAGOGIC TOOL – TIME, LIMITED AND OTHERWISE

Working within a limited time frame where completion of a project is non-negotiable creates interesting opportunities in the learning process. Some authors see having limited time as a negative aspect; they feel students could lose the flexibility and investigative possibilities in their work (Christenson & Srivastava, 2005). Also, because there is an 'ethical and legal obligation to the clients to complete the work on time … [and this] can often run counter to the pedagogical goals of student learning' (Canizaro, 2012: 33).

Other authors see the limited time available as an opportunity for students to learn about time restraints (Van der Wath, 2013) and the project management aspects of professional practice. Students themselves start to value and 'appreciate time and materiality as integral to design' (Cricchio & Butko, 2014: 36). And not everything is predictable in a time-limited process. Sara (2004) writes that while students learn to manage their time, the 'real-world … also introduces a contingent element to the work, whereby unexpected and unpredictable occurrences influence and affect the work as it progresses' (Sara, 2004: 2).

Students have no choice but to deal with what happens in a real-life, real-time situation. Doan and Seavy describe this clearly. They write that, since 'a Design-Build project must be built, a student cannot ignore certain aspects of the project. It forces the student out of their comfort zone to confront all facets of a project, learn on the fly, and think on their feet' (Doan & Seavy, 2014: 38).

Some projects are structured so that students still get an opportunity for experimentation with design and technology and other aspects of the project, but focus on completion as well. Where programmes have developed their projects from experience and include the time constraint with deliberate design, the limited time becomes not a constraint but a tool to enable specific aspects of learning. Reliance on others and productive and positive teamwork could be highlighted as a necessity in working towards a strict deadline that would be impossible to achieve on one's own.

iv PEDAGOGIC TOOL – FEEDBACK, MISTAKES AND DEVELOPING THROUGH REFLECTION

When working within time constraints and in real time, as discussed above, an approach of active feedback and reflection can contribute positively to the unfolding process. Bernhard and Taylor write about studying such a deliberate and conscious approach where the 'recursive feedback loop with numerous instances of continual learning and adaptation … [had] greatly improved the architectural outcome' (Bernhard & Taylor, 2014: 58).

Abdullah (2011) and Brillhart (2014) highlight that incorporating the idea of Schön's reflective practitioner is important in the project process. Brillhart mentions that reflection-on-action between the 'concept and final outcome' can lead to an understanding of 'how the project fit(s) within larger architectural themes and typologies' (Brillhart, 2014: 8). Both authors mention reflection-in-action as continuously feeding back and reflecting during the process. Brillhart says further that reflection-in-action, or what he calls 'real-time reflection', occurs 'when we are confronted with unexpected circumstances that challenge our programmed knowledge and require us to reformulate what we are doing in the moment' (Brillhart, 2014: 8). In a reflective process the link between drawing and making is highlighted by Brillhart (2014) and Gelpi (2014a). Both authors describe project processes where there is continuous feedback between drawing and building and of adapting drawings from the real-time feedback and reflection while making. Drawings are also used as a means of keeping record and could aid reflective conversation. Cavanagh et al. (2005: 8) report a project where '[a]s built drawings recorded daily progress, and facilitated discussion about issues such as structure, questions of detail'.

‘Mistakes are part of the learning experience’ (Abdullah, 2011: 14) and often part of the building phase of a project (Dagg, 2014). Reflection and feedback allow for mistakes to be an important part of the process. As Christenson and Srivastava (2005: 235) write, ‘mistakes are of profound educational value’. They quote Samuel Mockbee of Rural Studio, who allowed his students to make mistakes, which was an unusual teaching strategy. Mockbee said: ‘I’ve learned to trust their resourcefulness, to let them push directions I probably wouldn’t follow’ (Christenson & Srivastava, 2005: 235). Making feedback and reflection an active part of the activity system allows the student to realise ‘the value of process rather than exclusively prioritising final product’ (Voulgarelis, 2012: 265), and to ‘understand that in solving problems you reveal new problems’ (Brillhart, 2014: 8). This is true not only for students, but also for educators. As will be shown when collaboration principles are discussed, reflection is an active part of the collaboration process. Again, this emphasises that knowing how to work with others contributes to information and feedback at the right time and in the right place, which can contribute to a positive outcome.

v PEDAGOGIC TOOL – AUTHENTIC CONTEXT

Design-build projects are 'grounded in ... realities that may include the site, setting, clients, schedules, budgets, and technical demands of construction, design decision-making is made more informed and responsive' (Canizaro, 2012: 21). In design-build projects students deal with authentic concerns and this proves to be a powerful pedagogic device. Cavanagh et al. (2005: 8) describe the development of a 'design framework [that] evolved out of a set of pragmatic and aesthetic considerations many of them discovered in the field'.

The actual context in its broader sense, including 'both climate and local culture' (Canizaro, 2012: 24), and 'the richness of the cultural, social and physical environment of a particular place' (Vlahos, 2000: 95), becomes a concrete reality for students. The physical context of the site allows students to develop locally appropriate climatic responses. Weber (2014b: 26) reports that students designed 'passive systems into the design, including ventilation, orientation, and daylighting', and Sommerfeld (2014: 34) writes about students including a 'vertical shading device [that reduced] the heat load on the building by 66%'. The context also gives students the opportunity to learn 'from location re local building method and materials' (Cavanagh et al., 2005: 8). The context leads to 'knowledge of regional vocabulary and indigenous materials' (Wu, 2007: 6). Students also use existing structures and recycle locally available materials. As Sommerfeld and Galarza (2014: 50) report, the students 'decided to utilize the existing foundation and virtually all of the build kit materials stock piled on site in their design'.

The cultural and community* context is an equally important informer of process. Blake (2014: 28) writes that 'participants recognize that site context is far more than the built fabric.

The connections forged and sustained with neighbors, community*-based organizations, consultants, contractors, and end-users inform the connections made on-site by the designer-builder'. As Samuel Mockbee puts it: 'the best way to make real architecture is by letting a building evolve out of the culture and place' (in Dean, 2001: 1).

The locality of the context becomes another informant in the design process. The University of Kansas uses the idea of working over a long distance to focus on technology that is premanufactured and can be transported (Corser & Gore, 2009). Stevens (2014: 44) also describes a project that 'was fabricated off-site … so it needed to be designed in components, or chunks, that could be assembled for testing, disassembled for transport and reassembled on-site'. The realness and authenticity become a valuable tool that aids the development of the design process and informs decisions.

vi PEDAGOGIC TOOL – DIAGRAMMING, MODELS AND MOCK-UPS

The tools that students use to develop their designs in a design-build project contribute to the learning experience in a different manner from that of the normative studio. 'In the design studio, most of the tools at our disposal are utilised to evoke architecture's visual qualities alone, foreclosing on the fundamental richness that comes in a synthesis of touch, sound and movement' (Luescher, 2010: 20). In the conventional studio diagramming and drawing, both by hand and digitally, are the 'essential developmental tools' (Cook & Stephenson, 2014: 18; Kober, 2014: 48). In the design-build project, physical model making, working prototypes (Corser, 2014; Dagg, 2014) and full-scale mock-ups (Weber, 2014b) aid in the hands-on discovery of material properties and possibilities. Kober (2014: 48) describes their design-build studio's process as 'text to 3D', working from two-dimensional aspects to three-dimensional diagrams and then onto paper models, from where it develops to 1:10 models and then onto CAD to print 3D forms.

Model making and mock-ups do not exclude the use of diagramming and drawing, but are used in conjunction with them. Van der Wath (2013) observes a decrease in the use of sketching and drawing in a recent case study and posits this as problematic and something that must be addressed. Diagramming and drawing are still seen as an important part of the design development process. Kober (2014: 48), on the other hand, describes a case study where 'diagrams were the essential tools used to transform scientific research into [a] built, inhabitable' project. It seems to not be an either-or situation, but a synergy that needs to exist between drawing and making.

The iteration between building and drawing also informs the final design, as explained by Gelpi, who writes that 'several times the section needed to be redrawn based on the observed bending radius of materials at various scales, and then finally at full scale, based on the specific wood-species of tree used' (Gelpi, 2014a: 46). Van der Wath (2013) expands on this notion by quoting Badanes, who says: 'we try to do a good set of drawings, but if an opportunity presents itself or if a mistake is made, we brainstorm right there. You get a certain feedback from what you are building, like a sculptor does' (in Van der Wath, 2013: 192).

Cavanagh et al. (2005: 6) recount a project where 'physical models were useful in exploring concepts, but we all began to rely more and more on the qualities and characteristics of the actual materials placed in situ at 1:1 to determine the remainder'. The value of full-scale mock-ups is reiterated by Deal (2014: 24), who says that by 'engaging in the full-scale construction of digitally native forms, invaluable learning took place as the students employed both traditional and digital means of material manipulation, experimenting and innovating as needed to realize their design'. Weber (2014a) describes an intense process where a mock-up served as a guide to the development of screens that were 'affordable, efficient, and functional' (Weber, 2014a: 22). Deal (2014: 24) also reports that full-scale mock-ups provide a 'heightened awareness of the pitfalls in the translation of form from digital to physical', knowledge which can be transferred to future projects and practice by the students. Digital technologies are also used to aid in minimising waste during production (Gray, 2014).

Abdullah (2011) explains that this two-way conversation between drawing and making becomes a means of communication, and the full-size mock-ups make clear to students the relationship between drawing and building. He further says that 'bad working drawings with bad details frustrate even experienced builders' (Abdullah, 2011: 14) and the drawing to mock-up practice learned in design-build could become a way to 'ensure smooth communication between architects and builders' (Abdullah, 2011: 20).

vii PEDAGOGIC TOOL – THE POSSIBILITIES OF TECHNOLOGY

Reported case studies of design-build projects indicate a definite experimentation with more unusual technologies (earth, straw bale (Sommerfeld & Galarza, 2014); recycled, digital). Students can be guided to explore but may be guided in a specific manner. This can be done by focusing students' attention on the embedded 'geometric rules' (Sass & Oxman, 2006: 336) of materials, as opposed to focusing attention on the specific properties of the material at hand. If students understand that cardboard, a flat sheet of stock material, is embedded with similar geometric rules as plywood, they should, in principle, be able to apply knowledge gained to future interior design projects (Van der Wath, 2013).

viii PEDAGOGIC TOOL – FLEXIBILITY AND OPEN-ENDEDNESS AS PEDAGOGIC TOOL

Flexibility of the architectural curriculum can be viewed as a tool in the development of design-build projects. In his thesis Brown (2012) reports that architectural educators were able to introduce live projects into the studio without difficulty. He writes that 'there was a consensus amongst architectural educators interviewed for this survey about the value and pedagogical flexibility of their discipline, and that live projects are excellent opportunities to take advantage of that flexibility' (Brown, 2012: 228).

This flexibility also allows for cross-disciplinary pedagogy possibilities (Christenson & Srivastava, 2005) and 'collaborating with outside disciplines to solve an architectural problem' (Brillhart, 2014: 8). In short, flexibility allows for design-build projects to be introduced into a course and for these projects to provide opportunity for collaboration with other professions where it is necessary to make the project possible. Flexibility in the curriculum is disputed by Saidi (2005), who writes that there are minimal experiential learning and flexibility in South African schools of architecture (with specific reference to the theoretical, research-based universities) 'as most of the learning course modules are required modules' (Saidi, 2005: i). Whether this is the case for universities of technology in South Africa is not clear.

There are also arguments for flexibility within the design-build project itself. Foot (2012) argues for the notion of reflection, open-endedness and non-linearity where it is not necessarily clear what the end product/project will be and where the discovery of possible solutions happens within the building process (described in the explorative model in this chapter).

Dagg (2014) argues for flexibility in terms of the design-build product and that different groups of students can work on aspects of a project towards the completion of a final building, depending on the available time and finances. He writes that 'this smaller element is then incorporated into a larger construction process, or can be repeatable is a potentially important strategy' (Dagg, 2014: 60).

Canizaro (2012) writes that the project outcome, or what he calls 'instructional intentionalities … [can] … can 'influence the internal processes carried out by the students and faculty, the kinds and sites of projects selected, and even the time frame allowed for the work' (Canizaro, 2012: 22). Such choices are made possible by the flexibility in the curriculum. As Bradbury and Papaefthimiou (2013: 1) rightly say, the 'challenge is striking the right balance between pedagogic benefits versus providing a service'.

Image 3.2: A seat made from recycled school chairs found on site at St Michael's

ix PEDAGOGIC TOOL – MOTIVATION AND RESPONSIBILITY

When describing case studies most academics mention the enthusiasm and enjoyment (Abdullah, 2011) with which students take on these projects, stemming both from the idea of contributing to 'social upliftment or social justice' (Garraway & Morkel in Bozalek et al., 2014: 26) and from engaging in real, hands-on work. Motivation comes also from a sense of empowerment that students get when receiving positive feedback from their clients (Chiles & Till, 2004). Students therefore have both intrinsic motivation, linked to their experience of 'doing good', and extrinsic motivation, which resides in the physical completion of the project and the contribution this makes to their studies. 'Traditionally, educators consider intrinsic motivation to be more desirable and to result in better learning outcomes than extrinsic motivation' (Lai, 2011: 4). Van der Wath (2013) discusses enthusiasm in design-build projects as important to facilitate deep learning. Having motivated students is almost a given in these projects, making for an interesting project environment where the tutor can concentrate on aspects other than trying to be a motivator.

Working for a real client also gives students a sense of responsibility, as Canizaro (2012: 27) says: 'the students often feel a greater responsibility to something beyond themselves, making them more serious and motivated to complete the work'. Even where students start out with reservations about the work, they soon develop 'enthusiasm, confidence, and ingenuity' (Cook & Stephenson, 2014: 18), along with 'pride and camaraderie' (Nason, 2014: 14). These are all very positive attributes for facilitating learning and are inextricably linked to these projects. As many others observe, 'student interest and engagement is strong' (Swartz, 2014: 16).

x PEDAGOGIC TOOL – COLLABORATION

Although group work and collaboration are mentioned as important aspects of these projects, only Sara (2006) describes in any detail how this should happen. She gives the following guidelines:

> 'Consider providing workshops around how to manage working in groups, or structure support to facilitate successful group-work (perhaps through group-focussed assessment of processes. Expose relations of domination within the group-work. Determine a group-working protocol. Hand over to students as much responsibility for the projects as possible and trust students to rise to that responsibility. Work with students as a part of the team wherever possible' (Sara, 2006: 5).

Wallis (in Salama & Wilkinson, 2007) describes collaboration and competition as part of the initial design process. Students either collaborate to develop a design that will be built or competitively develop separate designs of which one is then chosen, with hybrid models in between. But collaboration plays an important part in more than the initial design stage; it is part of the entire course of the project.

Van der Wath (2013: 184) says design-build projects offer a place where students can be 'exposed to the complex collaborative nature of spatial design'. Cook and Stephenson (2014: 18) discuss 'collaborative hands-on exploration, experimentation, and refinement'. Kober (2014: 48) mentions 'collaborative work … [resulting in] a new collective form'. Collaborative construction or building is also part of the design-build process (Rice-Woytowick, 2011; School of Architecture Design and Planning, 2014). Besides working collaboratively with other students, students also work collaboratively with others, including 'faculty, professionals and community* members' (Feuerborn, 2005: 1).

Collaboration does not exclude, since 'the process is more dialogic and inclusive than traditional studio projects, allowing and embracing alternative voices in the studio environment' (Sara, 2004: 2). Students not only enjoy collaboration above the usual competition among themselves (Chiles & Till, 2004), but collaboration enhances self-confidence in group work and students realise they do not have to be the best at everything (Sokol, 2008). Collaboration teaches students about individual responsibility within a team (Chiles & Till, 2004; Abdullah, 2011), and teaches students about consensus-based decision-making (Cook & Stephenson, 2014). Chiles and Till (2004: 4) believe that the 'core skills of organisation, team working and working to a tight timescale' must be formally taught to students.

xi PEDAGOGIC TOOL – ASSESSMENT

Assessment of design-build projects can become a tool that enhances the learning experience. Canizaro (2012: 24) is of the opinion that the 'basis of judgment is made more relevant by the reality of the project setting'.

A variety of assessment approaches is reported in the literature. Chiles and Till (2004) describe self-assessment, group-assessment and reflection through written work in a management course. The most valuable for them is a formal presentation at the end of a project that 'highlights how well the team have worked together, how successful the briefing process was and how the end result has been communicated back to the client' (Chiles & Till, 2004: 5). They also reflect that formative assessment is necessary, but that the danger is for 'tutors to fall back on the traditional, architectural assessment process' (Chiles & Till, 2004: 5). Van der Wath (2013) reports self-assessment and individual assessment through reflective design reports and group assessment through verbal critiques. Vlahos (2000) also emphasises students' reflections as part of assessment.

Harris and Widder (2014) set out a live project manifesto and provide six principles against which to evaluate live projects: 'Respond to the pressing need; Reward successful failure; Measure social impact; (Re)define what is valuable; Reward the missing skills; Engender criticality, complexity, conflict' (Harriss & Widder, 2014: 85).

3.3.3.2 PROFESSIONAL PRACTICE TOOLS

Design-build projects sit between education and practice. While students 'must develop an approach to the practice of architecture' (Doan & Seavy, 2014: 38), the practical aspects of being professional often fall through the cracks between projects and student process, and need to be dealt with by the faculty.

Brown (2012) points out that what is often missing is 'a single point of contact who can not only co-ordinate the disparate elements ... but also to ensure that it "feeds back" into the curriculum' (Brown, 2012: 241). He suggests creating proper internal evaluation of the 'successes and failures' (Brown, 2012: 241) of projects and also establishing a permanent, well-resourced projects office with an assigned manager who 'can provide administrative support, connect live [read also design-build] projects to wider learning outcomes, manage professional client liaison and maintain quality assurance' (Brown, 2012: 241).

It is often necessary to deliver a professional building service in collaboration with professionals, trades and craftsmen outside the faculty. Canizaro (2012) explains that 'due to the complexity of many projects, legal and/or code considerations, programs are forced to work with consultants and sub-contractors for electrical, plumbing, specialty trades, and the operation of complex equipment' (Canizaro, 2012: 29). However, except for the necessary trade work, the rest of the project could be completely executed by the students (School of Architecture Design and Planning, 2014). The direct contact with professionals and trades provides students with valuable experience for use in their professional careers.

3.3.3.3 PRACTICAL TOOLS

Design-build is so much about making that a section on practical tools that assist in the physical making process cannot be excluded. Corser and Gore (2009) wrote that 'few academic design-build programs have yet to critically engage new digital fabrication technologies in community*-service projects' (Corser & Gore, 2009: 33), and then reported their own use of digital technologies in their programme. Since then many programmes have documented the use of digital technologies both in the development of the design and in the final building process. Huang and Belton (2014: 62) write about engaging in 'craft as it applies to architecture with the introduction of digital fabrication methods'. Weber (2014a: 22) mentions the 'synthesis of digital technology and thoughtful application of tectonic principles', and Corser (2014: 66) discusses Collab/Fab that 'also focuses on digitally enhanced building techniques like CNC, Pre-fab and Modular approaches, favoring "off-site manufacturing" paradigms over "on-site construction" ones'. Gelpi (2014a, 2014b) describes digital technology being used to explore 'new yet consistent forms' (Gelpi, 2014b: 56) as well as a project where digital technologies allowed production with minimum waste generated.

By engaging students in real, life-sized digital technologies the often enticingly generated form is taken out of the computer and into production. Deal (2014: 24) describes that students learn 'to explore material properties and the limits of manipulation in order to ultimately discover the tectonic realities of the full scale construction of an ambitious parametric form the likes of which are so often digitally represented with ambiguity regarding materiality and constructability'.

Students often do not possess advanced building skills and have 'varying degrees of prior experience in: design, tool use, and problem solving' (Cook & Stephenson, 2014: 18). This variation in skills and experience implies that some programmes limit their design-build projects 'to the use of familiar or standard building techniques and methods' (Fowels in Canizaro, 2012: 34). The use of digital technologies brings another dimension to design-build projects and to some extent disposes of these limitations.

Programmes also actively teach physical skills, including 'how to use a specific tool, the sequencing of construction to sourcing materials' (Doan & Seavy, 2014: 38). Awareness and 'critical understandings' of physical skills are reported by Deal (2014: 24), who describes a project where students had exposure to aspects of 'wood structure, formwork, flexure, mitering and milling … cutting and welding steel with consideration for expansion, contraction, bending and tolerances, as well as … [to] lessons surrounding pouring, vibrating, patching and finishing concrete' (Deal, 2014: 24).

Allowing students to use power tools as part of their university course is a challenge and requires professional supervision (Chiles & Till, 2004). Student indemnity, safety and insurance become legal aspects with which the academic has to deal. Making real structures on a full scale is part of the motivation of the design-build activity system, and the challenges to involve students in this work seem challenging, but from the uptake in programmes internationally it also seems worth taking on the challenge.

3.3.3.4 PROCEDURAL TOOLS

What is necessary to make these projects a reality? Funding is probably the biggest hurdle for most programmes (Brown, 2012). The community* or clients often do not have money to contribute to the process. Students do at times get involved in the fundraising, but 'tend to be most successful with in-kind donations of materials and products. Only in rare cases the students generate both the funding and projects' (Canizaro, 2012: 29).

Programmes describe varying strategies to work within or outside academic institutions: 'The longevity and sustainability of any live project programme, constructed or not, may depend on the amount of time, academic resource[s] and institutional support that can be assigned to it' (Brown, 2012: 246).

3.3.3.5 PARTICIPATORY TOOLS

To work successfully with and within a community* requires advanced social skills. Students enjoy this social experience (Abdullah, 2011) and gain 'knowledge on social issues' (Wu, 2007: 6). Tovivich (2009) believes that a participatory design process addresses the needs of the individual, the community* and the architect. Chiles and Till (2004) introduce students to stakeholder mapping once the students realise the complexity of working with a real client.

Students need to develop communication skills (Wu, 2007), as there is an 'absolute need for clear communication and mutual understanding of expectations' (Corser & Gore, 2009: 33). Communication skills, according to Abdullah (2011: 13), include 'agreement, suggestion, reinforcement or disagreement'. Chiles and Till (2004) conducted a study where they explored the communication skills of architects at a variety of project stages. They say about this study that 'it is a revealing portrait of how architects need to learn to communicate better with non-architectural audiences' (Chiles & Till, 2004: 5). Working successfully with a community* requires also that 'appropriate collaborations are established early in the process' (Taylor, 2014b: 30), and that the decision-makers are identified (Vlahos, 2000). Students often have close interaction with the community* throughout the process, making proposals and refining them on the basis of the comments received (Boling, 2014).

3.3.4 RULES

Rules are norms, conventions and values and represent a way of minimising conflicts in an activity system. Rules affect how the subjects move towards the object and how they interact within a community (Torres et al., 2011: 8).

The rules (Figure 3.7) describe the shared definitions and characteristics or norms, conventions and values that are currently present within the design-build activity system. From the various definitions of design-build projects and live projects in the literature and the characteristics of the six typologies, thirteen rules were extracted. These rules are presented in the table below and linked to each of the six typologies and to live projects.

Inhabitable full-scale investigations as

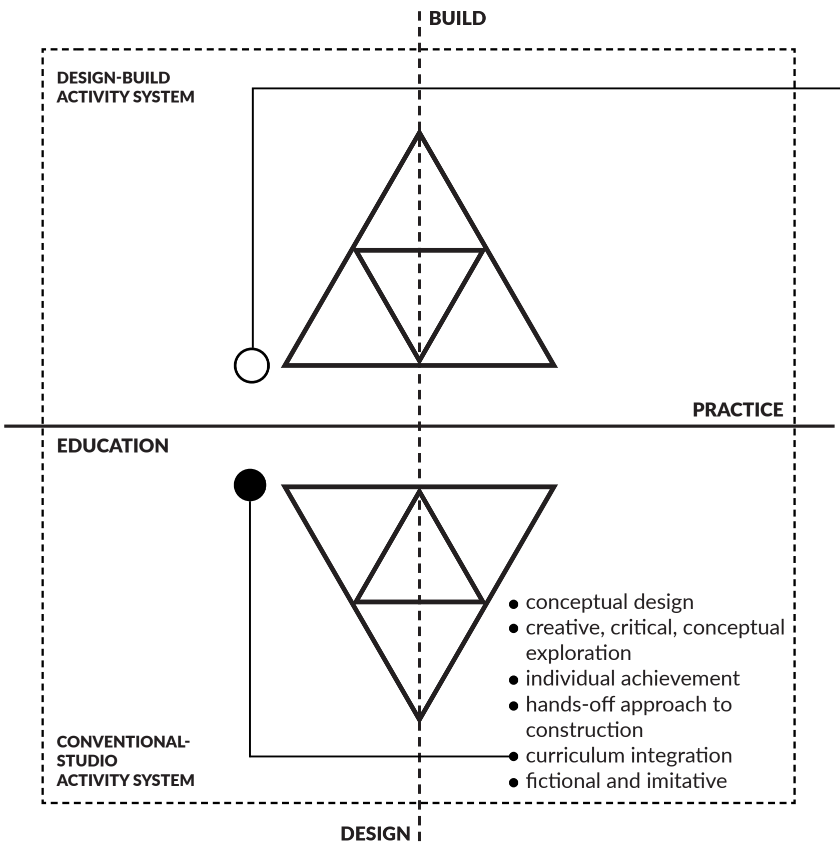


Figure 3.7: Rules for inhabitable full-scale investigations and the

	Rules	Experimental	Prototypical	Inhabitable	Generative	Explorative	Programmatic	Live projects
1	Construction at full scale	X	X	X	X	X	X	
2	Conceptual design at full scale	X	X	X	X	X	X	
3	Community* engagement			X			X	X
4	Contribution of other architectural solution						X	X
5	Creating habitat			X		X	X	
6	Collaboration, externally			X				X
7	Collaboration, internally	X	X	X		X	X	X
8	Contextual reality			X		X		X
9	Creative, critical, conceptual exploration	X		X	X	X	X	X
10	Curriculum integration	X	X	X	X	X	X	X
11	Critique of practice			X				X
12	Creation of practice	X		X			X	X
13	Controlled, experimental and scientific	X						

Table 3.1: Rules of the six typologies and of live projects

The following section presents and explores the rules that define and are inherent to inhabitable full-scale investigations. Figure 3.7 indicates the rules for inhabitable full-scale investigations as object of the design-build activity system and the conventional-studio activity system. The aim of the exploration that follows is not to compare the two systems directly, but to use the knowledge of the difference in rules as context for the discussion.

3.3.4.1 CONSTRUCTION AND DESIGN AT FULL SCALE [1]

In the conventional studio, projects are predominantly set around the design of fictional buildings. 'Although the projects might imitate real-life scenarios as far as possible or even be set in response to actual problems or opportunities, students very seldom (if ever) get to see the actual final product ... since it is obviously impractical, if not impossible, to build the actual designed buildings of a class full of students' (Voulgarelis, 2010: 2). Conventional studio projects often become no more than presentations of thoughts via a graphic medium. Hill and Beaverford (2007: 2) assert that the 'very specific, and at times discipline-centric studio experience, often fails to promote interest and understanding of new perspectives, social realities and collaborative methods'.

Being immersed in both designing and building a project brings about a changed perspective on the design process and the physical execution of a conceptual building design. Wallis (in Salama & Wilkinson, 2007) says that, by engaging in the construction aspects of a project, 'students ... realize their design misconceptions' (Wallis in Salama & Wilkinson, 2007: 205). Cook and Stephenson posit that 'engaging (in) both design intent and the physical challenges of construction gives students an empowering vehicle for the transition from theory to execution of design' (Cook & Stephenson, 2014:18). This is echoed by Van der Wath, who writes that in design-build projects there is a 'deeper understanding of the relationship that exists between conceptual thinking and technical resolution' (Van der Wath, 2013:192).

The enhanced understanding of and experimentation with materials and construction feed back into the design process (Feuerborn, 2005), and 'extend students' design skills' (Wallis in Salama & Wilkinson, 2007: 205).

[1]The rules 1 and 2 have been combined for this discussion

The direct material engagement in this 'manifold design activity … enriches the student's decision-making with building materials' (Canizaro, 2012: 24) and allows students to 'carry project components from aggregates of design, scheduling, and procurement into the reality of materials, fasteners, and finishes' (Cook & Stephenson, 2014: 18).

Construction and building technology comprise a wide area of knowledge and expertise and 'while it is quite impossible to expect architects to master all areas of specialization in the construction industry, it is possible to improve the understanding of building construction by becoming actively involved' (Abdullah, 2011: 20). The idea, however, is not necessarily to turn architectural students into master builders (Wallis in Salama & Wilkinson, 2007).

The idea is rather to introduce students to hands-on knowledge through exposure to a wide array of technologies and materials used in these projects. Sustainable materials and technologies are incorporated in most design-build projects (Wu, 2007; Canizaro, 2012; School of Architecture Design and Planning, 2014). These sustainable choices range from recycled and reclaimed materials to earth building (Cavanagh et al., 2005; Grieb, 2014; Sommerfeld et al., 2014).

Chiles and Till (2004) argue that construction and design at full scale give fundamental relevance to architectural education, and although not all students like the hard physical work there are some students who 'are really enthusiastic about this and find it enormously rewarding, putting in long hours and developing other carpentry and practical building skills' (Chiles & Till, 2004: 3). Compared to the conventional studio solutions, the design-build projects are 'less personal, theoretical, and grounded valuably in a messy reality' (Hoppa, 2002: 4).

3.3.4.2 COMMUNITY* ENGAGEMENT

Community* engagement in this thesis refers predominantly to working for communities* that cannot afford architectural services (Wu, 2007; Harriss & Widder, 2014). The concept is linked to the idea of the alternative practitioner as defined by Tovivich (2009).

In the design-build activity system discussed here, 'construction and conceptual design at full-scale and community* engagement are the most fundamental rules. According to Canizaro (2012), this is also true for most design-build programmes where, besides the aspect of hands-on construction, 'the most prevalent characteristic of design-build programs is their organization around and intention to provide service to local communities' (Canizaro, 2012: 23). Wu says design-build programmes are initiated to 'address the challenges and urgent physical needs of marginalized communities* around the globe' (Wu, 2007: 2).

i COMMUNITY* AS CLIENT

The community*, or external collaborator as Anderson and Priest (in Harriss & Widder, 2014) prefer to call it, is the client for whom the project is designed and built. This 'who' could typically be people who are 'marginalized' (Wu, 2007: 3) and cannot afford professional design services, especially in countries like South Africa, and also includes public entities, non-profits, but not a lot of private clients (Canizaro, 2012).

ii COMMUNITY*'S WORKING RELATIONSHIP

Communities* and programmes develop a working relationship in different ways. The community* often approaches the design-build programme (Blake, 2014; Boling, 2014; Sommerfeld & Galarza, 2014); or the programme assists in areas of disaster (Corser & Gore, 2009). Sometimes the programme works continuously in a local neighbourhood (Corser & Gore, 2009; Mullin, 2010; Abdullah, 2014) or the programme selects once-off deserving projects as opportunities arise, sometimes against set criteria (Wallis in Salama & Wilkinson, 2007). Corser and Gore (2009: 34) argue for working continuously with one local community*:

> the commitment to a single neighborhood and community* partner inserts students into a rich social milieu and relates their work to that of others in a temporal continuum that challenges the singularity and hermetic focus that is too often the nature of architectural practice and design-build pedagogy (Corser and Gore, 2009: 34).

Some design-build programmes choose to work with an intermediate party, either a non-profit or another entity that would already have an established relationship with a community* and that would be involved with community* even after the completion of the building. However, each approach has its own benefits and disadvantages.

Choosing to work with clients who cannot afford professional services is done mostly from a social responsibility perspective and from wanting to make a difference in the lives of people. However, working with such local communities* does have the benefit of keeping design-build programmes 'out of competition with local professionals as they tend to work on projects with no potential for profit and it sidesteps the conflict between students paying fees so that they can in turn provide services to others' (Canizaro, 2012: 23).

iii COMMUNITY* BENEFITS

The benefits the community* derive from the working relationship are numerous. These include possibly significant contributions 'to the development of a community*'s assets' (Wu, 2007: 7). Wu describes these assets as various capitals: physical capital (buildings, tools); intellectual and human capital (skills, knowledge, and confidence); social capital (norms, shared understandings, trust); financial capital (access to monetary resources) and political capital (the capacity to exert political influence). The completed design-build project therefore not only makes a spatial contribution to a community*, but it

might free up the inhabitant of a previous non-functional building to now pursue new economic opportunities because of the restructuring of space and function or simply because of better living conditions (Sokol in Voulgarelis, 2012: 265).

Because the contribution to the client goes beyond the physical value of the building, considerations beyond the immediate are necessary. Some of these are articulated by Taylor (2014: 30), who says that consideration must be given to how 'an … intervention in a community* [can] provide long lasting benefits beyond the construction of just one building' and 'how … the knowledge gained in a Design-Build project [can be] conducted abroad, [and can] be more widely distributed amongst the community* that needs information, as opposed to back in the Academy where its value is scrutinized'.

iv COMMUNITY* – IT IS STILL ACADEMIC

Brown (2013) explains that it is incredibly important for the client or community* to understand that the work is academic and performed by students and that it is not a professional service. This should be made clear from the inception stages of the project. The client or community* needs to understand that their own role in the project might be slightly different than within a professional project.

While students perform a valuable, significant and necessary service that has real consequences to the community*, the process is based on a reciprocal relationship in which the service reinforces and strengthens the studio learning, and the studio learning reinforces and strengthens the service (Vlahos, 2000: 95).

On the other hand, because the service is not professional, the clients or community* might underestimate the value and possibilities of the service they could expect from the students. Chiles and Till (2004: 7) write that:

> at the beginning of a project clients are often unaware of the value and quality of the work the students will produce and in some cases almost feel they are doing the university a favour with their time. It is afterwards they realise the power of the work they have, when it is too late.

Chiles and Till (2004) further emphasise that briefing the clients properly about the project and possibilities is very important.

v COMMUNITY* LEARNING

Not only the students learn. The client involved and the community* at large also receive some education through this interaction. They learn about the value of architectural services, but also about aspects like technological possibilities and sustainability (Lutz et al., 2014: 52).
Students, on the other hand, besides learning core architectural knowledge, will

> ideally ... learn something about themselves and others, their community* and neighbourhoods, and about pressing local and global issues while making a positive impact (Vlahos, 2000: 96).

vi COMMUNITY* – MAKING A DIFFERENCE

Working within a community* provides the 'opportunity for students to describe and critique their work according to two value systems: that of the academy and that of the client' (Brown, 2013: 2). Students feel that they are making a difference in the lives of others (Garraway & Morkel in Bozalek et al., 2014), but are also themselves 'empowered by the positive feedback from the clients' (Chiles & Till, 2004: 3).

> engagement of architecture students with community* members of the studio creates an opportunity for a comprehensive learning situation. This will provide a transdisciplinary type of knowledge base on a wide range of values. By applying this approach, future professionals will have a greater opportunity for understanding the consequences of their design actions and decisions (Salama, 2015: 49).

vii COMMUNITY* – GIVING PROPER CONSIDERATION

Hamdi (2010) warns of the danger of entering communities* without proper consideration for process and participation and the impact of intervention. He says that we must think about the relationship between what is designed for a community and what the meaning of that structure becomes within the community. He asks specifically

> how much structure will be needed before the structure itself inhibits personal freedoms, gets in the way of people and progress? At what point does it disable the natural and organic process of emergence? How much is negotiable and with whom? (Hamdi, 2010: xvii).

The delicate relationship with the community* is inherent in the design-build activity system, and needs dedicated research, but falls outside the scope of this thesis.

3.3.4.3 CREATING HABITAT

The notion of completion, both in terms of completing the object and engaging in a complete process from design to construction, is part of the nature of design-build projects. There are arguments for and against the pedagogical value of having to complete the built object and engaging with the complete process from inception to full execution.

In terms of engaging with a complete process the observation is mostly positive. Van der Wath (2013) says this engagement introduces students to the complexities that go with such a process, and Doan and Seavy (2014) write that,

> because a Design-Build project must be built, a student cannot ignore certain aspects of the project. It forces the student out of their comfort zone to confront all facets of a project, learn on the fly, and think on their feet (Doan & Seavy, 2014: 38).

In terms of a design-build renovation project Blake (2014) argues that design-build helps to place the emphases on the 'during', as opposed to emphasising just the before and after condition. Cricchio and Butko (2014: 36) claim that engagement with the whole process allows 'students to appreciate time and materiality as integral to design'.

There is a difference in approach to the iteration between designing and building in different design-build programmes. Some programmes use a more linear process, where the design is basically concluded before the building aspect commences. Other programmes use a more iterative approach between designing and building, linking to aspects of the other typologies described earlier in this chapter. The process is not necessarily that clear, as Gelpi (2014b: 56) writes: 'the sequence of design to production is also distorted as the process produced feedback between materials and representation, iteratively distorting itself'.

In terms of working towards the physical completion of the object, which is unavoidable, 'since there is an ethical and legal obligation to the clients to complete the work on time, the need to "get the job done" can often run counter to the pedagogical goals of student learning', argues Canizaro (2012: 33). Some authors see the notion of completion in a very tight timeframe as problematic, as – just as in real life – 'unforeseen events such as conflict of events, technical problems, problems with materials and lack of manpower could arise unexpectedly' (Abdullah, 2011: 18). However, Chiles and Till (2004: 6) argue that although 'the luxury of the long-term studio project development is often not an option ... prevarication is [therefore] not possible. For a number of students this is their most productive project'. Wu (2007) contributes that the completion of the object is ensured 'within a limited project time based on a schedule set by designers' (Wu, 2007: 7).

3.3.4.4 COLLABORATION INTERNALLY AND EXTERNALLY [2]

Collaboration is in direct contrast to the individuality of the conventional studio. Chiles and Till (2004: 3) say that there 'are clear social benefits. They are ideal group projects that are contained time wise and need a group to succeed'.

Collaboration is variously linked to aspects in design-build projects such as 'digitally enhanced collaboration [that enables] … fruitful collaboration over long distances' (Corser, 2014: 66), as 'collaborative design practices … that are generally not taught in architecture school' (Lepik, 2010: 16), and as positive working relationships that entail decisions made in a consensus-based manner and collaborative construction teams (Rice-Woytowick, 2011).

Collaboration is said to enhance interdisciplinary learning and working together (Swartz, 2014) and that the 'potential for interdisciplinary learning is huge' (Lutz et al., 2014: 52). Bernhard and Taylor (2014: 58) describe a research project that 'demonstrate[s] how a group of faculty and students from a range of design and engineering disciplines' worked together. Sommerfeld (2014) describes the collaboration of architectural students with an engineering firm that enabled students 'to minimize the diameter and number of columns through finite point analysis software' (Sommerfeld, 2014: 68).

Although group work and collaboration are mentioned as important aspects of these projects, only Sara (2006) describes in any detail how group work could happen. She gives the following guidelines:

> Consider providing workshops around how to manage working in groups, or structure support to facilitate successful group-work (perhaps through group-focussed assessment of processes. Expose relations of domination within the group-work. Determine a group-working protocol. Hand over to students as much responsibility for the projects as possible and trust students to rise to that responsibility. Work with students as a part of the team wherever possible (Sara, 2006: 5).

[2]Rules 6 and 7 have been combined for this discussion.

Collaboration, such a valuable aspect of these projects and with the possibility of becoming an informing pedagogy in the design of design-build projects, has not received much analytical attention in the literature.

3.3.4.5 CONTEXTUAL REALITY

Working in a real physical environment and on a real site is an inevitable part of design-build projects. There are a variety of approaches in selecting and choosing a place to work and the place is inextricably linked to the community* for which the project is designed. Some programmes choose to work 'close to home, some abroad ... most prefer to work close to home for pragmatic and ideological reasons' (Canizaro, 2012: 30). Canizaro (2012) also describes the outcome of working contextually as an enhanced awareness of place.

Working close to home allows students the opportunity to be close to the site and therefore being able to visit often. Other programmes like DesignBuildBLUFF (DesignBuildBluff, 2015) have students moving to a far-off site for a semester to complete the build part of the project. Vlahos (2000: 95) writes that 'students also impact local issues and needs and develop an understanding of the richness of the cultural, social and physical environment of a particular place'.

3.3.4.6 CREATIVE, CRITICAL, CONCEPTUAL EXPLORATION

Some design-build projects allow students to test the abilities of both space and materials more than others. Luescher describes this process as 'dreaming of possibilities, discovering limitations, making compromises, coming to realizations and reflecting on the process' (Luescher, 2010: 20). Sommerfeld and Galarza describe a process where students explored alternative roofing options hands-on by 'resisting the idea of a traditional gable roof house' (Sommerfeld & Galarza, 2014: 50), and ended up choosing to turn the trusses provided upside down and create a 'sombrero' for a home.

Other design-build academics (Christenson & Srivastava, 2005) stress the importance of making sure that creative, critical, conceptual exploration is not neglected in design-build projects but is regarded as of equal importance to that in the conventional studio. There is also evidence that there are perceptions from design-oriented faculty not taking part in design-build projects that the hands-on physical making process diminished the complexity of design (Gjertson, 2011).

3.3.4.7 CURRICULUM INTEGRATION

Different programmes adopt different strategies for integrating design-build projects into course work and the curriculum. Projects need to be in dialogue with the curriculum of core architectural knowledge and projects need a clear academic outcome. Bradbury and Papaefthimiou (2013: 1) say quite clearly that 'the challenge is striking the right balance between pedagogic benefits versus providing a service'.

A lack of integration into the curriculum may lead to the 'marginalization of design/build' (Gjertson, 2011: 25) programmes, and to prevent marginalisation it may be necessary to make design-build a syllabus requirement supported by accrediting bodies (Gjertson, 2011).

i CURRICULUM – SPACE

How design-build projects fit into the space of the curriculum are influenced by a number of aspects, some academic, some practical, and at times the integration seems simply incidental (Voulgarelis, 2012). Where some programmes engage with design-build projects in an ad hoc (Perold & Voulgarelis, 2012) and opportunistic manner, others have a specific and dedicated place for their design-build projects, and for some integration into the overall curriculum is important. In the University of Oklahoma's creating-making curriculum an introductory design-build project 'occurs annually at approximately the mid-point of our curriculum' (Cricchio & Butko, 2014: 36). The Urban Residency Program at Miami University views design-build as 'a keystone of a broader interdisciplinary curriculum' (Blake, 2014: 28).

ii CURRICULUM – TIME DEDICATED

Canizaro (2012) as well as Anderson and Priest (in Harriss & Widder, 2014b) write specifically about the time dedicated to live and design-build projects and explain that the projects can vary from a number of days to stretching over a few years. The fact that there is a big variance in time dedicated to projects among programmes is supported by the variety of documented information on design-build projects, too numerous to mention here, but some examples will explain. Studio 804 gives students the opportunity to collaboratively design a house where the 'typical house design-construction period is compressed into a nine-month period that sees students covering every part of a design-build practice' (School of Architecture Design and Planning, 2014: 2). Eric Weber (2014a: 22) of the University of Nevada describes a project that ran from 'fall 2011 to fall 2013'. Doan and Seavy (2014: 38), in turn, write about a project that 'evolved over a period of 4 years, involved over 30 students, 3 faculty members, and culminated as a student's master's thesis'.

iii CURRICULUM – COMPULSORY OR NOT

There are arguments for and against projects being compulsory for students (Abdullah, 2011). The 'Jim Vlock First Year Building Project' (Yale School of Architecture, 2015) is compulsory for all first-year students. Having to take part gives them all an opportunity to experience this practice. Yale has identified great student enthusiasm for these projects and that students 'arrive at school with a desire to include such socially responsible work in their future professional lives. Having the opportunity to participate in the design and construction of such building projects often reinforces their conviction and inspiration to do so' (Yale School of Architecture, 2015: 4).

In other schools, projects are part of elective studios and therefore not compulsory. No accreditation body prescribes design-build projects as an essential part of the curriculum.

iv CURRICULUM – COMPLEMENTARY SUBJECTS

In terms of complementary subjects that support these design-build projects there generally 'are no specific subjects in mainstream architecture schools that are devoted to the understanding of design-build construction' (Abdullah, 2011: 5). However, Chiles and Till (2004: 4) describe formal teaching support given in terms of 'communication and brief building workshops, attached to the management module, as well as seminars on consultation and creative participatory techniques'. The University of Kansas provides a number of elective courses in support of their programme, which includes

> Materials Investigation; CAD/CAM Technologies; Building with Intelligence; Building Information Modelling; Architect-Led Design Build; Advanced Design-Build for Architects; Construction Project Management for Architects; Bidding and Estimating; and more (School of Architecture Design and Planning, 2014: 2).

Where subjects are not formally taught, mention is made of new knowledge, skills and values that students acquire through the process, either by the specific nature of the project or from collaborating with professionals and others and from the input of tutors. Some of the knowledge, skills and values include time management 'and the progress of the project in a real-world setting, which also introduces a contingent element to the work' (Sara, 2006: 1) ; project management and the 'skill of producing the creative feasibility study, necessary for all architects, is one very tangible outcome of many of the projects' (Chiles & Till, 2004: 7) and 'collaborative design practices, budgeting, and hands-on experience-thing that are generally not taught in architecture school' (Lepik, 2010: 16).

v CURRICULUM – SUMMARY

The Laurentian University in Sudbury, Canada introduced a new complete architectural programme with a full-on design-build-dedicated curriculum, which commenced in 2013 and took the integration of design-build projects into the curriculum to a new level (Gaber, 2014).

Design-build projects provide the opportunity to both create and expand the curriculum. However, this depends very much on the culture of the programme and school. It also depends on where projects are situated within the curriculum and whether the curriculum can accept new content that would specifically contribute to design-build practice (Sokol, 2008). As Peshkin (1990: 10) writes:

> to varying degrees, subcultures are in competition with each other as they try to enact their 'meaning systems' in the curricula of their society's schools. It is, therefore, a matter of good guys doing battle with each other as they contend for the right to define what goes on in school.

3.3.4.8 CRITIQUE OF PRACTICE

The awareness of alternative values and the actual execution of a design-build project becomes a silent but direct critique of normative academia and practice. Brown (2013: 3) writes that the 'live project offers educators and students an opportunity to become aware of and even subvert the influence of these value systems (that of a normal professional value system), developing instead pedagogies that are situated in the communities they serve'.

In terms of critiquing current practice in academia, Harriss (Harriss & Widder, 2014: 83) writes that live projects 'bravely "radicalize" architecture pedagogy by reviving dying architectural curricula and reversing their terminal decline'. What design-build allows is experiential learning in subjects beyond the design studio (Canizaro, 2012) taking building construction out of the theoretical and instructional classroom, where the '1:1 investigations are intended to serve as both a medium of exploration for the designer-builder, and as a kind of critique of conventional building and assembly' (Erdman & Leslie in Canizaro, 2012: 26).

The student taking part in these projects is given an empowered perspective to define their own stance in terms of education and practice. As Chiles and Till (2004) posit, there

> is an interesting balance between practice and education which encourages the student to position themselves politically. They have to re-assess the relationship between client, business and community* in the context of the university rather than from an office perspective (Chiles & Till, 2004: 3).

Therefore, as a critique of conventional practice, taking part in the design-build project allows students to learn about moral and ethical issues (Chiles & Till, 2004) and to 'become critical of, and reflective on, the role of the architect within wider society and develop an awareness of the need of professionalism as a key competence' (Hands-on-Bristol, 2015: 2). Dutton (in Sokol, 2008) expresses what he is trying to achieve with student perceptions on practice:

> We're not just trying to help a community*, but we're trying to deconstruct students' privilege. We're trying to get them to be better citizens, better community* advocates (Dutton in Sokol, 2008: 6).

What is instilled through taking part in these projects is a sense of 'social ethics of professionalism, volunteerism, individual responsibility, and community* service' (Feuerborn, 2005: 2). That is a very specific set of values, which is not necessarily instilled in conventional studio education.

Brown (2013) writes the following that can be used to summarise this section well:

> perhaps the most valuable pedagogical outcome of a live project is not the finished outcome but the revelation to student and educator of the subjectivity of our own academic and professional value systems (Brown, 2013: 3).

He also writes that, 'since live projects invite students to work alongside and for people outside the academic community* live projects create the opportunity for pedagogies of resistance and opposition to normative architectural education. They are both complimentary and critical of established practice' (Brown, 2012: 284).

3.3.4.9 CREATION OF PRACTICE

Stemming from the inherent critique against academia and practice is the opportunity for the creation of a different kind of academic and professional practice. Tovivich (2009: 70) calls this practice a 'new professionalism', with this new professional being 'a provider, a supporter, and a catalyst'; this is iterated by Perkes (2009), who contributes the alternative values of 'service, proximity, and experience' (Perkes, 2009: 65) to this new type of professional. Corser and Gore (2009) write that design-build educational projects open new avenues for alternative models of practice. Canizaro (2012: 24) regards the reason for doing design-build projects as 'a larger vision of professional practice', a 'broader scope of professional practice' and also the creation of 'new methods of project delivery'. This new practice is also described as 'a practice with values that support the aim of being useful to the community*' (Perkes, 2009: 64), and 'architectural practice as based in an ethical commitment to others' (Canizaro, 2012: 24).

The changed values that contribute to the creation of new practice are well described in much of the literature. Brown (2013: 3) writes: 'Garry Stevens has argued that architectural education is less about educating students for practice, but inculcating them into a professional value system'. Vlahos (2000: 96) mentions the values of 'empathy, social and self-awareness, self-confidence, social responsibility, and a sense of caring. In addition, there is greater awareness developed in understanding the impact of one's actions, the development of a project and the overall design skills needed to communicate ideas to the client'. Blake observes that becoming aware of the broader community* that shapes the project, both user and professionals, 'temper[s] design decisions and give[s] reason to build, and that build becomes more than an aesthetic exercise focused upon rendered befores and photogenic afters' (Blake, 2014: 28).

Creating this alternative type of practice requires entrepreneurial skills (Corser & Gore, 2009) and a sense of social entrepreneurship (Bernhard & Taylor, 2014).

3.3.5 COMMUNITY AND THE DIVISION OF LABOUR

Community is a larger group with the subject as participant. Communities share the same objects, are governed by rules and divide tasks among participants who belong to a particular activity system ... Division of Labour is related to the organisation of the activity system, linked to roles, tasks and power relationships in an activity system (Torres et al., 2011: 21, 26).

3.3.5.1 THE ACADEMIC AS SUBJECT

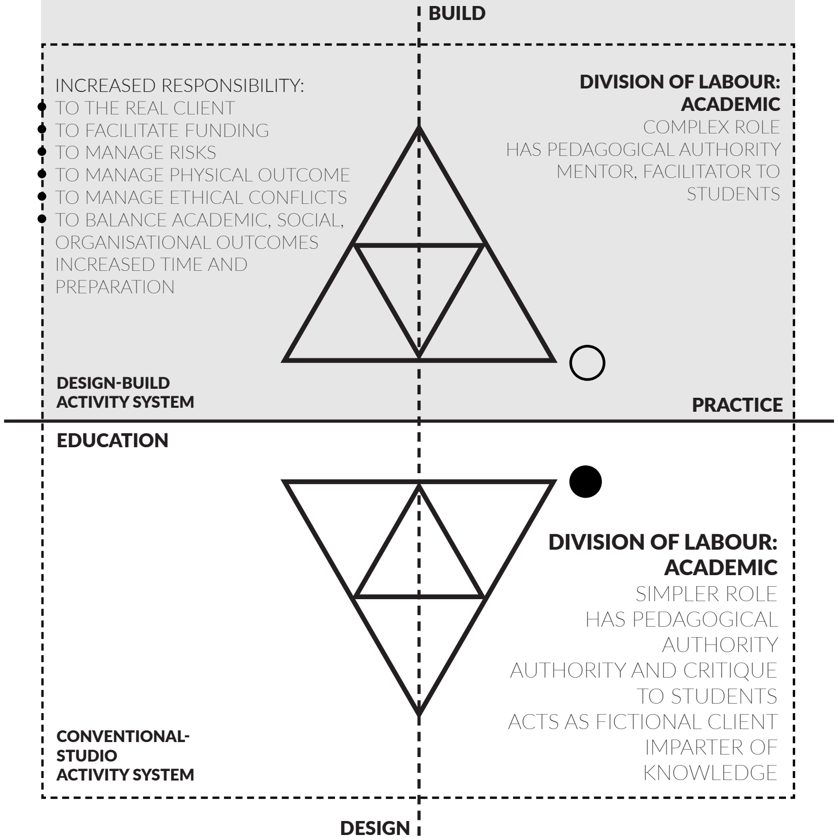


Figure 3.8: Division of labour: The academic

The role of the academic in the design-build studio becomes much more complex than in the conventional studio. 'The pedagogical authority … remains, but the role of the architectural educator changes, adopting and developing a mediating role between client and student' (Brown, 2012: 237). This role change implies a huge adaption and increase in responsibility, since the educator must simultaneously 'be attentive to the learning processes of individual students and the collaborative processes of live project stakeholders' (Brown, 2012: 284). The educator in the design-build activity system needs to balance academic, social and organisational outcomes.

The role of the academic in conventional architectural education is typically that of studio master or instructor or imparter of knowledge. In the design-build project the role of the academic in their capacity as tutor changes. The relationship that the tutor has with students is probably the most significant change, as there is 'an important revision of normal power relations' (Tovivich, 2009: 80) where the tutor moves out of the usual authoritarian role to one of mentor (Malmqvist et al. in Van der Wath, 2013). Brown (in Harriss & Widder, 2014a: 56) describes the role change in live projects as a subversion of the 'binary teacher-student relationship'. Tovivich (2009) explains further that the tutor becomes a facilitator, consultant and mentor. The tutor as consultant is iterated by Chiles and Till (2004) and Van der Wath (2013), who also describes the tutor as facilitator and adviser. The outcome of this role change is a change in the power relations between the tutor and the students, which results in a more enabling environment that is open for discussion, reasoning and exploration (Van der Wath, 2013) and more committed students (Tovivich, 2009).

In the conventional studio there is no real client. The tutor acts as generator of the problem, in other words acting as fictional client and at the same time as critiquing academic. In the design-build studio the client is real, with real expectations that must be met.

The tutor or academic stands in a real relationship towards the client and needs to act as the responsible professional, while also taking on the 'sometimes difficult role of stand-in for the client' (Chiles & Till, 2004: 4) in the relationship with the students. Chiles and Till (2004) posit that clients should be briefed properly on what they can expect from students, as they are often not aware of the possibilities and quality of the work that the students can provide. Tovivich says that the challenge for the academic

> 'lies in the balance between "structure" and "emergence". Without enough structure, things would be too chaotic. Simultaneously, if the structure is too rigid or dominant, creativity and spontaneity from local communities and students would hardly emerge' (Tovivich, 2009: 80).

Brown (2012) acknowledges that there are inherent complexities in real projects and that the academic takes on a number of new management roles. These include risk management, expectation management and outcome management and management of 'ethical conflicts that are both external (e.g. competing with local practices) and internal (e.g. employing students during vacations for work that they may be assessed for during term)' (ibid: 238, 240).

There are other additional roles that the tutor assumes in the design-build project, which are for the most part simply necessary to facilitate a successful building project within an academic and service learning environment. Canizaro (2012) describes the educator's role as also securing both projects and primary funding. Vlahos describes a similar scenario where the educator researches and selects the community* and site before the commencement of the project to 'assure ... [a] proper match between the community* and the level of students' (Vlahos, 2000: 96). Both Canizaro (2012) and Vlahos (2000) say that the amount of time and preparation needed for design-build projects are much more than for conventional studio projects.

The additional time and roles are not necessarily acknowledged by the institutions in which the academics reside. Canizaro goes as far as saying that

> perhaps the primary difficulty faced by design-build programs concerns their reception within their own institution. Programs of all types face purposive and unintentional scrutiny, misunderstanding, mistrust, and marginalization by colleagues, administrators, and students. It is a testament to both luck and will that many of the projects ever see the light of day, much less get built (Canizaro, 2012: 30).

Dedicated educators are often the reason a programme continues and is successful, and when such an educator is no longer able to run the programme, that role is difficult to replace and the programme often ceases to exist (Ockman & Williamson, 2012).

Academics in design-build projects need to juggle a number of responsibilities. They should also remember that these projects are still academic and require academic rigour. Projects are described where the educator took on the role of designer or articulator of the structure and where students only acted as the builders or executioners of the project (Day, 2014; Nason, 2014). Under such circumstances academic outcomes should be carefully phrased. Christenson and Srivastava (2005: 233) ask educators to be reflective and to 'ask hard questions at every moment and seek alternate explanations at every shift in conditions. Particularly if we are testing systems or assemblies (not simply the performance of a specific, isolated material) ... We believe that successful experiments, carried out over time, must occasionally produce contradictory or conflicting results to provide educational value'.

What is not currently discussed in the literature is the role of the academic as researcher within the design-build project. How and why research is conducted and what it can contribute to the broader discourse on design-build projects remains a field for further study.

The relevance of the role of the academic for this thesis lies with the academic's changing role from knowledge instructor to facilitator and mediator. In the current literature this role of the academic is not brought into perspective against the change that happens within the role of students. Students do not work individually in design-build projects. They work in teams or groups. It is known that for cooperative learning to be successful the academic needs to take on a mediational role of both task and group function (Johnson & Johnson, 1999). It is not clear whether, in the design-build project, there is necessarily any relationship between the change from group to individual and the change from informer to mediator. It seems, however, that in the design-build project the academic is already acknowledged and positioned in such a mediational role. This position could offer possibilities and influences in the collaborative learning process.

Another aspect not touched on specifically in the current literature is the collaboration that might exist between academics who execute these projects. Design-build project descriptions suggest that there are often teams of academics working together, taking on collaborative roles, mostly necessitated by the complexity of these projects. Tucker and Abassi (2012) explain that team teaching serves as visible example from which students learn about working collaboratively. This again positions design-build projects as unique educational settings for collaborative learning.

Image 3.3: Dividing work and roles on site at St Michael's

3.3.5.2 THE STUDENT(S)

The students take on more roles than in the conventional studio. A new role that the students fulfil is in relation to the client. Chiles and Till (2004: 6) write that students are in a unique position to fulfil a 'mediating role that a professional would struggle to do'. Students fulfil this role among all role players, but especially with the clients who are more open for discussion with the students. Boling (2014) describes a typical case study where students had close interaction with the client throughout the process, and where the students made direct proposals to the client and refined the design in accordance with the feedback and discussions.

The contribution to the client or community* is the motivation that makes students want to perform within the activity (Garraway & Morkel in Bozalek et al., 2014). This motivation is not like that of the conventional studio, where students are motivated by becoming the best designer and a searching for the best grade.

Another new and significant role that students get exposed to is that of project manager (Chiles & Till, 2004; Brown, 2013). Students sometimes generate projects and funding and are then most successful with securing donations of materials and products (Canizaro, 2012).

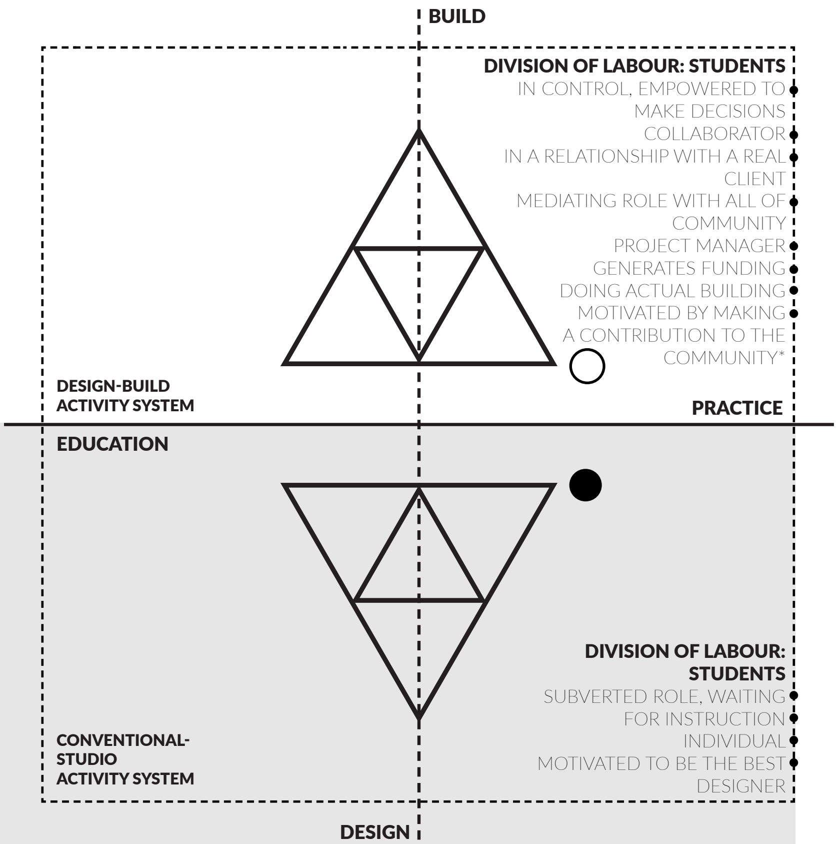


Figure 3.9: Division of labour: The students

Corser and Gore (2009: 34) describe students being 'responsible for all communication, fundraising, design, fabrication, and installation of their interventions, as well as subsequent maintenance and repair of previous students' projects'.

The most significant role change for this study is the change from the student as individual in the conventional studio to collaborator in the design-build studio. In the conventional-studio project the student is in a subverted role, experiencing the tutor as superior. In the design-build project the student is more in control and becomes empowered to make decisions. Nepveux (2010) describes that students feel in control of their learning when the tutor takes on a different role where students feel they are allowed to make most of the decisions. The hierarchy of the student in the whole process changes and the change in hierarchy combined with the changed role of the academic and the change from individual to collaborative seem to empower students.

3.3.5.3 THE COMMUNITY*

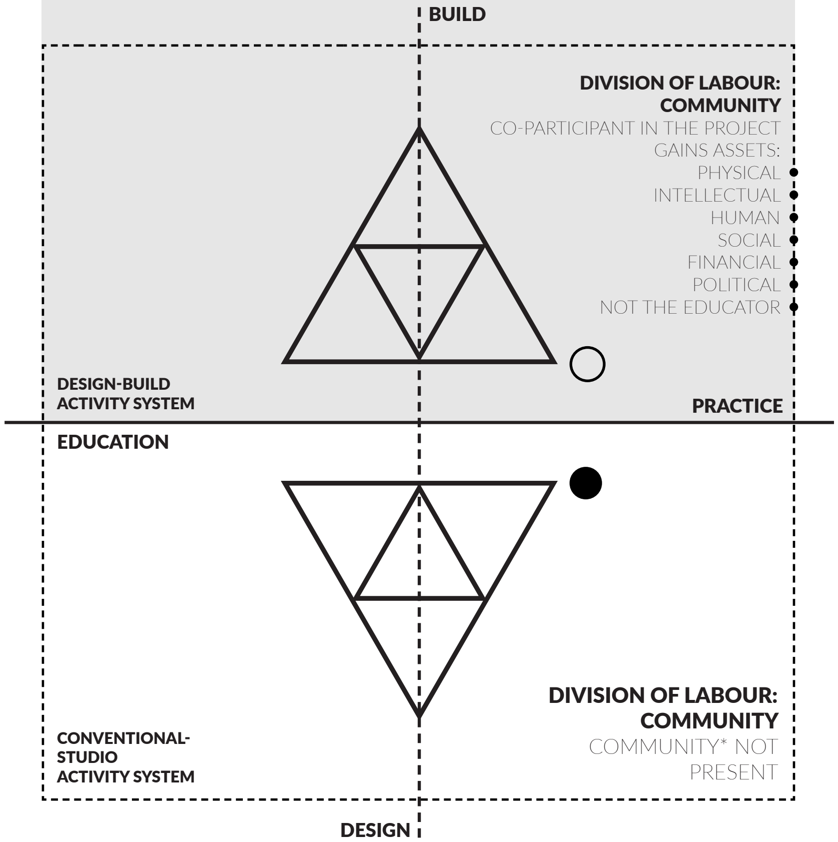


Figure 3.10: Division of labour: The community*

In the literature reviewed the client could be an individual, who sometimes also finances the project, but most often the client is a group of people, often referred to as a community*. The client needs to be aware that the design-build project is an academic project and the client should not take on the role of educator in the project. The client becomes co-owner of the project (Cavanagh et al., 2005), not just because physical assets are received (Wu, 2007), but because there is participation in the process and value is given both to the client's own contribution and that of the student. Wu (ibid) describes the assets as physical capital (buildings, tools); intellectual and human capital (skills, knowledge, and confidence); social capital (norms, shared understandings, trust); financial capital (access to monetary resources) and political capital (the capacity to exert political influence).

The needs of the client are the reason for most design-build projects, and specifically the inhabitable full-scale investigation that is the object of this study, being initiated. Because the client exists, the project exists and is both in the real world and at the same time academic. This resonates with the earlier discussion of the design-build project as boundary activity. Perkes (2009: 64) describes this well when he writes that

'the lesson learned is, while the day-to-day activities internal to the (design-build educational) practice are conventional, the alternative values and working methods are developed on the boundaries where the work engages the community*'.

3.3.5.4 THE ACADEMIC INSTITUTION

Academic institutions must be aware of the risk of letting students do building work, as Chiles and Till (2004: 7) write, 'allowing students to use power tools as part of their university course is a challenge and requires professional supervision'. Institutions therefore carry more risk and liability in the design-build activity system.

The institution within which a design-build programme is situated plays a role in the operational aspects of the programme. Although service learning is part of many universities' agendas, building actual structures is not. To get approval for a project is often a difficult process, which can cause delays and can upset programmes and expectations of both students and clients (Canizaro, 2012). The support and facilitation of the institution also influence the academics who engage in these projects. Canizaro (Canizaro, 2012: 30) also writes that most 'faculty that engage in these types of projects over a period of time face burn out if the institution is not structured to facilitate and encourage these types of experiences. The fact remains that ... ongoing administrative and institutional support for this type of undertaking remains the exception rather than the norm'.

The conventional structure of and lack of support by the academic institution are probably some of the biggest tensions within the design-build activity system. There is a strong contradiction between the object of a design-build activity system and the object of a conventional studio system as situated within a conventional academic institutional activity system. The object of the design-build activity system is a real built structure, where that of the conventional academic system is a purely academic object.

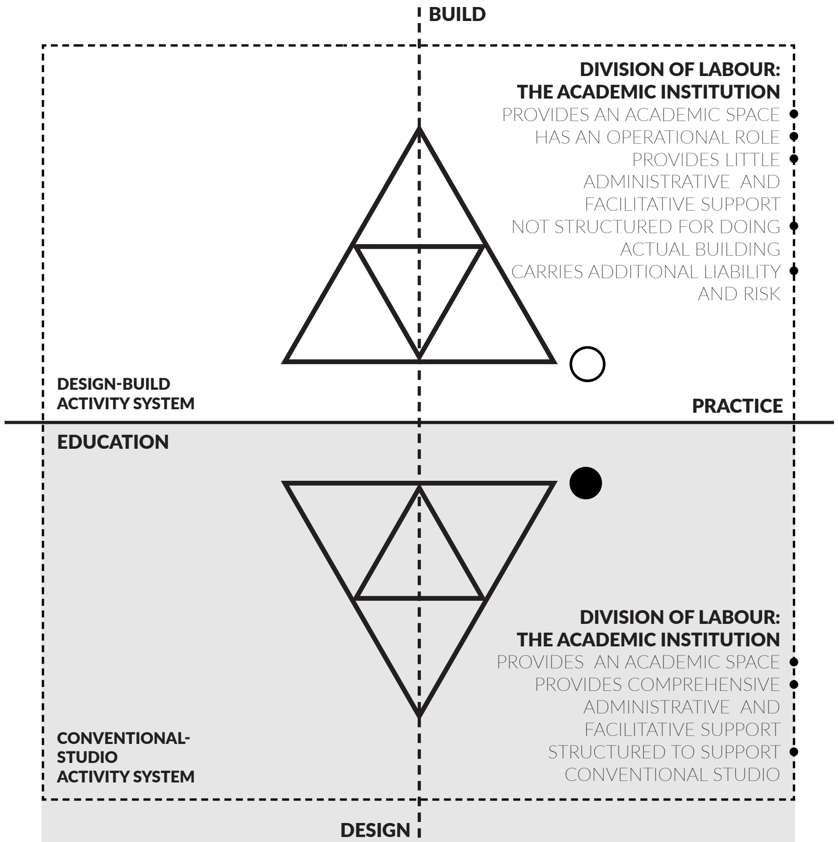


Figure 3.11: Division of labour: The academic institution

3.3.5.5 PROFESSIONALS, CONSULTANTS AND TRADES

Design-build projects offer collaborative opportunities for students to work with professionals, consultants and trades (Feuerborn, 2005; School of Architecture Design and Planning, 2014). Also, 'due to the complexity of many projects, legal and/ or code considerations, programs [are] forced to work with consultants and sub-contractors for electrical, plumbing, specialty trades, and the operation of complex equipment. In these cases, most [faculty] report that students work closely with the consultants, often coordinating them while also receiving on-the-job training' (Canizaro, 2012: 29).

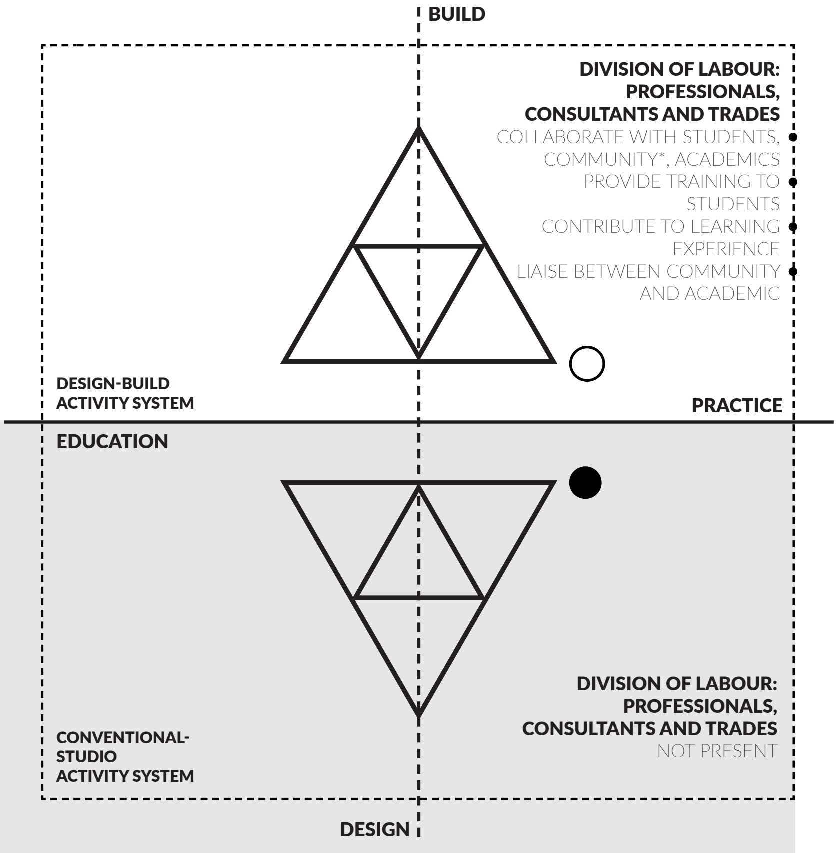


Figure 3.12: Division of labour: Professionals, consultants and trades

Professionals contribute to the learning experience. 'Professionals help students understand enclosure systems, structures, mechanical systems, and the many various details associated with building documents and construction' (Feuerborn, 2005: 7). The costs of these outside consultants are often carried by funding in order not to burden the receiving community* with the cost (Perkes, 2009).

The consultant may also be the liaison with the client and be outside the architectural and building profession, as in a project described by

Nason (2014: 14), where an artist 'oversaw the design, assembly, and community* engagement for the entirety of the process'.

Professionals, consultants and trades (Figure 3.12) are necessary to help make execution of the project real, contribute to both the student learning and the community, and are part of making the project real and closer to professional practice than the conventional studio.

3.3.5.6 OTHER FACULTY MEMBERS

Academics engaged in design-build experience a lack of support from faculty not taking part in design-build projects. Canizaro (2012: 30) posits that this stems 'from both jealousy and legitimate criticism' and mentions as reasons that other faculty members do not see these projects as challenging and view them as vocational and not academic, as not worthy of the number of credits given to the projects, and as exploitative of students.

Peshkin (1990: 10) writes that 'to varying degrees, subcultures are in competition with each other as they try to enact their "meaning systems" in the curricula of their society's schools. It is, therefore, a matter of good guys doing battle with each other as they contend for the right to define what goes on in school'.

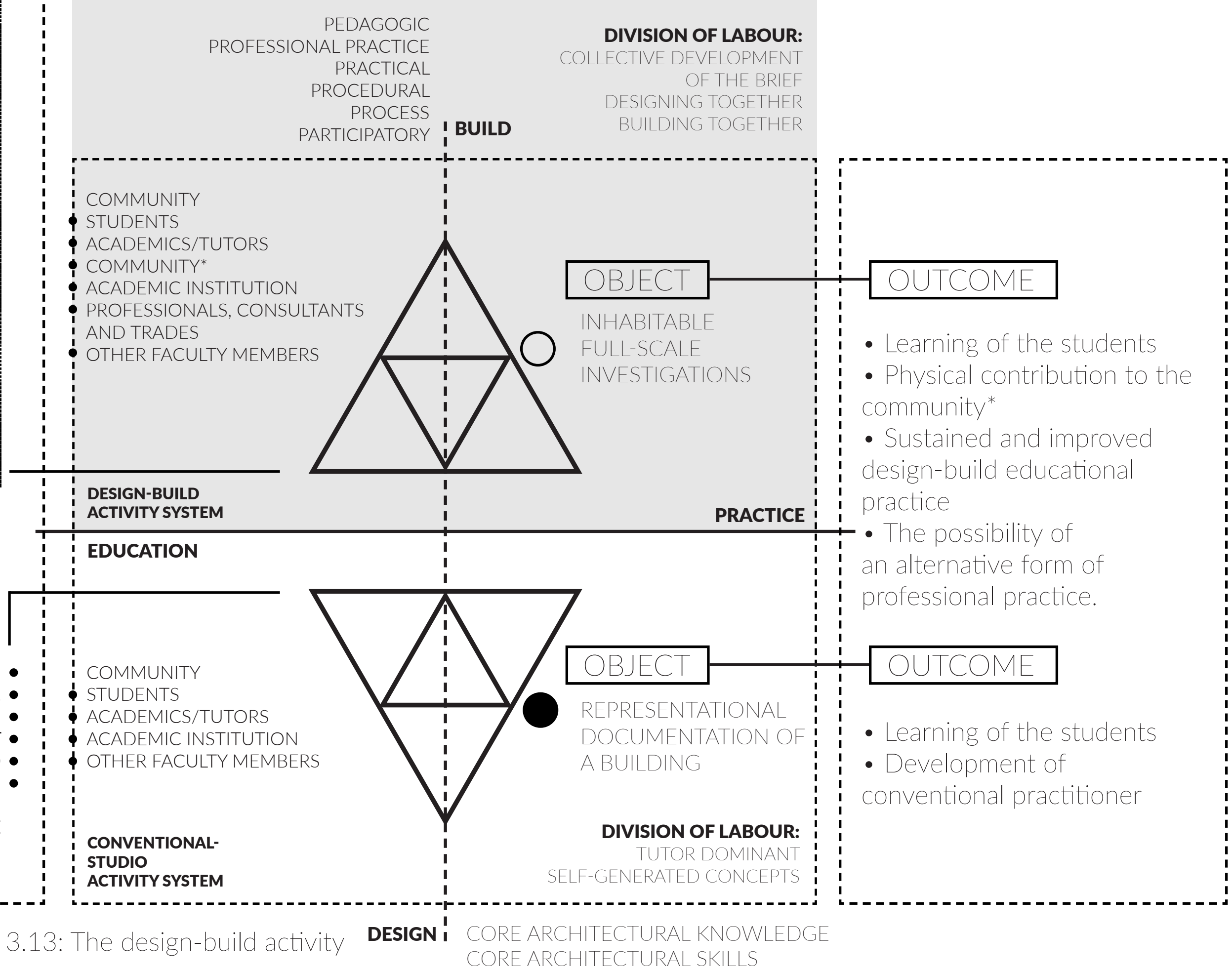
It might be the unknown and the publicity that often surrounds design-build projects that instil jealousy and scepticism. It is probable that jealousy and scepticism are not as pronounced in conventional architectural education because the system is known and faculty members take a more or less equal part in the system.

3.4 SUMMARY

The literature study foregrounded six design-build typologies and engaged with the literature through activity theory with an attempt to highlight aspects that are situated uniquely within the design-build activity system. The literature study supported the development of the midpoint threshold of the research journey.

The design-build activity system and the conventional-studio activity system appear graphically throughout Chapter 3 as juxtaposed systems. Figure 3.13 summarises the two systems graphically.

The end of this chapter represents the end of the 'expansive 'analytical' stage (Bachman, 2010: 471) of the research journey. The midpoint threshold is presented next. The threshold summarises the concerns and patterns that emerged through the data events and the literature study and proceeds to suggest the opening of specific explorative windows. In essence it provides a departure point for the framed views that follow in Chapter 4.

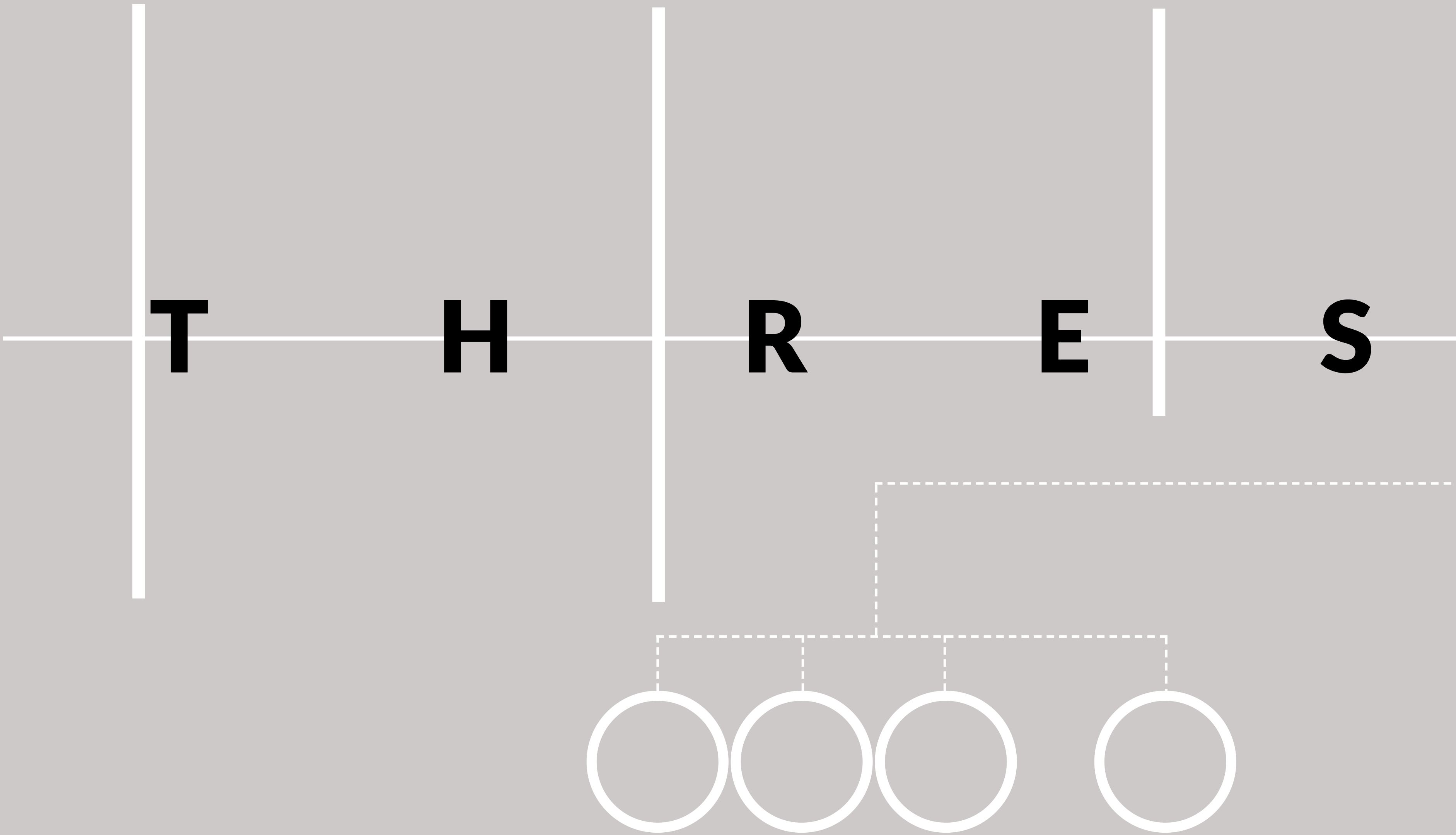


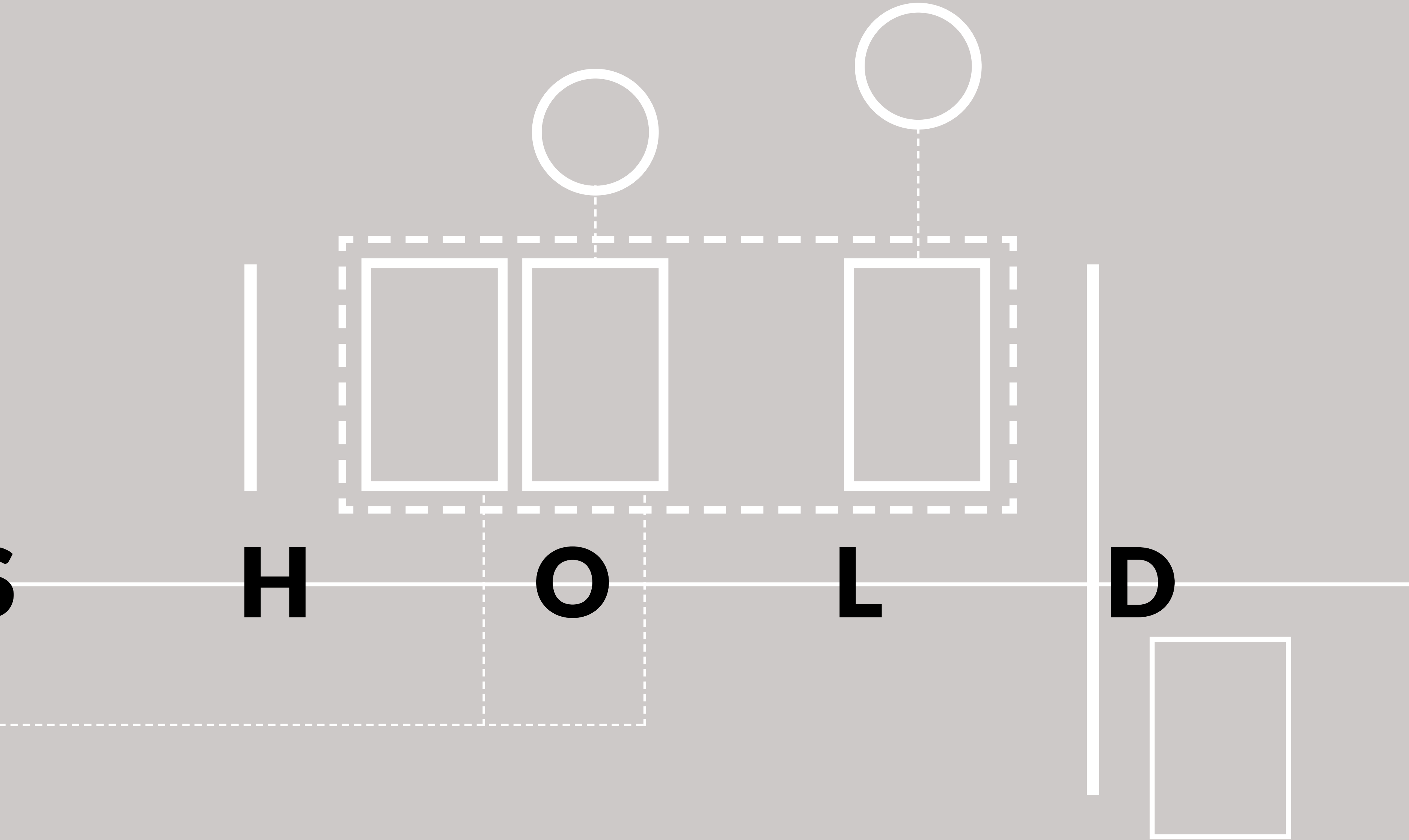
	Rules
1	Construction at full scale
2	Conceptual design at full scale
3	Community* engagement
4	Contribution of other architectural solution
5	Creating habitat
6	Collaboration, externally
7	Collaboration, internally
8	Contextual reality
9	Creative, critical, conceptual exploration
10	Curriculum integration
11	Critique of practice
12	Creation of practice
13	Controlled, experimental and scientific

Figure 3.13: The design-build activity system and the conventional-studio activity system

‘A strip of wood or stone forming the bottom of a doorway and crossed on entering a house or room’ (Soanes, 2006: 1501).

‘A level or point at which something starts or ceases to happen or come into effect’ (Soanes, 2006: 1502).





[T]

T.1 INTRODUCTION

This thesis starts with two broadly framed questions:

1. What are the unique educational opportunities and possibilities present in the design-build project?

AND

2. How do these unique opportunities and possibilities potentially inform

i the development of future design-build projects and the broader architectural curriculum?

ii professional architectural practice?

In attempting to answer these questions, Chapters 1 to 3 are presented as the 'expansive analytical' and 'creative philosophical' (Bachman, 2010: 471) section of the research. In this section of the research initial uncertainty and inquisitiveness are coupled with 'analysis and exploration of existing knowledge' (Bachman, 2010: 470) to cross a threshold to a 'transitional midpoint proposition … where a significant gap in existing knowledge is identified' (Bachman, 2010: 470).

In the physical thesis document this threshold is situated between Chapter 3 and Chapter 4. Chapter 1 sets the foundation for the research by introducing aim, focus, context, rationale, paradigm and theoretical underpinning. Chapter 2 explains the blueprint for the research design, process and method. Chapter 3 presents a literature study that locates the design-build project as object of the design-build activity system and uses activity theory as a heuristic framework to study the literature.

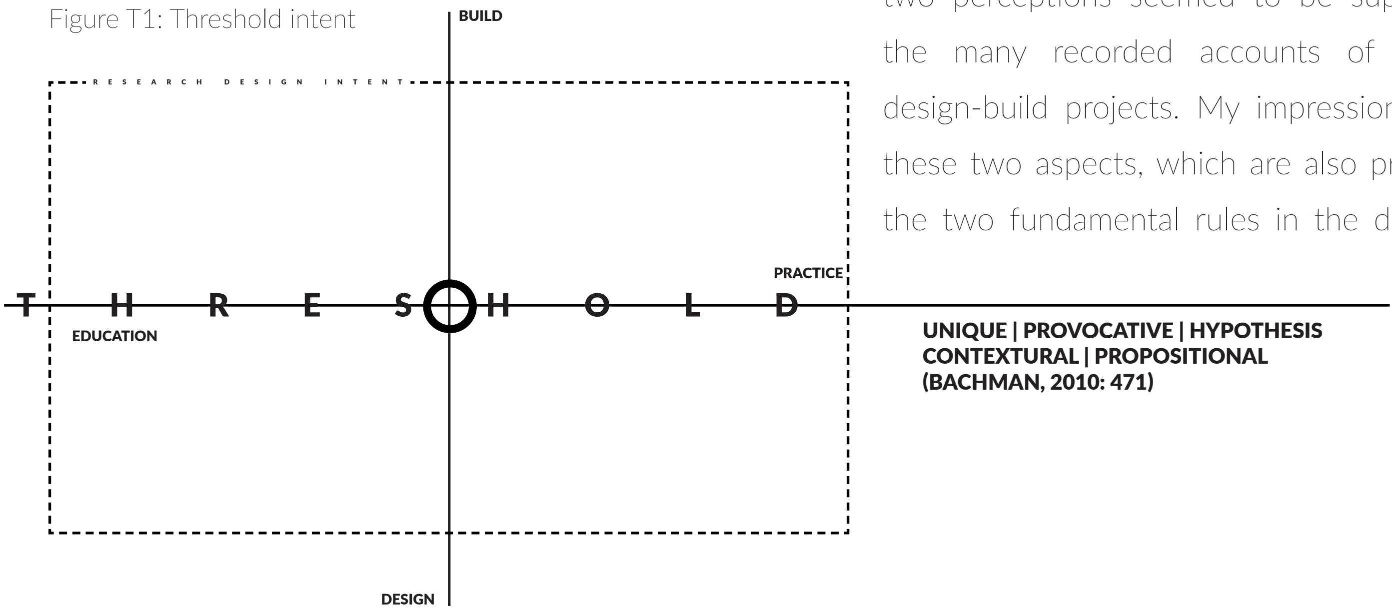
The threshold is part reflection, part academic rationale and the transition to the 'strategic synthetic' and 'generative methodical' (Bachman, 2010: 471) section of the research. The threshold reveals the reasoning behind the transition and includes two midpoint propositions.

In Chapter 4 three windows are opened to explore the two midpoint propositions. Windows 1 and 2 explore collaboration, and window 3 explores the relationship between design-build education and architectural professional practice.

T.2 REASONING BEHIND THE MIDPOINT PROPOSITION

Internationally there has been a steep increase in the introduction of design-build projects to architectural programmes (Canizaro, 2012; ACSA, 2014) in the past few years. My initial notion was that this increase in design-build projects was influenced by two aspects. Firstly, making or construction at full-scale, or the hands-on, constructionist motivation of making real, full-scale buildings (Rice-Woytowick, 2011; Nulman, 2012), as opposed to developing representational drawings and models in the conventional studio. Secondly, that it was due to the extrinsic motivation of community* engagement or making a difference in the lives of others (Vlahos, 2000; Feuerborn, 2005), where others mainly represent disadvantaged communities (Jann, 2009; Bradbury & Papaefthimiou, 2013). These two perceptions seemed to be supported by the many recorded accounts of successful design-build projects. My impression was that these two aspects, which are also proposed as the two fundamental rules in the design-build

Figure T1: Threshold intent



UNIQUE | PROVOCATIVE | HYPOTHESIS
CONTEXTURAL | PROPOSITIONAL
(BACHMAN, 2010: 471)

In this thesis 'community' is used to refer to predominantly underprivileged communities in South Africa that do not have the financial means to afford architectural services. Where only the word 'community' is used, it is used to refer to a concept within activity theory that refers to all role players taking part in an activity.

activity system (Chapter 3, section 3.4.2), would inform the unique educational opportunities and possibilities (research question 1) that underpinned the educational design-build project.

During the first section of the research, presented in Chapters 1 to 3, evidence contrary to my initial notion became evident. Collaboration came to the fore as the unique educational opportunity in the design-build activity system and not construction at full-scale or community engagement. Collaboration was also revealed, from an activity-theory perspective, to be intrinsic to the design-build activity system, and collaboration was identified as a recurrent concept in design-build literature. Stepping across the midpoint threshold, the evidence of collaboration informed the development of explorative window 1 and explorative window 2. In explorative window 1, collaboration as experienced in design-build activities is linked to cooperative and collaborative educational pedagogy. In explorative window 2, collaboration emerges unprompted from student data collected in the design-build constructions.

During the first section of the research, presented in Chapters 1 to 3, it also became evident that the link between design-build education and professional architectural practice has not been addressed in the literature. To address this gap, explorative window 3 was introduced. The evidence of collaboration and the link with professional practice as midpoint proposition are discussed in more depth in the section that follows.

T.2.1 COLLABORATION

The table below summarises how collaboration was conceived to be part of the midpoint proposition.

Can be read about in the threshold in this section	How collaboration was conceived to be part of the midpoint proposition:	Where in the thesis document further exploration can be read.
T.2.1.5	Collaboration emerges unprompted from student data collected in the design-build constructions	Explorative window 2
T.2.1.4	Collaboration in design-build activities resonates with cooperative and collaborative educational pedagogy	Explorative window 1

T H R E S H O L D | M I D P O I N T

T.2.1.1	Collaboration is revealed to be intrinsic to the design-build activity system	Chapter 3
T.2.1.2	Collaboration emerges as the *unique educational opportunity* in the design-build activity system and not *construction at full-scale* or *community engagement*	Chapter 3
T.2.1.3	Collaboration stands out as a recurrent concept in the literature	Chapter 3

Table T.1 Collaboration at the midpoint proposition

T.2.1.1 COLLABORATION IS REVEALED TO BE INTRINSIC TO THE DESIGN-BUILD ACTIVITY SYSTEM

Collaboration was highlighted from four angles by using activity theory as heuristic framework, and specifically by contextualising the design-build activity system against the conventional-studio activity system to study the literature (Chapter 3).

Firstly, two main contradictions between the design-build activity system and the conventional-studio activity system were revealed. These contradictions are the inherent motivational drive of the systems and the individual as subject of the system as opposed to the collective as subject of the system. In the design-build activity system the motivational drive is community engagement or making a difference in the lives of others, and in the conventional-studio activity system it is a pursuit to be the best designer. The first contradiction is linked to the second contradiction. The collective as subject in the design-build activity system acts collaboratively partly because of the motivation. The individual subject in the conventional-studio system does the same, acting individually from motivation. The collective as subject allows for collaboration to be part of the design-build activity system.

Secondly, collaboration is identified as rule, and thirdly, as a pedagogic tool in the design-build activity system. Collaboration as a rule in the system implies that the system needs collaboration as a value to minimise conflict within the system (Torres, Buchem & Attwell, 2011). Collaboration is specifically highlighted as a pedagogic tool (Ellis, 2011) in Chapter 3, section 3.3.1.10. As a pedagogic tool in the design-build activity system collaboration can assist in mediating the activity. Very little is known about the use of collaboration as pedagogic tool from the design-build literature. Collaboration needs to be unpacked and explored to become a useable tool for both students and educators within the design-build activity system.

T.2.1.2 COLLABORATION AS THE UNIQUE EDUCATIONAL OPPORTUNITY

After reviewing the literature (Chapter 3) and initially exploring the data (stories of the design-build constructions, Chapter 2) in the first section of the research it became evident that the educational significance of design-build projects is not directly related to construction at full-scale or premised on community engagement. Where construction at full-scale or community engagement was present it provided motivation primarily for the design-build activity system (Fowles, 1984; Abdullah, 2011, 2014; Rosenthal, 2013).

The design-build typologies proposed in Chapter 3 indicate that construction at full-scale is part of each of the six typologies, but that a community engagement is not. In fact, in some of the design-build typologies neither client nor external collaborators, who are the others, exist. The question arose whether it might simply be the construction at full-scale that makes the design-build activity system as pedagogy both unique and popular with tutors and students.

The answer is, however, that construction at full-scale is also not present in all the projects and activity systems discussed in this thesis. Construction at full-scale was not experienced in the Sutherland design-build construction (presented in Chapter 2, section 3.1.3.4). In the Sutherland design-build construction there was neither construction at full-scale nor community engagement. It was merely the project process that was propositioned on actually building the design proposal. In the Sutherland design-build construction students worked with the same enthusiasm and motivation as in the other design-build constructions and proposed complete documentation for a buildable object.

The big difference in the design process between the Sutherland design-build construction and the conventional studio was that in the design-build construction the students worked together, not individually, from the inception of the project until the submission of the documentation.

In addition, construction at full-scale is not necessarily experienced in most live projects (discussed in Chapter 3, section 3.2.1). Although this thesis is essentially focused on inhabitable full-scale design-build projects, as defined in Chapter 3, section 3.2.6, design-build projects are positioned in relation to live projects (Chapter 3, section 3.2.1 and 3.2.6), and there are definite commonalities between inhabitable full-scale design-build projects and live projects. Live projects do not necessarily have a built outcome, in other words construction at full-scale is not necessarily present. Live projects are, however, driven by a process where students work collaboratively.

In Chapter 3, 13 rules are conceptualised from an activity-theory perspective for the six proposed design-build typologies (Chapter 3, section 3.2). These 13 rules are listed in Table T2. Inhabitable full-scale investigations, the Sutherland design-build construction, live projects and conventional-studio projects are positioned in the table, with the presence of the rules being indicated in each. What can be read in Table T2 is that rules 9 and 10 are present in all four of the projects. The presence of rules 9 and 10 in the conventional-studio projects indicates that these rules are not unique to design-build constructions. Rules 6, 7 and 8 are present in all but the conventional-studio projects. Rule 8, contextual reality, predominantly has an influence on the reality of the information on which the students have to base decisions. Contextual reality is a unique feature of both live and design-build projects. Contextual reality is evident and already clearly articulated in the literature (Vlahos, 2000; Cavanagh, Kroeker & Roger, 2005; Canizaro, 2012).

Rules 6 and 7, internal and external collaboration, are the only other rules shared by the three projects that differ from those of conventional-studio projects. Collaboration is emerging as the unique educational opportunity in the design-build activity system.

		Projects			
	Rules	A not built design-build project (Sutherland)	Inhabitable full-scale investigations	Live projects	Conventional studio projects
1	Construction at full-scale		X		
2	Design at full-scale	X	X		
3	Community engagement		X	X	
4	Contribution of other architectural solution	X		X	X
5	Creating habitat	X	X		
6	External collaboration	X	X	X	
7	Internal collaboration	X	X	X	
8	Contextual reality	X	X	X	
9	Creative, critical, conceptual exploration	X	X	X	X
10	Curriculum integration	X	X	X	X
11	Critique of practice		X	X	
12	Creation of practice		X	X	
13	Controlled, experimental and scientific				

Table T2: The significance of rule 6 and rule 7

T.2.1.3 COLLABORATION STANDS OUT AS A RECURRENT PHRASE IN THE LITERATURE

Collaboration is often mentioned but not necessarily explored in design-build project literature. Canizaro (2012), for instance, writes that

> a further clear alternative to the studio environment offered by design-build is that of necessary collaborative work, which some programs make a significant point in emphasizing (Canizaro, 2012: 24).

Canizaro continues to describe the work of Badanes and his Neighborhood Design/Build Studio and says that 'consensus is central to his pedagogy' (Canizaro, 2012: 25) because of the importance of 'working well together with your team mates' (Canizaro, 2012: 26), which in essence is collaboration. However, like in other literature, Canizaro does not explain how this collaboration or consensus is practised. As one example, in the 107 paper abstracts of the conference 'working out_ thinking while building' the word collaboration is used 93 times (ACSA, 2014), and in the 31 project proceedings it is used 34 times (Cavanagh, Hartig & Palleroni, 2014). In the abstracts and project proceedings the word collaboration is used not only to describe interaction between students, but also between students and others, including tutors, community, professionals, etc. Yet, in none of these cases is collaboration explored or explained further as a concept.

Midpoint proposal 1: Collaboration as a unique educational opportunity in design-build projects should be explored further.

The midpoint proposal I make on the basis of the reasoning in sections 2.1.1, 2.1.2 and 2.1.3 is that that collaboration should be explored further in the next part of the research.

At this midpoint a threshold is crossed to the 'strategic synthetic' and 'generative methodical' (Bachman, 2010: 471) section of the research. In this section, on the other side of the threshold, collaboration is explored by opening two windows. Window 1 explores collaboration as pedagogic tool that can be used to inform and design the development and operation of future design-build constructions. Window 2 explores the design-build constructions (presented in Chapter 2, section 3.1) that were not developed with collaborative principles in mind to determine if there were inherent instances of collaboration within these design-build constructions.

Architectural educators do not traditionally engage with educational theories and theoretical pedagogy. As educators we often step from professional practice into the studio and then teach as we were taught. When I commenced this research, I had to first familiarise myself with general educational research. This has prompted me to engage with design-build projects as a form of pedagogy. To use collaboration as pedagogic tool one would need an understanding of the underlying theoretical premise that collaboration entails. It is within this need that explorative window 1 and explorative window 2 are located. Beyond the midpoint, the next section of the research is explained below. In Chapter 4, explorative window 1 and 2 validate collaboration as one of the unique opportunities present in the design-build project.

T.2.1.4 COLLABORATION IN DESIGN-BUILD ACTIVITIES RESONATES WITH COOPERATIVE PEDAGOGY

In explorative window 1 collaboration as experienced in design-build activities is explored and found to resonate with more general cooperative and collaborative educational pedagogy (Johnson, Johnson, Holubec & Roy, 1984; Doolittle, 1995) and with current literature on collaboration in design disciplines (Tucker & Abassi, 2012; Williams, Henry, Tucker & Abassi, 2013). The inherent motivation within the design-build activity system and the inherent group goal emerged as significant constructs of cooperative pedagogy.

Collaboration as pedagogic tool is conceptualised by exploring three collaborative typologies that, together with three design-build project stages, three design-build physical settings and collaborative rules and tools, form a conceptual collaborative framework. This framework can guide the design and development of collaboration in future design-build projects.

T.2.1.5 COLLABORATION EMERGES UNPROMPTED FROM STUDENT DATA

Explorative window 2 uses the conceptual framework proposed in explorative window 1 to take a closer look at inherent incidences of group work in the constructions and explores whether it equates collaboration. Data generated from the students' participation in the design-build constructions (reflective essays, blog entries, social media entries, questionnaires) is used for reflection. The data showed an intrinsic motivation to contribute to the success of the group. This notion of the students finding group work valuable and important emerged as significant from the first four design-build constructions. In the first four constructions students were not prompted in the data collection about group work or collaboration. Students wrote about group work and collaboration spontaneously. The group work and collaboration started to express themselves as the inherent pedagogic premise that supported the design-build system. Beyond the importance that students themselves attached to group work, other aspects of the design-build construction resonated with several of the rules and tools of the conceptual collaborative framework. These include a common goal and a shared reward, and the changed role of the tutor in the design-build activity system.

T.2.2 THE LINK TO PROFESSIONAL PRACTICE

Research question 2b asks how the unique opportunities and possibilities of the design-build projects potentially inform professional architectural practice.

In the literature studied in Chapter 3, section 3.4.9 the concept of a 'new professionalism' (Tovivich, 2009: 70) with alternative values (Perkes, 2009) is mentioned. However, in the literature there is currently very little or no indication of the relationship that educational immersion in design-build projects has with the professional practice that graduates will enter. In an attempt to answer this question I had to ask further questions. What happens to students who were exposed to design-build projects at university? Do they just join conventional architectural practices? Do they have or want another option? One of the biggest critiques of conventional practice is that it is removed from the social reality of everyday life. But are there any alternatives?

While immersed in the 'expansive analytical and 'creative philosophical' (Bachman, 2010: 471) section of the research I started to follow the work of a young design-build architectural practice, *Change Practice*[1], that is focused on making a difference in the community*. This professional practice was founded in the same year I commenced my studies and is to my knowledge the only professional design-build architectural practice in South Africa. I corresponded with *Change Practice* in writing and then conducted interviews with each of the three practitioners. I discovered a journey that started for them as students in the conventional architectural studio, where they were introduced to design-build projects, which later led to the establishment of their own design-build professional practice. The knowledge that their journey could give possible answers to research question 2b led to midpoint proposal 2.

Midpoint proposal 2: The link between design-build architectural education and professional design-build practice should be explored further.

Explorative window 3 shares the story of Change Practice to explore the possible relationship that could exist between architectural education and practice. Explorative window 3 searches for the potential of design-build education to inform professional architectural practice.

[1]*Change Practice* is a nom de plume for the professional practice.

T.3 THE OTHER SIDE OF THE THRESHOLD

The midpoint proposition at the threshold in this thesis indicates that collaboration and the relationship between design-build education and professional practice should be explored further. What will not be explored further is construction at full-scale or community engagement, which are, respectively, the physical built outcome and the primary motivation within the design-build activity system. Both of these aspects are already covered extensively in the current literature and have been indicated to be the most fundamental rules of the design-build activity system in Chapter 3, section 3.4.2.

In a review of the book Radical pedagogies: Architectural education and the British tradition by Harriss, Day (Harriss, 2015: 11) writes that

> Given its name, this book performs a surprising trick by demonstrating how radical approaches to architectural education are beginning to give way to pedagogies that foreground the (simple) production of space. I am left with an image of students in the future armed with a pencil and saw, learning first to make simple drawings and build simple buildings.

With the two fundamental rules of construction at full-scale or community engagement the design-build activity system returns to the 'simple production of space' (Day, 2015: 11) and provides the context into which the pedagogic construct of collaboration inherently fits. This context is studied in Chapter 4, explorative window 1 and explorative window 2. These are also the two rules that are not currently present in conventional professional architectural practice. In following the story of how three young students became three young design-build practitioners the possibilities of developing such a design-build professional practice can be explored. This story is presented in Chapter 4, explorative window 3.

The threshold ends where it began, with the research questions, to serve as reminder of what the intent of the crossing of the threshold is.

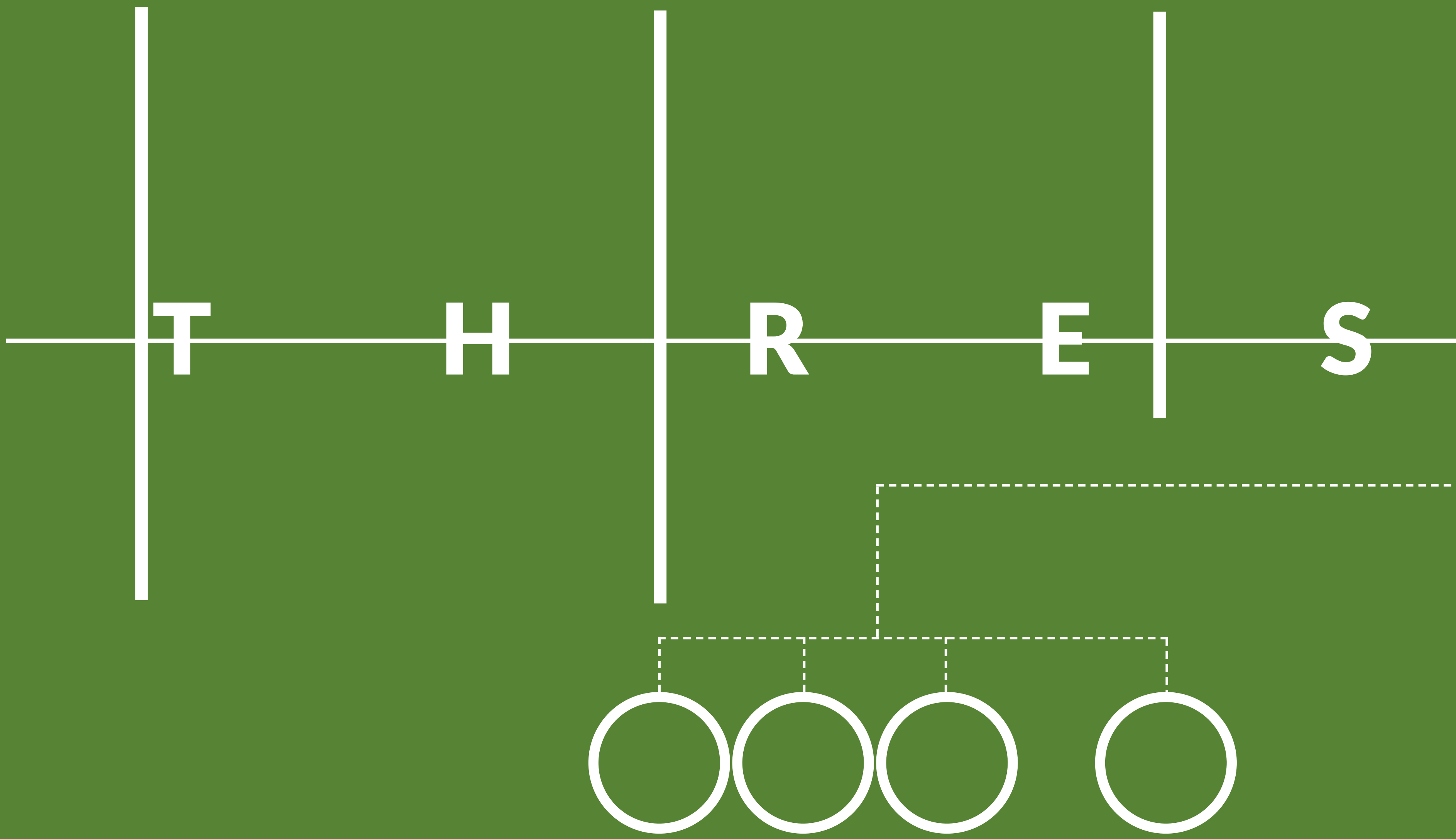
1. What are the unique educational opportunities and possibilities present in design-build project?

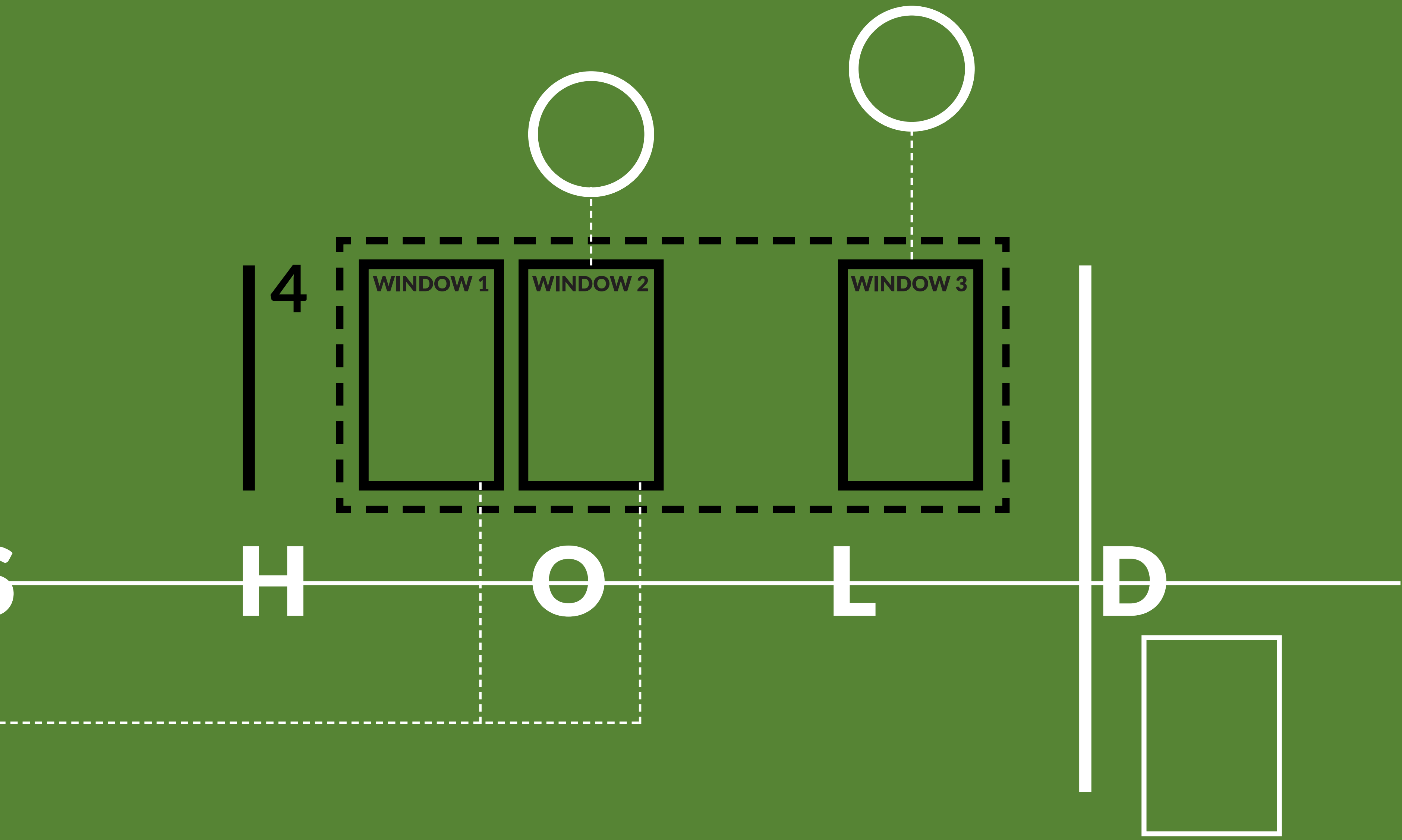
AND

2. How do these unique opportunities and possibilities potentially inform

i the development of future design-build projects and the broader architectural curriculum?

ii professional architectural practice?


T H R E S



CHAPTER 4

FRAMED VIEWS

OPENING THE WINDOWS

In Chapter 4 we step into section 2 of the research journey and document. This is the ‘strategic synthetic’ and ‘generative methodical’ (Bachman, 2010: 471) section of the research. Chapters 1 to 3 set the foundation for the research, gave a blueprint for the research design, process and methodology, and located the research by contextualising it in the literature. In Chapter 2, the blueprint, the stories of the five design-build constructions, were shared. The preliminary analysis of the data of four of these explorative design-build constructions and the literature study informed the development of a midpoint threshold that preceded Chapter 4. At the threshold two midpoint proposals were made that informed the further exploration of the research process in section 2.

Midpoint proposal 1: Collaboration as a unique educational opportunity in design-build projects should be explored further.

Midpoint proposal 2: The link between design-build architectural education and professional design-build practice should be explored further.

The further explorations and the findings are presented in Chapter 4 in three explorative windows. Window 1 explores collaboration as a conceptual pedagogical construct through a focused literature exploration and window 2 explores the five design-build constructions for instances of collaboration. Window 3 explores the story of three design-build practitioners. In their story there is a search for lessons about the link between design-build education and architectural design-build professional practice.

EXPLORATIVE WINDOW 1

EXPLORING COLLABORATION AS PEDAGOGY IN DESIGN-BUILD EDUCATION

4.1.1 INTRODUCTION

As pedagogic activities design-build projects are alternatives to the conventional architectural studio. Design-build projects take students out of the studio into the real world, where they design and build at full-scale. The focus in this explorative window is on design-build projects as a social learning space. Design-build projects are defined as community*-oriented, inhabitable full-scale investigations (Christenson & Srivastava, 2005). In design-build projects students are exposed to knowledge, skills and values they would not necessarily encounter educationally elsewhere. Design-build projects also give students the opportunity to explore the possibility of alternative types of practice. The real-life exposure the students get in design-build projects has the potential to influence their sense of being in the architectural landscape. As Wenger (2010: 180) writes, 'learning is not just acquiring skills and information; it is becoming a certain person'.

Already in 2002 Erdman et al. (2002) held that, in design-build projects, the physical activity and outcome take precedence over critical examination and theoretical discourse. Erdman et al. (175) concluded that 'typical theoretical investigations address the products of a process and not the process itself ... the challenge lies in our ability to meaningfully integrate pedagogy with process'. More recently, the lack of theoretical investigation in design-build project pedagogy is still foregrounded by various authors, including Abdullah (2011), Brown (2012) and Canizaro (2012). Harriss and Widder (2014) write that discussions on live projects[1] focus predominantly on the why and the what, but not on the how. They write that there is a general shortage of the

> language of learning intentions, outcomes, assessment means, and criteria ... [and] while the use of such terminology does not directly imply meaningful learning, we do need to capture and understand its pedagogical methodologies and structures in order to refine them. ... [W]e need the component parts of a conceptual framework: a working definition, categorized exemplars, and analysis of content and method, that are specific, though not necessarily exclusive, to the concept (Harris & Widder, 2014: 21).

[1] 'Live Projects' is a broad term for projects where students engage with real problems and real clients, but the projects do not necessarily have a built outcome. Design-build projects are a kind of live project, but with a specific built outcome.

Design-build projects are unique and complex educational activities (Canizaro, 2012) and are fairly new in formal architectural programmes and therefore the 'development of their pedagogy and organizational structure is [still] emerging' (Rice-Woytowick, 2011: 1). At a recent design-build conference one of the pertinent questions asked was how design-build projects could be explored 'as distinct pedagogic practice' (Cavanagh, Hartig & Palleroni, 2014: 6).

It is within the need for exploring pedagogic methodologies and a conceptual pedagogic framework that this explorative window is located. In the broader study in which this research is situated, collaboration has been identified as a significant tool in design-build activity systems. Specifically, I am interested in exploring how collaboration can be conceptualised as a pedagogic tool for student interaction and learning. The focus here is not on what students are learning, but rather on their interactions and engagement and how this can ultimately contribute to their knowledge acquisition and the development of their professional being.

The primary structure of this explorative window has three main components. Firstly, collaboration is contextualised within conventional architectural education and practice, within design-build projects, within educational research and within learning theories and activity theory. Secondly, collaboration is conceptually explored as a pedagogic tool underpinned by three collaborative typologies. These typologies are collaborative learning, collaborative design and collaborative construction. And thirdly, these three collaborative typologies are situated and discussed within three broadly defined design-build project stages and design-build physical settings. A reflective section concludes this explorative window.

4.1.2 CONTEXTUALISING COLLABORATION

The longest-running and first formal design-build programme, the Yale Building Project, was introduced by Charles W Moore in 1967 in an era of social activism and responsibility (Ockman & Williamson, 2012). However, Rural Studio is the most acclaimed and best-known contemporary design-build studio (Rural Studio, 2015). Carpenter (2011) is of the opinion that the Yale Building Project is based on a flawed competition model and that the Rural Studio model has a strong collaborative model that is 'valid … and transferable to most contexts' (Carpenter, 2011: 10).

Design-build projects in architectural programmes have increased steadily over the past two decades and rapidly over the past five years. Design-build projects are now included in more than 70% of the curricula of institutions belonging to Association of Collegiate Schools of Architecture (ACSA, 2014a).

In South Africa, inhabitable design-build projects can be traced back to the Peninsula Technikon's Community Projects Office (CPO, 2000; Carter, 2013). Since 2000 international students have completed various design-build projects in South Africa. These include projects at Orange Farm (Vienna University of Technology, 2015), at the Ithuba Skills College and in Prince Alfred Hamlet (Barcon, 2010; Faculty of Architecture RWTH Aachen, 2015) and in Grabouw (DOMUS, 2013). Local learning institutions have increasingly introduced design-build activities into their programmes, and noteworthy constructions include the ongoing work by UCT students at Imizamo Yethu (UCT, 2012), the ongoing work of UP students at Slovo Park (Slovo Park, 2010), and various projects by UJ students (UJ, 2015), CPUT students (Kansley, 2011) and WITS students (Saidi, 2005: 244).

4.1.2.1 COLLABORATION IN CONVENTIONAL ARCHITECTURAL EDUCATION AND PRACTICE

In most publicised design-build case studies mention is made of either group work or collaboration. In the 107 paper abstracts of the conference 'working out_ thinking while building', the word collaboration is used 93 times (ACSA, 2014b) and in the 31 project proceedings it is used 34 times (Cavanagh et al., 2014). In the abstracts and project proceedings the word collaboration is used not only to describe interaction between students, but also between students and others, including tutors, the community and professionals.

Working in groups or collaboratively as opposed to working individually is one of the key differences between conventional studio activities and design-build activities. The focus in the conventional studio is on the individual student and their relationship with the tutor as design expert (Jann, 2009), a practice that is both lauded and criticised. Cuff (1992: 44) concurs, saying that this relationship is the 'principal social relation' that exists in architectural schools and that it leads to the 'primacy of the individual' (Cuff, 1992: 45) being taken into practice and that architects are not educated in 'group decision-making processes' (Cuff, 1992: 45) . Active collaboration is not encouraged in the conventional studio.

Citing various authors, Parnell (2003: 58) writes that 'collaboration, teamworking and communication skills are not, apparently, strengths of the architecture profession … [and] of greatest concern is evidence of a perception, held by the public, that architects are arrogant'.

Furthermore, architectural practitioners are expecting students to learn collaborative skills through formal education and to be ready to work collaboratively upon entering professional offices (Tucker & Abassi, 2012). Is this premise of individual arrogance born during education and should we be focusing more on teaching students how to collaborate?

Where collaboration or group work does occur in the conventional studio, it tends to be limited to research and pre-design work (Nicol & Pilling, 2000). Group dynamics are, however, almost never managed or directed by the tutor, but left entirely up to the students. The group outcome is often just a consolidation of work that was simply divided and completed individually. Hill and Beaverford (2007: 2) write that the 'very specific, and at times discipline-centric studio experience, often fails to promote interest and understanding of new perspectives, social realities and collaborative methods'. Specific to the South African architectural education context Saidi (2005: 122) writes that 'competition [is] emphasized over collaboration'.

Design per se, whether conceptual or developmental, is almost never practised collaboratively in the conventional studio. Cuff (1991: 45) explains that, in order to pursue 'pure' design in the studio, some 'key aspects of professional practice: the client or patron, the coordinated group process of design, and economic and power relations' are simply removed from the process. A simplified design process is an inevitable teaching tool in the conventional studio, where the tutor becomes context, client and critical reflector. According to Nicol and Pilling (2000), even if some group work is part of the design process in the conventional studio, 'the final design [is] invariably produced and assessed on an individual and competitive basis' (Nicol & Pilling, 2000: 7). Why then would a student put effort into the collaborative effort if assessment necessitates individual performance?

4.1.2.2 COLLABORATION IN DESIGN-BUILD PROJECTS

In contrast, design-build projects require group work[2] from a purely practical level, and it is simply not possible to build each individual student's design. The physical reality of design-build work requires group work to succeed. Design-build activities allow students to work in a variety of different manners. Students get the chance to work as leaders, in different types of groups or in solitude and to express their personal interests (Polizzi, 2014). Students inevitably start to work with others beyond the tutor, as there are real clients and often other professionals contributing to the process. There are simply more intrinsic opportunities for collaboration in design-build projects than in the conventional studio.

Nepveux (2010), who describes a design-build studio where collaboration and communication were specifically prioritised, writes that this studio changed students' perspectives from focusing on their own creations to 'the view that architecture is an inherently interdisciplinary and collaborative form of artistic expression' (Nepveux, 2010: 84). He posits that the 'primacy of the individual' was here replaced with the 'primacy of the group' (Nepveux, 2010: 84).

> At this point, the group has a distinct advantage over the individual, because ideas can become personal property or one's own intellectual territory. The strength of that territory is considerable, and the difficulty of working alone is often in the breaking of the bonds caused by it. With a group the bonds are broken more easily, because the critical faculty is depersonalised
> (Burton in Lawson, 2005: 241).

Collaboration is a necessity in architectural professional practice. Literature suggests that it is neglected in conventional architectural education. It seems that design-build projects provide a natural setting for practising collaboration. An awareness of the underpinning principles of collaboration can provide an opportunity to explore collaboration within design-build projects and to approach it from a more conceptual and theoretical perspective.

[2]And a real client, with the accompanying economic and social realities.

4.1.2.3 COLLABORATION AND COOPERATION IN EDUCATIONAL RESEARCH

In an experimental (conventional) studio project where collaboration was deliberately introduced, Türkkan et al. (2012) found a direct relationship between the level of collaboration and the quality of the design outcome. They also observed that intentional negotiation and conversation became tools that strengthened collaboration and still allowed for individuality within a collective design process.

The findings of Türkkan et al. (2012) resonate with the work of Johnson and Johnson (1994), who have done extensive research into cooperative[3] learning in general education. Johnson and Johnson describe cooperative learning as 'more productive than competitive and individualistic efforts' (Johnson & Johnson, 1994: 46), under specific circumstances. They did an analysis of 875 studies on cooperation and found that

> the average cooperator performed at about two thirds [of] a standard deviation above average student learning within a competitive … or individualistic situation … [and cooperation] resulted in more higher level reasoning, more frequent generation of new ideas and solutions (i.e., process gain), and greater transfer of what is learned within one situation to another (i.e., group-to-individual transfer) than did competitive or individualistic learning (Johnson & Johnson, 1994: 44).

[3]Cooperation vs. collaboration: Although the words cooperation and collaboration are often used interchangeably, both in this explorative window and in the general literature, there is a difference between the two. Panitz (1999) provides a simplified summary. He describes cooperation as: 'a structure of interaction designed to facilitate the accomplishment of a specific end product or goal through people working together in groups' and collaboration as 'a philosophy of interaction and personal lifestyle where individuals are responsible for their actions, including learning and respect [for] the abilities and contributions of their peers' (Panitz, 1999: 1).

i JOHNSON AND JOHNSON AND COOPERATIVE LEARNING

Cooperative learning as a pedagogic concept is grounded in the social constructivist learning theory of Vygotsky (1930–1934/1978). Johnson et al. (1984) and various other theorists (Rottier & Ogan, Ormrod, Sharan in Doolittle, 1995a) continued to build on Vygotskian principles to establish cooperative principles and elements, which are predominantly used as guidelines to construct learning activities in a variety of educational settings. Figure 4.1.1 gives an overview of these principles and elements, which, from an activity theory perspective, can be seen as the rules necessary for collaboration within the design-build activity system.

Of the researchers above, the work by Johnson and Johnson has been the most influential in educational research. In an expansive body of research (1984–2015) they propose five elements for cooperative learning in environments, mostly classroom based, where students firstly 'learn knowledge, skills, strategies, or procedures in a cooperative group' and then 'apply the knowledge or perform the skill, strategy, or procedure alone to demonstrate their personal mastery of the material' (Johnson & Johnson, 1994: 42).

The five elements of cooperative learning by Johnson and Johnson are described in more detail in Figure 4.1.1.

Cooperative learning is in principle more applicable to the building of foundational knowledge, and collaboration more applicable to the development of critical thinking and non-foundational knowledge (Bruffee, 1995). However, collaboration as a word is widely associated with practising in the architectural profession. Also, in the South African education system cooperative learning predominantly refers to work-integrated learning or office/industry-based experiential learning. Therefore collaboration has been used as the preferred term throughout the broader research in which this paper is situated.

Components and attributes of cooperative learning according to various theorists and authors summarised by Doolittle (1995: 8)

	(Johnson, et al ,. 1984)	(Rottier & Ogan, 1991)	(Ormrod, 1995)	(Sharan, 1990)
1	positive interdependence	group cohesion	interdependence of group members	positive interdependence
2	face-to-face interaction	face-to-face interaction		face-to-face interaction
3	individual accountability	individual accountability	individual accountability	individual accountability
4	small-group and interpersonal skills	social skills development		small-group and interpersonal skills
5		group accountability		
		teacher monitoring group self-evaluation	teacher monitoring group self-evaluation clear group goal	group self-evaluation
			small-group size	

Note: These additional elements are essentially tools that can assist in adhering to the rules to reach the objective of collaborative action.

Five Elements of cooperative learning by Johnson and Johnson (1994: 38)	Elements of cooperative learning explained
(Johnson & Johnson, 1994)	(Johnson & Johnson, 1994)
Clearly perceived positive interdependence	students perceive that they are linked with the group in such a way that they cannot succeed unless their group does (and vice versa) and/or that they must coordinate their efforts with the efforts of their group to complete a task
Considerable promotive (face-to-face) interaction	individuals encourage and facilitate each other's efforts to achieve, complete tasks, and produce in order to reach the group's goals
Clearly perceived individual accountability and personal responsibility to achieve the group's goals	the performance of individual students is assessed, results are given back to the individual and the group, and the student is held responsible by group members for contributing their fair share to the group's success
Frequent use of the relevant interpersonal and small-group skills	students must be taught to get to know and trust each other; communicate accurately and unambiguously; accept and support each other; resolve conflict constructively
Frequent and regular group processing of current functioning to improve the group's future effectiveness	clarify and improve the effectiveness of the members in contributing to the collaborative efforts to achieve the group's goals
small-group size is the one element not mentioned in research on collaboration in design and is transferred to the proposed collaborative framework for design-build activities	

Note: These five elements are used extensively today as guidelines in various educational settings. For the aim of this research these five elements become the rules in an activity system. This implies that a team will be effective when the rules are followed.

Table 4.1.1: Summarising cooperative learning principles

Johnson and Johnson (1994) provide extensive quantitative evidence that, for cooperative learning to be more successful than individual or competitive learning, these five elements need to be present. Ensuring that the five elements are present and actively practised requires:

- The formal tuition of small-group and interpersonal skills
- The tutor to become a mediator of both the task and the group function
- The consideration of the composition of the group
- The consideration of the leadership of the group

These requirements in essence become the tools necessary within an activity system to enable collaboration.

Image 4.1 - 4.2: Students designing and constructing together at Hangberg

ii CONVENTIONAL GROUP WORK VS. COLLABORATIVE GROUP WORK

Clear distinctions are drawn between conventional group work and collaborative group work (Johnson et al., 1984; Doolittle, 1995). In conventional group learning:

- The focus is mostly on the task at hand and not on the successful functioning of the group.
- The group members do not or cannot necessarily rely on each other.
- The work is usually done by only some of the group members.
- The composition of the group is mostly homogeneous.
- The leader is a sole appointment.
- The group members are responsible only for their own achievement.
- The functioning and social skills necessary are not directly taught but assumed to exist.
- The evaluation of the internal group processing is not a priority or does not exist (Johnson et al., 1984; Doolittle, 1995).

The opposite should happen in collaborative groups. Figure 4.1.1 includes the differences between the conventional group and the collaborative group and consolidates these as tools in a collaborative activity system.

4.1.2.4 COLLABORATION IN PEDAGOGY, LEARNING THEORIES AND ACTIVITY THEORY

A number of learning theories and pedagogic approaches could be used to conceptualise learning in design-build projects. In this section service learning, reflective practice, experiential learning theory and situated learning theory are introduced, which can all be used to explore aspects of learning in design-build projects. This section concludes with an argument for the use of activity theory as a more complete framework to specifically explore collaborative learning in design-build projects.

i SERVICE LEARNING

Design-build projects are a form of service learning.

Service learning is a broadly accepted term that describes learning activities where, as part of the curriculum, students supply a service to the community and in turn gain learning and real-world experience. Mc Millan (2009: 39) argues that service learning is a form of 'boundary work', as it is situated between education and practice. Mc Millan explains that 'while such spaces are generally places of challenge, contestation and playing out of power relations, they can also be potential sites for new learning opportunities and new knowledge' (Mc Millan, 2009: 49). Service learning is an explanation of a way of learning, draws on experiential theory and other value systems (Morton & Troppe, 1996), but it provides no tools for explaining knowledge construction or collaborative interaction.

ii SCHÖN AND KOLB

Valuable tools for investigating learning are provided by both Donald Schön (1983) and his very well-known work on the reflective practitioner, and David Kolb (1984) and his work on experiential learning theory. Schön's work was originally influenced by a crit in the architectural studio and it has 'become a dominant "theory of practice" for all professional and vocational education' (Webster, 2008: 64). The focus of Schön's work is professional learning and knowledge transfer between expert tutor and novice student in projects that simulate real life. He introduces the concepts of reflection-in-action and reflection-on-action. Webster describes Schön's work as very seductive, but with many shortcomings, including being teacher-centred, focused only on formal learning, ignoring dimensions beyond the cognitive and being predominantly positivist. Lotz (2015: 2) says of Schön that he 'shows the valuable role of teachers as experts but scarcely considers student peer groups'. Webster (2008: 72) suggests moving to 'theories of situated knowledge, action and learning' and to 'a dialogue between theories' with a scrutinising eye and while recognising the particular lens of each.

Kolb's experiential learning theory explains learning as 'the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience' (Kolb, 1984: 41). The experience Kolb refers to here is direct, concrete experience and he proposes a four-stage learning cycle, moving from concrete experience to reflective observation, abstract conceptualisation and active experimentation. Learning as process is emphasised over learning as outcome. The theory has been criticised for not taking into account cultural experiences and differences, for placing emphasis only on learning in the individual mind and for not viewing learning as situated (Smith, 2010).

Brown (2012), in a recent doctoral study on live projects, considers the work of both Schön and Kolb as applicable frameworks for theorising live projects 'since they propose sequential frameworks that theorize the process by which an individual learns, examining the role of personal experience and personal reflection in a sequence of experience, reflection, and action' (Brown, 2012: 132). On the other hand he disregards both theories as being individually oriented and not providing 'practical tools for theorizing either ... inter-disciplinary practice ... or the collaborative learning environment' Brown (2012).

iii LAVE AND WENGER

Situated learning theory (Lave & Wenger, 1991) holds learning as a social and authentic process, situated within activity, context and culture, mostly outside the classroom, in real-world situations, and predominantly occurring unintentionally within communities of practice. Learning happens through participation with more knowledgeable other(s) in a process to which Lave and Wenger (1991) refer as legitimate peripheral participation. Communication and collaboration are indispensable to this process.

Social, authentic learning situated in activity, context and culture resonate strongly with design-build projects. However, while situated learning theory focuses on real experience in context, it 'does not really offer satisfactory analytical tools for examining interconnections and temporal emergence – that is how the meanings and functions of actions and objects emerge in and through practical activity' (Arnseth, 2008: 300). Furthermore, design-build projects are intentionally created learning experiences, not unintentional emerging in communities of practice. Students in design-build projects act within a broader community that is not necessarily definable as a community of practice.

iv ENGESTRÖM

Cooperative learning as a pedagogic concept is grounded in the social learning theory of Vygotsky (1930–1934/1978), having similar roots and resonance with activity theory. Vygotsky believed that 'all higher cognitive functions begin in external, social interaction, before turning inward' (Bozalek, Ng'ambi, Wood, Herrington, Hardman, et al., 2014: 11). In essence Vygotsky saw learning and the development of knowledge as socially and culturally situated, and together with Luria and Leontiev developed the concepts of artefact-mediated and object-oriented action (Smidt, 2013). Leontiev contributed the idea of motivation and collective action.

Engeström (1987) has continued the development of activity theory into the contemporary theoretical framework that is used extensively today. Activity theory essentially holds that social interaction and learning are situated within activities and are mediated through tools or artefacts, which can be physical, conceptual or cultural. 'Tools, means to divide work, norms and language can all be seen as artefacts for the activity: they are made by humans and they mediate the relations among human beings … and the material or product in different stages' (Ryder, 2015: 8).

Activity theory allows specifically for collective activity (Kaptelinin, 2005). In a collective activity system, the subject(s) collaborate(s) with others to solve problems in mediating towards the object of their collective activity; there is a division of labour among the community of the system and rules or norms that mediate the interaction. Internal contradictions become the 'driving force of change and development in activity systems' (Engeström, 1987: 6).

In design-build projects, students are in a process of transformation, needing to negotiate away from what they know of the conventional studio, in itself an activity system, towards a new form of interaction. In this explorative window, collaboration is conceptualised as a pedagogic tool that aids the students in mediating within the design-build activity towards the object of the activity. The activity has a number of outcomes, one of which is the development of collaborative knowledge and skills.

From an activity-theory perspective, change in student learning and change in the object occur throughout the design-build process. Students come from the more individually oriented studio and move into a more collaborative design-build studio. Students are immersed 'within a context of vulnerability, unpredictability and accountability' (Coar in ACSA, 2014b: 7). They need a new set of tools to help them negotiate within the new design-build activity system. These are tools with which the conventional studio did not equip them. As Nicol and Pilling (2000: 7) explain, in conventional studio education 'insufficient attention is … paid to the human interactive skills … for example listening, questioning, negotiating, explaining'. In an expansive activity system cycles of learning occur where artefacts or tools evolve and are modified and new practice is created through negotiated change.

Mc Millan's conceptualisation of service learning as 'boundary work' (Mc Millan, 2009: 42) is valuable in understanding design-build as boundary practice. Mc Millan highlights the importance of understanding the 'skills, values, and knowledge required by academics to do this work successfully, as they are often the most centrally placed potential boundary workers' (Mc Millan, 2009: 50). She also explored this notion of boundary work through the lens of activity theory and used it to illuminate the 'nature of service learning as social practice' (Mc Millan, 2009: 50). Her exploration of boundary work with activity theory resonates with the broader concepts in which this explorative window is located and gives particular relevance to the use of activity theory.

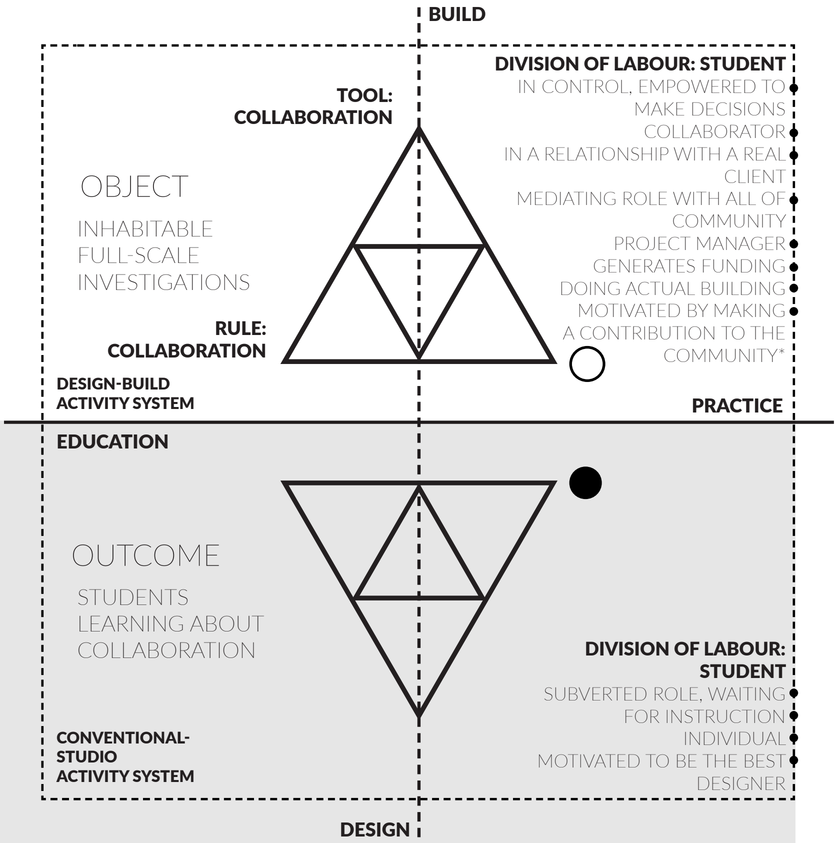


Figure 4.1.1: Collaboration as tool, rule and outcome of student learning and the division of labour of the student

Where both Schön and Kolb, in their work on the reflective practitioner and experiential learning respectively, recognise context and experience, they do not supply conceptual tools to explore the interrelationships within complex collective learning situations. Activity theory provides a framework that takes into account history and context, looks beyond the individual, looks both at the experience and the object towards which the activity is oriented, and seeks to understand relationships and influences among a number of different aspects within the system.

Although situated learning resonates with design-build projects, activity theory emphasises the 'the constitutive power of material production, that is, on the instrumentality of activity' (Engeström in Arnseth, 2008: 293)and provides a more 'powerful descriptive and analytical tool for understanding the interpretations and conceptualisations' (Torres, Buchem & Attwell, 2011: 30)) and the 'nature of knowledge and reality' (Miettinen, 2006: 389) of everyday activities. An understanding of design-build activities can ultimately help to transform them. In short, activity theory provides a holistic and heuristic framework to explore the design-build activity system.

In this explorative window activity theory is used to explore collaboration in the design-build activity system. In the broader research in which this window is situated, collaboration has been identified as both a pedagogic tool and an inherent rule within the design-build activity system.

4.1.3 COLLABORATION CONCEPTUALISED WITHIN THE DESIGN-BUILD ACTIVITY SYSTEM

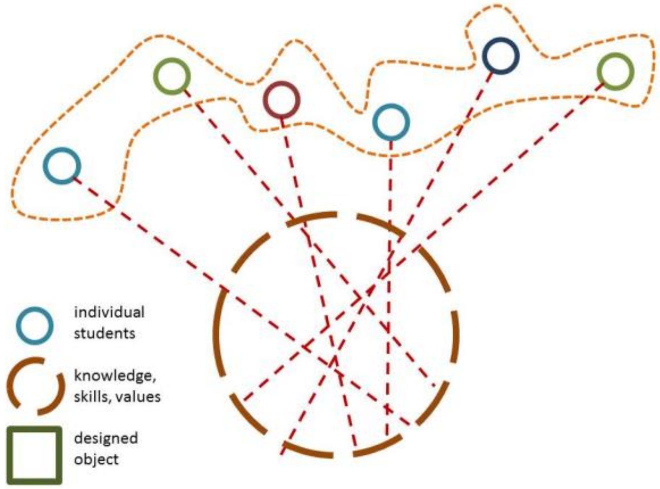
In the next section of the window collaboration is explored as a pedagogic concept in design-build projects. Collaboration is conceptualised as three activities within the design-build activity system. These are:

- Collaborative learning
- Collaborative design
- Collaborative construction

4.1.3.1 COLLABORATIVE LEARNING

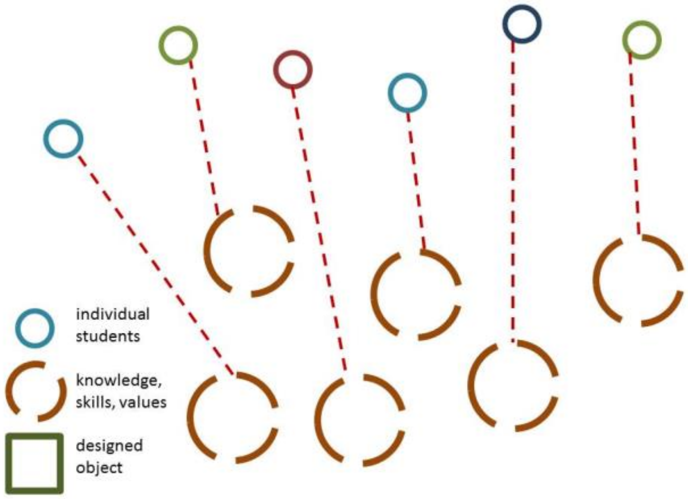
Collaborative learning focuses on individuals learning together where they gain skills and knowledge through active engagement with others. The outcome of a collaborative learning activity enables each subject to implement the knowledge and/or skills gained separately and individually after participation. Collaborative learning is therefore not necessarily focused on teaching collaboration skills to enhance later collaborative performance. It rather focuses on teaching collaboration to enhance learning in a specific situation. The development of social skills is required to be developed in order to operate within the collaborative learning environment. Figure 4.1.2 and Figure 4.1.3 graphically explain the collaborative learning process and the collaborative learning outcome.

For the purpose of this research, collaborative learning is therefore defined as group work where individuals are formally taught and directed to work purposefully together to acquire knowledge and skills. They will then be able to apply the acquired knowledge and skills individually afterwards.



LEARNING THE SAME KNOWLEDGE/SKILLS TOGETHER

Figure 4.1.2: Collaborative learning process



ABLE TO IMPLEMENT GAINED KNOWLEDGE/SKILLS INDIVIDUALLY

Figure 4.1.3: Collaborative learning outcome

4.1.3.2 COLLABORATIVE DESIGN

Collaborative learning as described above is currently practised in broad educational settings. The application of collaborative learning and associated research as specifically applied to the learning of design skills in architecture and related design disciplines is not so widespread. Collaboration in design education was extensively researched by the Australian Learning Teaching Council in a recent two-year study, with the focus on architectural design. The study (Tucker & Abassi, 2012) included a broad literature survey and in-depth discussions with tutors from design disciples during a national symposium specifically directed at this study.

Tucker and Abassi 'found a clear gap in knowledge relating to teaching teamwork in architecture and related design contexts' (Tucker & Abassi, 2012: 1). The findings by Tucker and Abassi resonate very much with the five elements of Johnson and Johnson and with the distinctions drawn between conventional and collaborative group work.

Elements of cooperative learning by Johnson and Johnson (1994: 38)	Shared views on effective teamwork in design disciplines by Tucker and Abassi (2012)

	(Johnson & Johnson, 1994)	Note: 1-5 similar to Johnson and Johnson		(Tucker & Abbasi, 2012)
1	Clearly perceived positive interdependence		RULES	High level of interdependence
2	Considerable promotive (face-to-face) interaction		RULES	Shared interactions
3	Clearly perceived individual accountability and personal responsibility to achieve the group's goals		RULES	Mutual accountability for collective performance
4	Frequent use of the relevant interpersonal and small-group skills		RULES	Individuals need to be good team players
5	Frequent and regular group processing of current functioning to improve the group’s future effectiveness		RULES	Active reflection on teamwork experiences and responsibility for self-management

TOOLS	working towards a common goal
TOOLS	shared authority
TOOLS	share rewards
TOOLS	assignment designed specifically for collaboration
TOOLS	explain the value of teamwork
TOOLS	students get specific training in teamwork, theoretically and experientially
TOOLS	assessment of individual and team
TOOLS	assessment of team process and design
TOOLS	learning of teamwork well integrated into curriculum
TOOLS	
TOOLS	model good teamwork through team teaching
TOOLS	
TOOLS	
TOOLS	
TOOLS	

Tucker and Abbasi identified a number of key characteristics of effective design teams and various shared views on effective teamwork and on the conceptualisation of teamwork in design. The key characteristics and the shared views are organised to read with the work of Johnson and Johnson. They are also presented according to the activity-theory framework, indicating aspects that are inherent rules and aspects that become tools within the collaborative activity system.

Key characteristics of effective teams in design by Tucker and Abassi (2012)	Conceptual framework for collaboration in the three defined design-build activities
(Tucker & Abbasi, 2012)	Team is effective when these rules are present
Cooperation and interdependence	Clearly perceived positive interdependence and cooperation
	Considerable, shared promotive (face-to-face) interaction
Accountability	Individuals mutually accountable for performance
Positive team culture	Frequent use of social skills, good team players
Flexibility and self-management, evaluation and reflection	Responsibility for self-management and self-evalution of teamwork and object
	Effectiveness can be achieved my making use of the tools
goals and objectives, structure and plan	shared common goal(s), objectives, structure and plan
leadership	shared leadership
	shared rewards
	assignment designed specifically for collaboration
	explain the value of teamwork
	students get specific training in teamwork, theoretically and experientially
	assessment of individual and team
	assessment of team process and design
	learning of teamwork well integrated into curriculum
	model good teamwork through team teaching
	tutor emphasizes and mediates both task and group function**
communication and information exchange	communication and information exchange
	small-group size*
	heterogenous group composition**
external support or recognition	external support or recognition

DIVISION OF LABOUR

TUTOR AND STUDENT MUTUAL RESPONSIBILITY

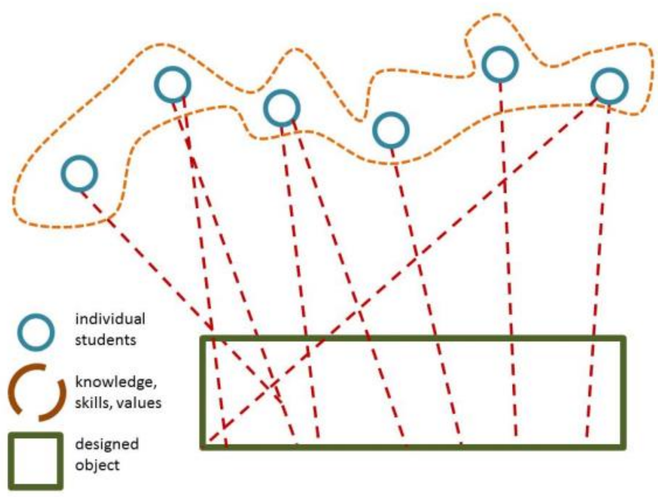
PREDOMINANTLY TUTOR RESPONSIBILITY

TUTOR AND STUDENT MUTUAL RESPONSIBILITY

COMMUNITY*, INSTITUTION, OTHERS

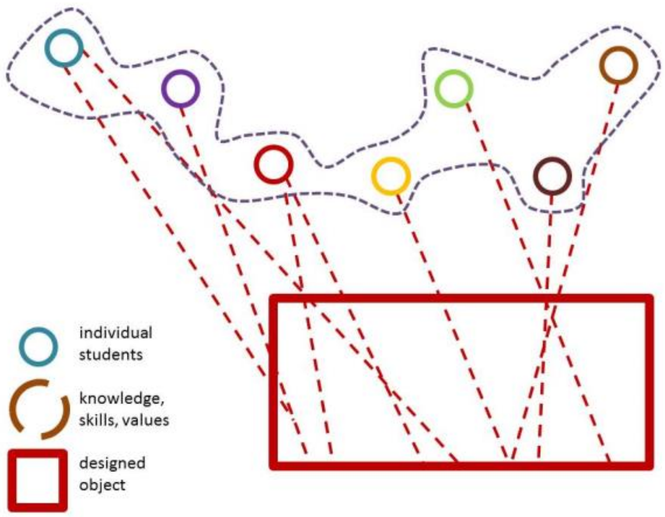
* Deduced from summary by Doolittle (1995)
** Deduced from difference between conventional group learning and collaborative learning (Johnson et al., 1984; Doolittle, 1995).

Table 4.1.2: Towards a conceptual framework for collaboration in design-build projects



LEARNING COLLABORATIVE DESIGN KNOWLEDGE/SKILLS TOGETHER WHILE DESIGNING

Figure 4.1.4: Collaborative design educational process



ABLE TO APPLY COLLABORATIVE DESIGN KNOWLEDGE/ SKILLS WITH OTHERS AT A LATER STAGE

Figure 4.1.5: Collaborative design outcome

To distinguish the broader educational concept of collaborative learning from the more specific collaborative group work in design, 'collaborative design' is from here on conceptualised as a more specific term.

Collaborative design is directed at the creation of an object that has been designed and considered together. The outcome for students is the development of collaborative design knowledge and skills that they can later apply in collaborative design situations.

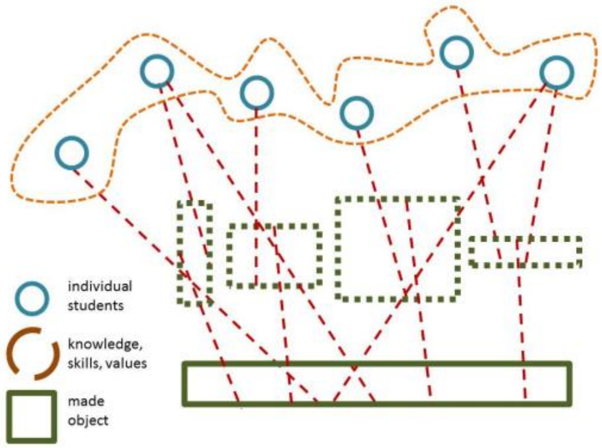
Collaborative design in education is thus understood and conceptualised as learning to design together in a team with the aim of creating a collective object and learning through and about collaborative design knowledge and skills for later application. The necessary formal and applied educational support should be provided to enable students to reach this outcome.

4.1.3.3 COLLABORATIVE CONSTRUCTION

In the previous sections I attempted to distinguish between collaborative learning and collaborative design. A third collaborative activity within the design-build activity system, collaborative construction, has been conceptualised from an idea by Hart (2015). Hart describes a type of incidental collaboration, more focused on production in terms of a business outcome, which she terms 'social collaboration' (Hart, 2015: 6).

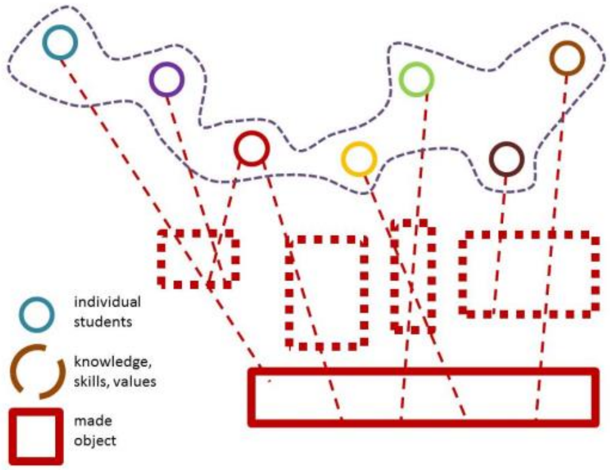
Hart specifically refers to the workplace, in other words stepping outside an educational realm. She argues that learning outcomes are not necessarily defined or do not necessarily drive the activity in the workplace, but that the work activity is driven by the rules of business metrics and by being oriented towards a work object and a productive outcome.

I posit that in design-build activities there is an aspect of the activity that is driven predominantly by similar rules: that of making and completing a built object. In the on-site stage where students are working physically on putting the structure together they become more focused on the making than on the learning. Learning still occurs, but it is more implicit (Hart, 2015) and not necessarily clearly defined in advance by the tutor. The learning occurring for each student is not focused on gaining similar knowledge and skills, but the focus is on the activity of construction. The idea of making resonates with principles of constructionism (Papert & Harel, 1991), which holds that the intrinsic motivation towards completion of an entity becomes the driving force for finding the necessary knowledge and skills to execute the work.



MAKING FULL-SCALE OBJECT TOGETHER

Figure 4.1.6: Collaborative construction educational process



ABLE TO COLLABORATE WITH OTHERS IN CONSTRUCTION ACTIVITIES

Figure 4.1.7: Collaborative construction outcome

The co-construction of knowledge or 'building collaborative knowing' (Stahl, 2004: 53) is used as descriptive words within discussions of collaborative activities and collaborative learning. Using the words 'collaborative construction' to describe the third collaborative activity conceptualised within the design-build activity system therefore has a double meaning. The two meanings are that of physically constructing buildings together and that of constructing knowledge together.

Collaborative construction in design-build activities is therefore defined as collaboratively working on physically making or constructing the full-scale object through constructing the necessary knowledge and skills with the aim of successfully completing the built object. Collaborative construction is presented graphically in Figure 4.1.6 and Figure 4.1.7.

4.1.3.4 THE THREE COLLABORATIVE ACTIVITIES SUMMARISED

The table below is adapted from a framework, Table 4.1.3, by Hart (2015: 3). Where Hart proposed five essential aspects of social learning (social e-learning, learning communities, communities of practice, social teams, professional networking) in both education and in the workplace, I propose six (learning communities, design teams, working teams, social teams, communities of practice, professional networking). Hart focused on e-learning and e-industry, while I focus here on design-build activities in both education and practice.

Social Learning in an Organisation

(c) C4LPT, 2015

		social collaboration		
SOCIAL E-LEARNING	**LEARNING COMMUNIITIES**	**COMMUNITIES OF PRACTICE**	**SOCIAL TEAMS**	**PROFESSIONAL (SOCIAL) NETWORKING**
An organised course or programme involving social interaction	A group of people brought together to learn from one another	A group of people coming together to improve their practice	A defined work or project team	Connecting with others around the world
explicit social learning		**implicit** social learning		
scheduled social learning	**continuous** social learning			
focused on **learning together**		focused on **working together**		focused on **being together**
success based on **learning metrics**		success based on **business metrics**		success based on **personal metrics**
managed by **L&D**	managed by a **Community Manager**		managed by a **Team Manager**	managed by the **individual**
underpinned by a **Social Learning Platform**	underpinned by an **Enterprise Social Network / Collaboration Platform**			underpinned by the **Social Web**

Table 4.1.3: Framework by Hart (2015: 3)

Hart uses seven categories to describe each of the five social learning aspects. These are a definition of the team, whether learning is explicit or implicit, whether learning is scheduled or continuous, what the predominant focus of the activity is, what success is based on, who manages the learning and what the underpinning e-platform is.

I have used, adapted and added to these categories by Hart (2015) to explore the three collaborative activities for design-build projects in education (see Table 4.1.4). The categories used are a definition of the team, whether the origin of the team is deliberate or incidental, where the underpinning social learning concept originates from, whether the social learning is implicit or

	EDUCATION			PROFESSIONAL PRACTICE		
	Learning Communities	Design Teams	Working Teams	Social Teams	Communities of Practice	Professional Networking
Definition	A group of people brought together to learn from one another	A group of people brought together to learn from one another through design	A group of people brought together to learn from one another through work	A defined work or project team	A group of people coming together to improve their practice	Connecting with others with similar practice to build relationships
Origin	Deliberate	Deliberate	Deliberate	Deliberate	Incidental/Deliberate	Incidental
Underpinned by social learning of Vygotsky	Johnsons and Johnson	Tucker and Abassi	Hart	Hart	Wenger	
Scheduled/continuous	Scheduled social learning		Continuous social learning			
Explicit/implicit	Explicit social learning		Implicit social learning			
Object	Learning of specific knowledge, skills, values	Design idea and presentation	Making a full-scale structure	Work outcome	Improved practice	New professional relationships
Focused on	Learning together	Designing and learning together	Making together	Working together	Learning together to improve own and collective practice	Being together
Success measure	Learning outcome	Learning outcome and design outcome	Construction outcome and process	Work object	Improved practice	Personal metrics
Managed by	Tutor	Tutor and Team	Team and Tutor	Team manager	Individual and Team	Individual
	Collaborative Learning	**Collaborative Designing**	**Collaborative Construction**	Collaborative Working	Collaborative Practice	Collaborative Socializing

Table 4.1.4: Adapting table by Hart to explore the three collaborative activities

explicit and scheduled or continuous, what the predominant focus of the activity is, the object and outcome, how success is assessed, who manages the activity. The three collaborative activities linked to the design-build activity system are collaborative learning, collaborative design and collaborative construction.

From the exploration in Table 4.1.4 the three collaborative activities were conceptually explored in more depth. These further explorations are presented in Table 4.1.5. Further categories, specifically relevant to the design-build activity system are included here. These categories are the role of the tutor, what the students are focused on, what the object of each collaborative activity is, what the outcome of each activity is for students, whether the object and outcome is explicit or implicit, who the activity is managed by and how the activity is assessed. The object, outcome and the role of the tutors and students are directly linked to the activity theory framework.

Collaborative activity	Collaborative learning	Collaborative design	Collaborative construction
Tutor bring students together to	learn from one another	learn from one another through and about design	learn from one another through productive work
Students focused on	learning together	learning and designing/making together	making and working together
Object	learning of specific knowledge, skills, values	design idea	making a real structure
Outcome (for students)	new knowledge, skills, values	collaborative design skills	community structure
	can implement individually	design idea, design artefact	completed project
Clarity of object and outcome	explicit	explicit, some implicit	implicit, some explicit
Managed predominantly by	tutor	tutor and team	team and tutor
Assessed on	learning outcome	learning outcome and design outcome	structural outcome and process
Conceptual project stage	**Generative-methodical**	**Generative-methodical/creative-philosophical**	**Creative-philosophical**
Physical settings	**Studio**	**Studio/ workshop** **Workshop/ studio**	**Construction site**

Table 4.1.5: Exploring the three design-build collaborative activities

4.1.3.5 THE THREE COLLABORATIVE ACTIVITIES AND THE DIVISION OF LABOUR

The previous section introduced collaborative learning, collaborative design and collaborative construction. These three activities use similar pedagogic tools, follow slightly different rules (refer to the definitions) and have different objects and outcomes (refer to Table 4.1.4).

The underpinning rules and tools that can facilitate collaborative learning, collaborative design and collaborative construction are essentially premised on the original work from Johnson and Johnson and have been expanded taking into account the work by Tucker and Abassi and Hart.

When all these rules and tools are consolidated as in Table 4.1.2, consideration can be given to the responsibility for implementation. In other words, what is the division of labour and who mediates the collaborative activity in the design-build activity system? The division of labour is a central concept within activity theory. The division of labour 'is both vertical and horizontal and refers to the negotiation of responsibilities, tasks and power relations' (Bozalek *et al*., 2014: 44) within an activity system.

It is clear from the study by Tucker and Abassi that the tutor has a significant role to play in enhancing or ensuring the success of collaborative design teamwork. The role of the tutor changes from that of design master in the conventional studio to becoming more of a facilitator, being probably the most significant change for the tutor moving from the conventional to the design-build studio. Table 4.1.2 shows the framework proposed for collaboration in the three defined design-build activities. In the framework the responsibility for implementation is indicated as belonging to either student or tutor or to both together.

The three collaborative design-build principles and the underpinning principles could assist academics in conceptualising design-build projects meaningfully. Students entering a design-build project for the first time must still learn to move away from the individual conventional studio. They need to learn to negotiate and mediate within this new design-build space where their own ideas need to be heard and to make place for others to reach one collaborative object.

4.1.3.6 THE THREE COLLABORATIVE ACTIVITIES AND DESIGN-BUILD PROJECT STAGES

Collaboration is predominantly mentioned in the conceptual design stage and in the building stage of various descriptive design-build stories. Collaboration is not really in the preceding research stage of the project. This part of the window 1 explores the possibility of different project stages and physical settings within the design-build project and how these can resonate with the three collaborative typologies.

In order to identify project stages within a design-build project it is worth looking at Bachman (2010), who proposes a 'framework for problem space models in design inquiry and research inquiry'[4] (Bachman, 2010: 471). He explains the difference between design inquiry and research inquiry and the perspective of the 'roles of generative-methodical and creative-philosophical processes' (Bachman, 2010: 471) and posits that these are reversed for the two inquiries.

Bachman acknowledges the framework as very linear, and that it is a simplified explanation of a complex process. Bachman's design process diagram is applicable to the design-build project, as the design processes in practice and education are very similar. The exception is that in conventional architectural education the built object as a physical design synthesis is hardly ever realised. However, in a design-build project the built object is realised.

If we accept that Bachman's stages would not stop abruptly in a linear fashion, but would overlap and that the resulting stages would not completely exclude principles of the others stages, as Bachman argues, then creativity, inspiration, novel thinking and all cognitive skills would be present throughout, and a model with three overlapping stages starts to emerge. There is the generative methodical, then a generative-methodical/creative-philosophical and finally a creative-philosophical stage, explained graphically in Figure 4.1.9 as three stages within the design-build project.

[4]Bachman's proposed research framework grounds the methodology of the broader research in which this paper is situated.

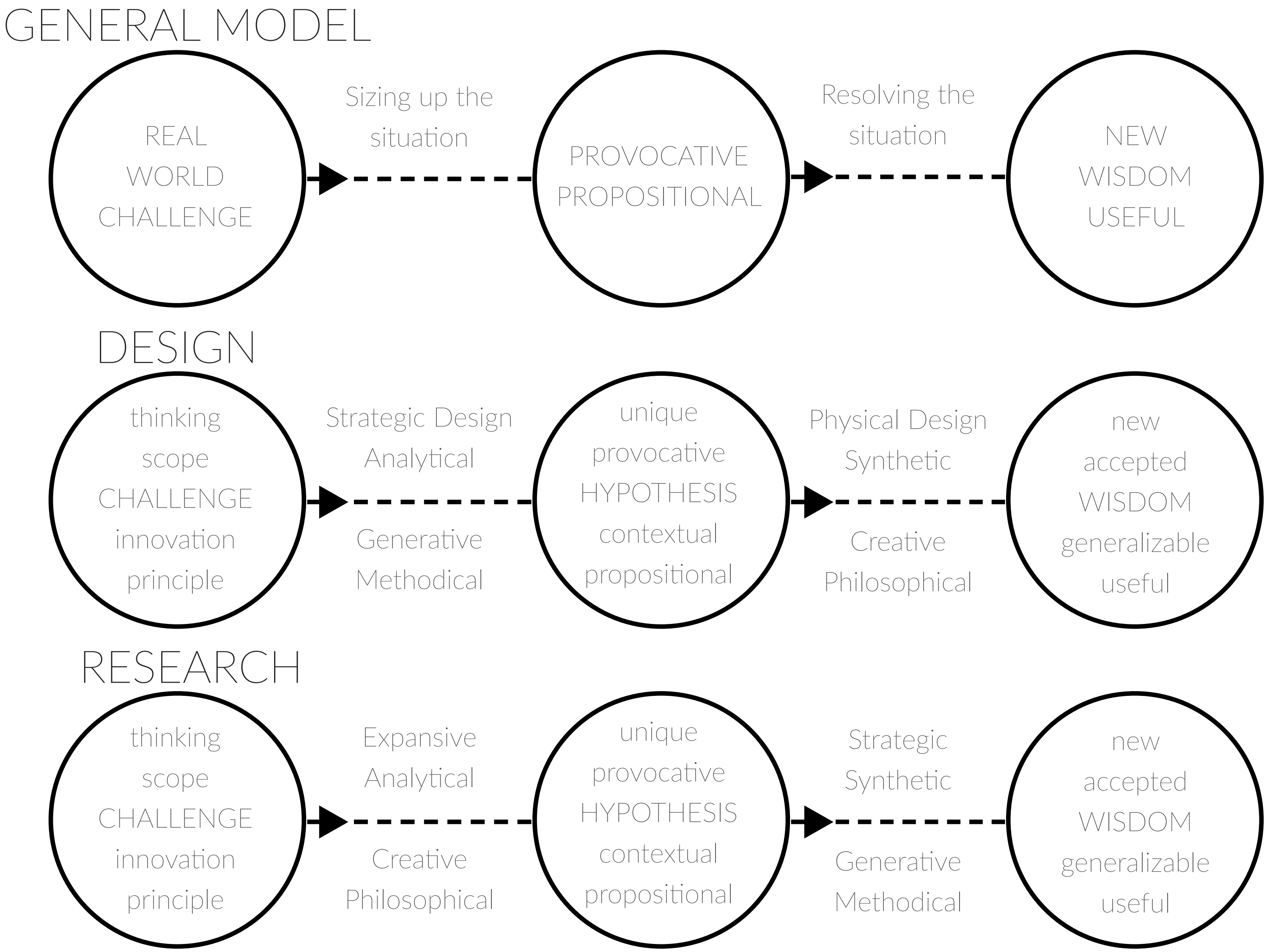


Figure 4.1.8: A framework for problem space models in design inquiry and research inquiry (Bachman, 2010)

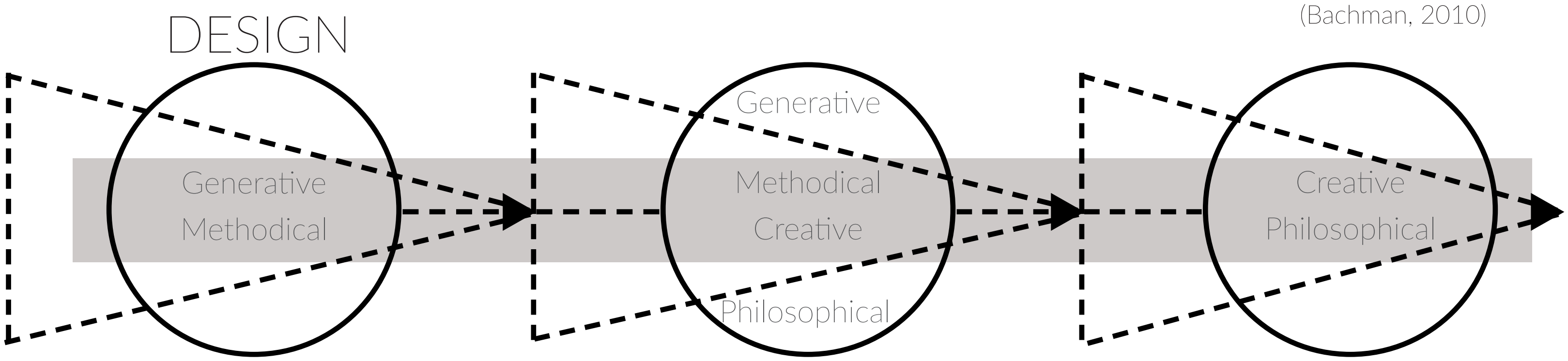


Figure 4.1.9: Three overlapping stages in the design-build activity system, after Bachman (2010)

i STAGE 1: THE GENERATIVE-METHODICAL

This is a project stage with which students would already be familiar, as it is very much part of conventional studio projects where they would clarify the brief, find precedent, research and study contextual requirements. It is often the only stage in conventional projects where group work is actively practised (Nicol & Pilling, 2000). The mode of work is inquiring and tentative.

In a typical design-build project students will do similar work during this stage, but in addition will engage with the client and community. Small groups would be working on finding similar information that could be shared in the bigger group. Students could 'exit' this stage having learned and acquired very similar knowledge. The challenge in this stage would be to move beyond conventional group work where students simply do individual work and consolidate the end product. The focus should be on learning together to define the problem. Students should be made aware of the possibilities of collaboration and be taught the necessary skills for collaboration.

ii STAGE 2: THE GENERATIVE-METHODICAL/ CREATIVE-PHILOSOPHICAL

During this project stage a conceptual proposal is made, or, as Bachman calls it, a 'unique provocative intention' (Bachman, 2010: 470). This intent or initial conceptual idea could also be developed collaboratively in small groups. Students could essentially start to design together. Collaborative design might be new to students and would be a skill that they could develop together. In design-build projects collaborative design is specifically held as a counter to competition (Wallis in Salama & Wilkinson, 2007) between students in creating an initial concept that will lead to the built object. Wallis describes a process where students work together to make an initial proposal, where overlapping and strong ideas are identified and where the proposals are consolidated until the process reaches a stage where the entire group has contributed to the intention and it becomes a collective idea.

The mode of working shifts from predominantly methodical thinking and analysing in Stage 1 and starts to focus more on creative making through drawing and modelling. Students would be acquiring similar but in some cases also very different kinds of knowledge and skills, depending on the group in which they are.

iii STAGE 3: THE CREATIVE-PHILOSOPHICAL

During Stage 3 the preceding design work is synthesised into a physical design through development, documentation and actual construction. In the design-build project students would now often take on completely different roles in different groups and each student might acquire different skills and knowledge necessary for the completion of the project. The mode of work might be progressively messy and intense, in the moment and focused on completion. All the students need to understand the whole vision and the end goal, but might be working only on parts of the structure. This stage is rarely experienced by students during conventional architectural studies or during professional practice.

4.1.3.7 THE THREE COLLABORATIVE ACTIVITIES AND PHYSICAL DESIGN-BUILD PROJECT SETTINGS

The three conceptual project stages described above reflect three physical spaces that Nepveux (2010: 85) describes as the 'three distinct settings' of the design-build project

i. Studio

ii. Workshop

iii. Construction site

where the 'development and integration of thinking … addresses Nicol and Piling's concern with isolation of the design studio' (Nepveux, 2010: 85).

Of the three physical settings, the studio represents the familiar, the link with the conventional way of working. The studio is also associated with the first stage of a design-build project, when inquiry is just starting out. The workshop represents the investigative, the testing of ideas, both physical and conceptual, to find a unique proposal. The construction site represents the final stage of the project, where ideas and methods are consolidated into a full-scale built object. These three physical settings are present in most design-build projects.

4.1.3.8 THE THREE COLLABORATIVE ACTIVITIES AND A PROPOSED RELATIONSHIP WITH THE STAGES AND SETTINGS

The three collaborative activities resonate with both the three conceptual stages and the three distinct physical settings. The proposed relationship among the activities, the conceptual stages and the physical settings are represented in the framework in Table 4.1.6.

The framework does represent a sequential order, but does not intend to suggest a strict alignment. Each of the related activities, conceptual stages and physical settings is not meant to be exclusionary of the other and does allows for iteration and overlap.

BUILD

Collaborative activity	Physical design-build project setting	Design-build project stages
Collaborative construction	**Construction site**	**Creative-philosophical**
Collaborative design	**Workshop/studio**	

PRACTICE

T H R E S H O L D

EDUCATION

Collaborative design	**Studio/workshop**	**Generative-methodical/ creative-philosophical**
Collaborative learning	**Studio**	**Generative-methodical**

DESIGN

Table 4.1.6: Conceptual collaborative matrix

4.1.4 SUMMARY

Explorative window 1 set out to explore collaboration from an activity-theory perspective as a pedagogic tool in design-build activity systems. Three collaborative activities are proposed. These three collaborative activities represent a shift from a way of working in the conventional studio, where collaborative learning is the only one of the three typologies that is in some way practised. The shift is towards integrated collaboration within the design-build project and practising collaborative learning, collaborative design and collaborative construction. The activities posit a shift in thinking and the way of working for students.

The proposed conceptual framework for collaborative tools, rules and division of labour (Table 4.1.2) and the three collaborative activities, each linked to three conceptual stages and physical settings as indicated in the framework (matrix in Table 4.1.6.), provide a point of departure for discussion of the pedagogic design of design-build projects.

This explorative window represents the beginning stages of research into collaboration in design-build projects. More research is required to investigate collaboration that is specifically designed and guided within design-build projects and also into the different collaborative activities to determine where the possible overlaps are.

EXPLORATIVE WINDOW 2

EXPLORING THE PRESENCE OF COLLABORATION IN DESIGN-BUILD PROJECTS

Parts of this explorative window were published as two peer-reviewed articles in the Journal of South African Institute of Architects, issues 77 and 78, with co-author Rudolf Perold. Rudolf Perold collaborated with me on the various design-build constructions and wrote the story of the Sutherland design-build construction, section 4.2 of this window.

4.2.1 INTRODUCTION

The formal teaching of collaboration is essential for the development of a well-balanced architectural professional (Nicol & Pilling, 2000). This explorative window posits design-build projects as ideal contexts for collaboration and proposes that collaboration can be taught purposefully through the appropriate structuring of design-build projects in the education of architects.

Architectural educators in general aim to continually improve their educational practice and believe that how and what they teach shape the identity and values of future professionals. Many architectural educators are investigating design-build projects as an alternative teaching methodology. This window aims to contribute to the international call to theoretically investigate the pedagogy of design-build projects (Abdullah, 2014; Harriss & Widder, 2014; Brown, 2012; Voulgarelis, 2012; Erdman *et al*., 2002) and to conduct an exploration of the educational value, implementation, pedagogy and the possibility of alternative forms of practice.

The Design Build Research Studio at the Cape Peninsula University of Technology was initiated in 2011 and investigates live and design-build projects as an alternative to the traditional architectural studio. Design-build projects form part of the broader definition of live projects. Live projects involve 'the negotiation of a brief, timescale, budget and product between an educational organisation and an external collaborator for their mutual benefit … students gain learning that is relevant to their educational development' (Anderson & Priest, 2015: 2). Some live projects have a built structure as outcome and are then defined as design-build projects.

The Design Build Research Studio initiated a number of design-build constructions over the past few years. The aims of these constructions included exploring alternatives to the conventional studio, investing and making a difference in local communities and embedding a sense of social responsibility in students while opening up the possibility of alternative types of practice.

The design-build constructions presented in this explorative window were executed within the existing academic paradigm, which is supportive of the conventional studio and curriculum, not of design-build. The constructions were not designed specifically with collaboration principles in mind. However, the idea of group work was implied, even if just from the perspective of the practical necessity of building together. The pedagogic design of the constructions relied on existing experience of teaching and learning in the conventional studio and on what was available in the literature. There is also a certain inherent flexibility in the architectural curriculum that enables the introduction of explorative projects (Brown, 2012).

The methodological approach included participant observation of the design-build constructions. The data consisted of site notes, photographs, students' verbal and written reflections, student questionnaires and informal discussions with collaborating academics and professionals. This is a qualitative study that considers the social constructivist learning theory of Vygotsky (Doolittle, 1995; Smidt, 2013). Learning is not an isolated activity but linked to context and social interaction and, from a radical humanist perspective, transformation in practice is 'possible by creating awareness of patterns of dominance' (Mills, 1990: 73).

This window explores collaboration as such a pattern in a series of design-build activities. Architecture per se is mostly a social and not only an individual practice, and working in a considered collaborative environment can positively influence design outcomes (Türkkan *et al*., 2012). The conventional architectural studio does not always allow collaborative practice to develop, as Hill and Beaverford (2007: 2) assert: the 'very specific, and at times discipline-centric studio experience, often fails to promote interest and understanding of new perspectives, social realities and collaborative methods'.

This window first opens briefly onto collaboration in architectural education and practice, then onto a conceptual framework for collaboration in design-build activities, and thereafter traces the stories of a number of design-build constructions. The window then seeks evidence of collaboration within these design-build constructions using the conceptual framework as guidance. A reflective interpretation is presented in three main parts. Firstly, collaborative learning, collaborative design and collaborative construction are explored, secondly three inherently present collaborative patterns are proposed, and thirdly the role of the tutor within the collaborative constructions is discussed. What emerged from the constructions was the inherent presence of opportunities for collaboration and a supportive environment where some of the underlying rules and tools for collaboration are already in existence.

Images 4.3 - 4.4: Collaborative construction at Hangberg

4.2.2 COLLABORATION IN ARCHITECTURAL EDUCATION AND PRACTICE

The Journal of South African Institute of Architects (JSAIA) recently published a number of articles on architectural education. These included views on situating sustainable studies within education (James, 2014), transformation in education and the profession (Le Grange, 2014), relevant qualifications (Carter, 2013), and curriculum development (Delport-Voulgarelis & Perold, 2012). Design-build as teaching methodology is specifically addressed by Carter (2013: 43) as typically having 'a utopian or community-based ideal' and an 'inherent orientation towards ... collaborative teamwork'. He further refers to three kinds of historically developed curriculum models: a compositional, a mathematical and a constructional curriculum. The latter is 'heavily workshop and site based, developing the material consciousness of the architect "as fabricator" (where the practical experience of making buildings is the driver of design thinking)' (Carter, 2013: 43). In South Africa the universities of technology are uniquely situated to explore collaborative constructional curricula.

Design-build projects are becoming more and more prevalent in architectural education and are already included in more than 70% of the curricula of members of the Association of Collegiate Schools of Architecture (ACSA, 2014). In general, students show more enthusiasm for and engagement with these projects than for conventional-studio projects (Sara, 2006; Schwartz, Morthland & Mcdonald, 2014). Students also develop 'confidence and initiative in sorting out details' (Cavanagh, Kroeker & Roger, 2005: 7). In general, architectural educators who write about design-build projects are predominantly positive about the contribution the projects make to a student's education.

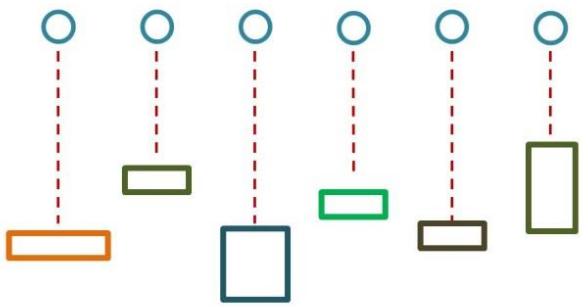
4.2.2.1 VIEWS OF ARCHITECTURAL EDUCATORS ON COLLABORATION

Collaboration and group work are mentioned, but not explored, in most descriptive and analytical design-build case studies (Delport-Voulgarelis, 2015). Van der Wath (2013), among others, writes that design-build projects offer a place where students can be 'exposed to the complex collaborative nature of spatial design' (Van der Wath, 2013: 184). Chiles and Till (2004: 3) state that there 'are clear social benefits' and that design-build projects are 'contained time-wise and need a group to succeed'. However, collaboration as an active pedagogical approach in design-build projects has not really been investigated.

Professional architectural practice requires collaboration. Professional teams work together in offices, often across diverse disciplines, and social architecture requires collaboration with non-professionals. Practitioners are already expecting students to acquire collaborative skills as an academic competency (Tucker & Abassi, 2012). James (2014: 48) called for the 're-evaluation of interdisciplinary, multi-disciplinary, collaborative and participatory models … in the context of architectural … production'. Professional practice expects design to be done collaboratively, but in the conventional studio such action can be seen as cheating, causing a tension between these two systems (Lotz *et al*., 2015).

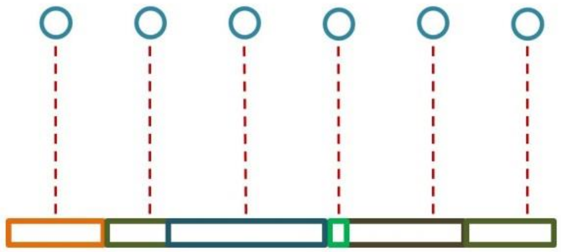
The conventional architectural teaching studio is still focused on the individual hero designer (Jann, 2009). In the foreword to the acclaimed work Changing Architectural Education: Towards a New Professionalism, Nicol and Pilling (2000: 8) state that the 'familiar model of architectural education seems unlikely to foster in students a positive attitude towards collaboration … while it remains primarily geared to developing individual stars rather than preparing team players'.

The dominant prevailing relationship in the conventional architectural studio is that between a student and a tutor and the development of the individual's design competence. Students as individual subjects produce individual design objects, this relationships is depicted in Figure 4.2.1. This 'individuality' is even referred to as a 'solo struggle' (Koch, Schwennsen & Dutton, 2002: 6), with little room for group interaction, since 'collaboration with other students means giving up the best ideas' (Koch et al., 2002: 6). Although there are two major modes of operating in both practice and education, namely that of the individual and that of the group (Türkkan *et al*., 2012), group work in the conventional studio is 'normally restricted to the early research stage of a project, with the final design invariably produced and assessed on an individual and competitive basis' (Nicol & Pilling, 2000: 8). The relationship between individual and group object is depicted in Figure 4.2.2. This assessment practice encourages students to work in parallel, collating the individual work into a single product, so as to move on to their individual design exercises as quickly as possible. Cuff (1991: 44) concurs, saying that students 'are rarely encouraged to work in groups on design problems explicitly intended to help them learn about the social construction of architecture, about collaboration skills, mutual satisfaction, and the like'. Collaboration is currently neglected as skill taught intentionally to students.



CONVENTIONAL-STUDIO DESIGN
INDIVIDUAL SUBJECTS PRODUCING INDIVIDUAL OBJECTS

Figure 4.2.1 Conventional-studio design



CONVENTIONAL-STUDIO GROUP WORK
INDIVIDUAL SUBJECTS PRODUCING A COLLECTIVE OBJECT WITH INDIVIDUAL CONTRIBUTIONS

Figure 4.2.2 Conventional-studio group work

Collaboration invites participation, since 'the process is more dialogic and inclusive than traditional studio projects, allowing and embracing alternative voices in the studio environment' (Sara, 2004: 2). Le Grange (2014) emphasises that working together in groups is beneficial to the whole conventional-studio learning process. About collaboration in design-build projects educators write that students not only enjoy collaboration more than the usual competition among themselves (Chiles & Till, 2004), but collaboration enhances self-confidence in group work and students realise they do not have to be the best at everything (Sokol, 2008). Collaboration in design-build projects teaches students about individual responsibility within a team (Chiles & Till, 2004; Abdullah, 2011), about not disappointing the team (Nepveux, 2010) and about consensus-based decision-making (Cook & Stephenson, 2014). Chiles and Till (2004: 4) further believe that the 'core skills of organisation, team working and working to a tight timescale' must be formally taught to students.

4.2.2.2. PREVIOUS RESEARCH ON TEACHING COLLABORATION IN ARCHITECTURAL EDUCATION

The Australian Learning Teaching Council conducted a comprehensive two-year study into teamwork in architecture and related design disciplines. The conclusion of the study was that most tutors in design studios do not have the requisite knowledge to teach effective teamwork. The study states:

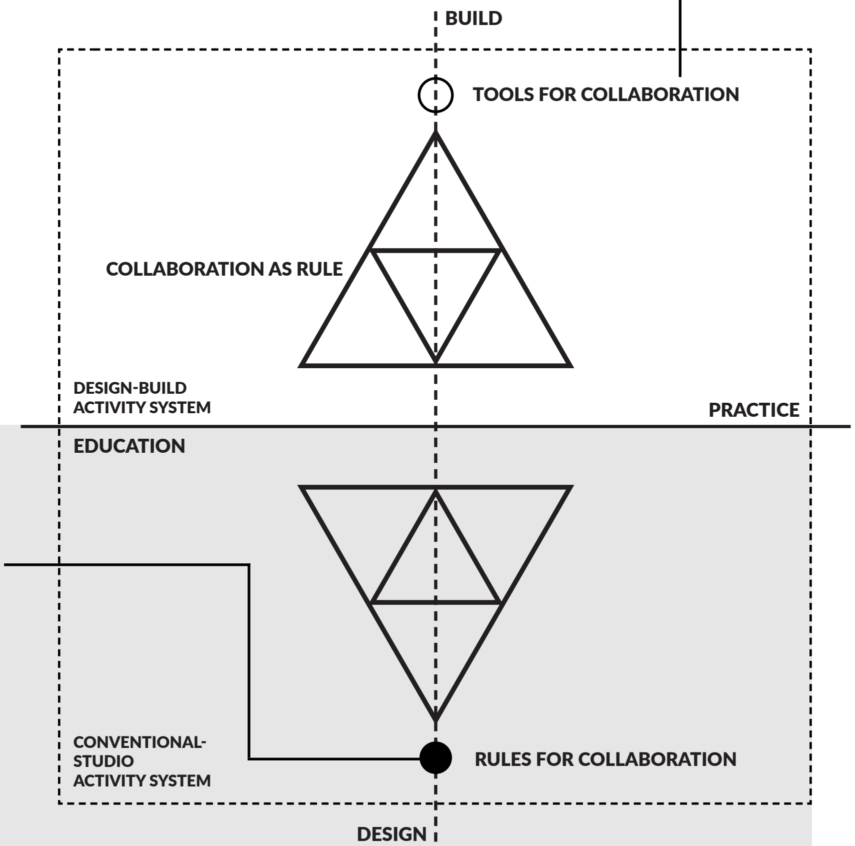
> What is clear from talking to educators nationally is that relatively few design-teachers focus on the teaching of teamwork skills and even fewer are involved in teaching scholarship or research in this area. It appears that as the teaching of teamwork is largely ad-hoc in Australian design education, there is a clear need for the integration of team and group learning into design curricula (Tucker & Abassi, 2012: 1).

The research also highlighted the need for pedagogical models that not only assess the products of teamwork, but also assess the process of teamwork and the teamwork skills. Furthermore, Tucker and Abassi conclude that 'as teamwork is listed as a graduate competency by accrediting bodies of design courses, we suggest that the need for the formal assessment of teamwork skills is pressing' (Tucker & Abassi, 2012: 7).

From experience and observation of various architectural learning sites over the past decade it would be fair to say that the situation is similar for South African educators. Also, although neither collaboration nor teamwork is mentioned per se in the South African Council for the Architectural Profession's (SACAP) competencies (SACAP, 2010), which implies that it is not a prerequisite for teaching to students, collaboration is mentioned as one of SACAP's core values (SACAP, 2014).

Collaboration, as well as the necessity to move from the individual to the collaborative, is acknowledged as important in both education and the profession. Collaboration encourages participation, yet in architectural education the focus is still on the individual. In addition, very little is known about the teaching of collaborative skills in architectural education so that it may be practised actively and purposefully. In many descriptive stories of design-build projects group work and collaboration are mentioned, but not with any explanation of what collaboration entails. There is a clear gap in the literature regarding research into collaboration as a specific tool in design-build projects.

SHARED COMMON GOAL(S), OBJECTIVES, SHARED STRUCTURE AND PLAN
SHARED LEADERSHIP
SHARED REWARDS
ASSIGNMENT DESIGNED SPECIFICALLY FOR COLLABORATION
EXPLAIN IN THE VALUE OF TEAMWORK
STIDENTS GET SPECIFIC TRAINING IN TEAMWORK THEORETICALLY AND EXPERIENTIALLY
ASSESSMENT OF INDIVIDUAL AND TEAM
ASSESSMENT OF TEAM PROCESS AND DESIGN
LEARNING OF TEAMWORK WELL INTEGRATED INTO CURRICULUM
MODEL GOOD TEAMWORK THROUGH TEAM TEACHING
TUTOR EMPHASIZES AND MEDIATES BOTH TASK AND GROUP FUNCTION
COMMUNICATION AND INFORMATION EXHANGE
SMALL GROUP SIZE
HETEROGENOUS GROUP COMPOSITION
EXTERNAL SUPPORT OR RECOGNITION



CLEARLY PERCEIVED POSITIVE INTERDEPENDENCE AND COOPERATION
CONSIDERABLE, SHARED PROMOTIVE (FACE-TO-FACE) INTERACTION
INDIVIDUALS MUTUALLY ACCOUNTABLE FOR PERFORMANCE
FREQUENT USE OF SOCIAL SKILLS, GOOD TEAM PLAYERS
RESPONSIBILITY FOR SELF-MANAGEMENT AND SELF-EVALUATION OF TEAMWORK AND OBJECT

Fig 4.2.3 Collaborative framework as rules and tools in the design-build activity system

4.2.3 A CONCEPTUAL FRAMEWORK TO EXPLORE COLLABORATION IN DESIGN-BUILD ACTIVITIES

The idea of cooperative or collaborative learning is not new. Cooperation and collaboration can be considered as underpinning concepts of social learning. Their roots can be traced back to the social constructivist learning theory of Vygotsky (1930–1934/1978). Vygotsky's social learning or sociocultural theory has greatly influenced contemporary social learning practice. Vygotsky considered cognitive development to be a cultural activity within a social context and as dependent on interaction with others. Communication, through language and other cultural artefacts, and collaborative learning are seen as essential tools by means of which externally developed cognition is internalised.

Johnson and Johnson (1984) conducted extensive research on cooperative learning based on, among other things, the work of Vygotsky. They found that cooperative learning experiences, more than individual and competitive learning experiences, promote creative thinking, acceptance of others, commitment, caring, feelings of inclusion, enhanced self-esteem and increased learning achievement. Johnson and Johnson's principles have a strong presence in a set of guidelines proposed by Tucker and Abassi (2012) for collaborative learning in design disciplines. Social collaboration in the workplace, described by Hart (2015) as learning that is implicit and a result of working together, is similarly grounded in social learning theory.

The work of Johnson and Johnson, Tucker and Abassi and Hart was considered together and developed into three collaborative activities in the broader research of which this window is part. Along with three conceptual project stages (Bachman, 2010) and three physical settings (Nepveux, 2010) the three activities are considered as a matrix (Table 4.2.1) to explore collaboration within design-build projects. When this matrix is expanded with a number of tools and rules that were also deduced from the work of Johnson and Johnson and Tucker and Abassi, a conceptual framework (Table 4.1.2 in Window 1) emerges that will be used to explore collaboration within the design-build constructions that are part of this explorative window. The framework is also graphically depicted as collaborative activity in Fig 4.2.3.

BUILD

Collaborative activity	Collaborative learning	Collaborative design	Collaborative construction
Conceptual project stage	**Generative-methodical**	**Generative-methodical/creative-philosophical**	**Creative-philosophical**
Physical settings	**Studio**	**Studio/ workshop** **Workshop/ studio**	**Construction site**

EDUCATION — T H R E S H O L D — PRACTICE

DESIGN

Table 4.2.1: Collaborative matrix

[1]Cooperation vs. collaboration: Although the words cooperation and collaboration are often used interchangeably, both in this explorative window and in the general literature, there is a difference between the two. Panitz (1999: 1) provides a simplified summary and describes cooperation as 'a structure of interaction designed to facilitate the accomplishment of a specific end product or goal through people working together in groups' and collaboration as 'a philosophy of interaction and personal lifestyle where individuals are responsible for their actions, including learning and respect for the abilities and contributions of their peers'. Cooperative learning is in principle more applicable to the building of foundational knowledge, and collaboration more applicable to the development of critical thinking and non-foundational knowledge (Bruffee, 1995: 15). However, collaboration as a word is widely associated with practising in the architectural profession. Also, in the South African education system, cooperative learning predominantly refers to work-integrated learning or office/industry-based experiential learning. Therefore collaboration has been used as the preferred term throughout the broader research in which this paper is situated.

4.2.4 A SERIES OF DESIGN-BUILD CONSTRUCTIONS

The descriptions of the design-build constructions are very succinct and aim to contextualise and focus on the students' processes. Instances of individual and group work are mentioned. The projects were completed mostly in the second year, except if mentioned otherwise.

4.2.4.1 THE ST MICHAEL'S PROJECT

The St Michael's project was featured in the Journal of South African Institute of Architects (Nov/Dec 2012, Nov/Dec 2013). There were three separate constructions, each approached differently in terms of organisational and design process. St Michael's is a multi-grade rural school. The aim was to improve the spatial teaching facilities and introduce students to a design-build activity.

Image 4.5: Detail at St Michael's construction

i ST MICHAEL'S 1 (STM1)

In February 2011 seventy students visited the site, discussed the project with the school community, gathered contextual information and collated this in groups. Until June 2011, students individually studied and designed projects focusing on timber-framed construction as part of the second-year curriculum. The design commenced with a collaborative brainstorming session in August. The ideas were consolidated during a discussion session, after which students had to individually prepare and submit ideas, including analysed precedent. Tutors identified resonating ideas and discussed this with the school management.

Ten students volunteered to take part in the final design process. The rest of the class was divided into groups for organisational aspects, including acquiring sponsored construction material.

An outdoor classroom space was built in two weeks in October/November 2011. On site, students worked in smaller groups of between five and eight. Sometimes students moved between groups. Two professionals joined the project: one local architect-builder and a natural building specialist. The build part of the activity was finished on time and handed over to the school during a celebratory function. As a final part of the activity, students had to submit an individual reflective essay.

Image 4.6: Detail of roofs meeting at St Michael's

ii ST MICHAEL'S 2 (STM2)

In 2012 two further activities were undertaken. The first involved students of the extended curriculum programme (ECP)[2]. A group of twenty students completed a small project in which they extended the deck and made a screen that defined a play area for the Grade R learners.

Image 4.7: Preparing for painting at St Michael's 2

[2]The extended curriculum programme offers intense support to students from disadvantaged backgrounds in an additional pre-first year.

iii ST MICHAEL'S 3 (STM3)

In the second 2012 activity a solar protection screen over the existing container and a library in the container were constructed.

During the year up to September 2012 students did preparation work similar to that in 2011. The design process started as a studio-based collaborative exercise. Students designed and developed their ideas in groups of two. The groups merged with other groups and ideas were combined. This was repeated a number of times. The final three proposals were discussed with the entire group and the main ideas were identified. These were consolidated into a conceptual design. This proposal was taken to site, where a scale model was started, design continued on a blackboard and students used the actual materials, mostly timber, to mock up and modify the design. A different half of the class went to site each day, while the other half did technological exercises on campus. This meant taking on site work that others had worked on the day before, which was an interesting challenge. Again students worked in small groups. The activity was completed during the allocated time, mostly in the rain, and handed over to the school.

Image 4.8: Constructing the solar screen at St Michael's 3

4.2.4.2 SUTHERLAND (S)

In 2012, the Sutherland 4x4 Route Overnight Retreat involving eight students was introduced to the third-year students. Conceptual and technological development spanned eight weeks. Unfortunately this project was not built due to funding constraints.

Students visited the farm in Sutherland and as a group did a site investigation and conducted interviews with the client. After the immersion on site, the students went back to the studio and two additional students joined the team. It was a challenge to get the new group members to understand the physical site, but it did provide an opportunity for good group discussion.

During two interactive sessions per week, tutors acted as facilitators and soundboards. Some key outcomes to attain were established as a group and collaborative physical models were much emphasised. The students first developed individual design models based on the collective concept statement. The pooling of design ideas with fellow students was initially met with apprehension, but the potential for a multitude of creative design solutions soon became clear. Individual idea models were discussed; strong and overlapping ideas identified and then formalised into collaborative idea models. Lecturers facilitated the establishment of guiding principles by asking questions and emphasising reflection and allowing each student to voice their opinion about all the aspects of the design. As the intention was to eventually build the project, the strong focus on modelling was also seen as preparation for the building work on site.

4.2.4.3 HANGBERG (H)

This project in 2014 involved collaboration with design activists Stephen Lamb and Andrew Lord[3]. It entailed an access deck and a vertical food garden as an addition to the Light House. The Light House was designed by Stephan Lamb and is an alternative solution to the City of Cape Town's temporary relocation homes (Hoffman, 2014).

This short, intense project, carried out over five days in November 2014, had as its main academic objectives the design of technology and learning about alternative practice. The completion of the work was not the main priority. The focus was on the quality of technical design resolution and participation.

Students first met the client on site and then did an off-site collaborative design exercise. The exercise focused on the technical design of the timber-framed deck and vertical garden through drawing and model making.

The rest of the week students worked in small groups on different tasks. Two additional projects were identified in conversations with the client: the construction of exterior concrete stairs and interior timber shelving. Found and recycled materials were used. Each group took control of the design and building of a component. There was constant interaction with the client, who was a knowledgeable builder and maker himself.

On the final day, progress was so good that an additional small chicken coop was designed and built before lunch. The local brass band gave a performance to thank the students. After a rather reluctant final clean-up of the site, a worsbraai was held for all the participants.

[3]Stephan Lamb and Andrew Lord are artists-activists of Design-Change (previously of Touching the Earth Lightly) and have extensive experience in hands-on sustainable community work.

Image 4.9: Constructing the front deck at Hangberg

Image 4.10: Detail of the vertical food garden under construction at Hangberg

		Collaborative activity
		Conceptual project stage
		Physical setting
		Typical project stages
Team is effective when these rules are present		
Clearly perceived positive interdependence and cooperation		RULES
Considerable, shared promotive (face-to-face) interaction		
Individuals mutually accountable for performance		
Frequent use of social skills, good team players		
Responsibility for self-management and self-evaluation of teamwork and object		
Effectiveness can be achieved my making use of these tools	RESPONSIBILITY	
Shared common goal(s), objectives, shared structure and plan	TUTOR AND STUDENTS	TOOLS
Shared leadership		
Shared rewards		
Assignment designed specifically for collaboration	PREDOMINANTLY TUTOR	
Explain the value of teamwork		
Students get specific training in teamwork theoretically and experientially		
Assessment of individual and team		
Assessment of team process and design		
Learning of teamwork well integrated into curriculum		
Model good teamwork through team teaching		
Tutor emphasizes and mediates both task and group function		
Communication and information exchange	TUTOR AND STUDENTS	
Small group size		
Heterogeneous group composition		
External support or recognition	other	
KEY		

M1S
cc
S

- which design-build construction

StM1 just as M1 etc, S Sutherland, H Hangberg

- cl_collaborative learning; cd collaborative design, cc collaborative construction
- s_student, t_tutor responsibility

Collaborative learning				Collaborative design		Collaborative construction	
Generative methodical				Generative methodical/ Creative philosophical		Creative philosophical	
Studio				Workshop		Site	
Studio					Workshop	Site	
Initiation	Administrati on	Introduction	Research	Conceptual	Prototype	Building	Hand over
	M1S cc S		M1S cl/cc S		M3SH cd S/T	M1M2M3SH cc S	
					M1M2M3SH cd S	M1M2M3SH cc S	
			M1S cl S		M1M2M3SH cc S	M1M2M3SH cc S	
			M1S cl S		M3SH cd S/T	M1M2M3SH cl T	
			M13S cc S	M3SH cc S/T	M1M2M3SH cc S/T	M1M2M3SH cc S	
						M1M2M3SH cc T	M1H cl T
			M1M2M3SH cc T			M1M2M3SH cc T	
		M1M2M3SH cl T			M1M2M3SH cd S/T	M1M2M3SH cc S/T	
			M1M2M3SH cc S/T			M1M2M3SH cc S/T	
			M1M2M3SHccc T	M1M2M3SH cc T		M1M2M3SH cc T	
		M1M2M3SH cd T	M1M2M3SH cd T/P	M1M2M3SH cd T/P	M3H cd T	M1M2M3SH cc T/P	
							M1H cl T
Inherently present	*Generally present*	*Partially present*	*Potentially present*				

Table 4.2.2: Conceptual framework and collaborative incidences

4.2.5 REFLECTIVE INTERPRETATION

The collaborative conceptual framework (Table 4.1.2 in Window 1) was used to explore the presence of collaboration within the design-build constructions. The data suggested instances of collaborative activities and of the presence of collaborative rules and tools within the design-build constructions.

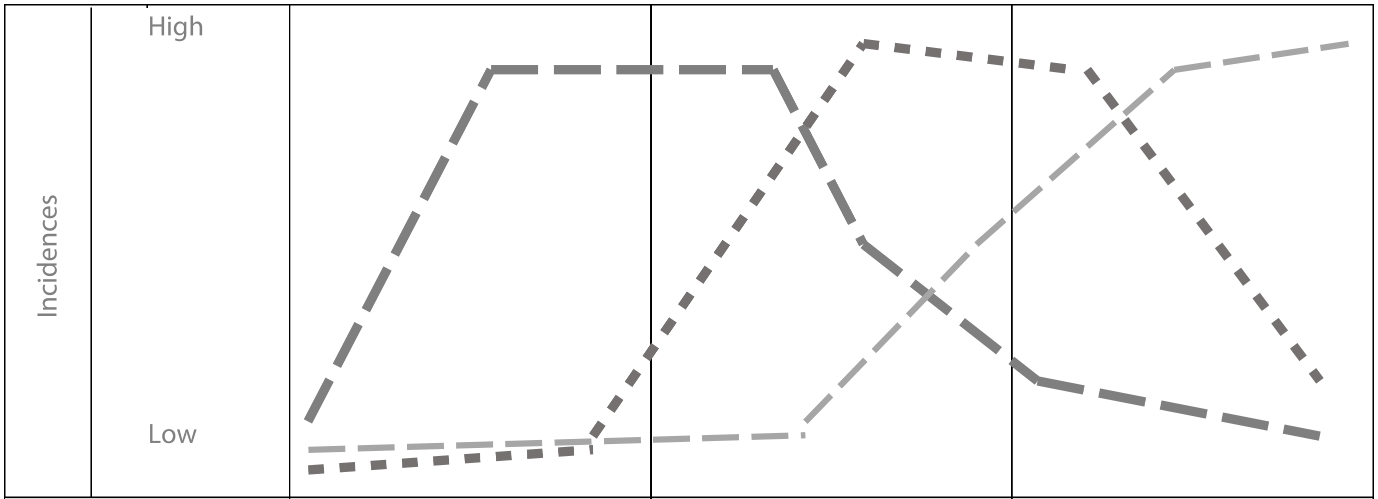
The identification of the instances of collaboration from the data was based on the conceptual framework and was not related to specific questions to participants in the design-build constructions. The frequency with which each instance appears was interpreted from the instances observed in the design-build constructions and instances reported by the students in the data collected from the design-build constructions. The collaborative incidences are indicated as inherently present, generally present, partially present or potentially present and is indicated in Table 4.2.2. In the same table the type of collaborative activity, the design-build construction where the collaborative incidences took place and whether the student, tutor or another was responsible for the collaborative incidence are indicated.

This section commences with an exploration of the presence of the three collaborative activities, then presents three inherent patterns, and moves on to the role of the tutor in the design-build constructions. The quotes in italics are from the participating students[4].

[4]Sections in italics are verbatim quotes from students with the number in brackets referencing the year of the project, followed by a coded number for a specific student.

4.2.5.1 COLLABORATIVE ACTIVITIES

Collaborative learning, collaborative design and collaborative construction were all visible in the design-build constructions. The incidences identified from studying the data are indicated in Table 4.2.3. The table relates the appearance of the incidences in relation to the project stages and physical settings.



<table>
<tr><td>Collaborative activity</td><td colspan="2">Collaborative learning</td><td colspan="2">Collaborative design</td><td colspan="2">Collaborative construction</td></tr>
<tr><td>Conceptual project stage</td><td colspan="2">Generative - methodical</td><td colspan="2">Generative - methodical/creative - philosophical</td><td colspan="2">Creative - philosophical</td></tr>
<tr><td>Physical settings</td><td>Studio</td><td colspan="2">Studio/ workshop</td><td colspan="2">Workshop/ studio</td><td>Construction site</td></tr>
</table>

Table 4.2.3: Collaborative incidences, project stages and physical settings

i REFLECTION ON COLLABORATIVE LEARNING

Collaborative learning opportunities presented themselves in the beginning stages of the design-build constructions, during project initiation, introduction, administration and research. These are the stages of the design-build construction that are also closest in experience to the conventional studio. The conventional-studio research in the first part of a project is often done in groups. While the design-build constructions presented were not designed specifically with collaborative principles in mind, it is interesting, but probably not surprising, that the least resonance with the collaborative rules and tools is observed in the part of the activity resembling the conventional studio the closest.

It seems that students were still in the individual mindset at this point in the constructions, drawing on their previous studio learning experiences. Students were able to identify their own goals (StM1, S) during research and were able to self-manage their process. However, they were still learning more alongside each other than learning collaboratively.

To enhance collaborative learning in design-build constructions it would help to keep the overall common goal with its physical and social outcomes visibly in mind. This can be achieved by having more interim meetings with the community or client, and making sure that the other tools of collaboration are in place.

ii REFLECTION ON COLLABORATIVE DESIGN

Collaborative design draws on previous individual design knowledge, but the act of designing collaboratively is quite foreign to most students. Surprisingly, students were quite positive about the experience of developing ideas, both conceptual and technological, together: … *(conceptual) designing in a group was a good exercise* (12_51). … *interesting to discuss the various (different members') detailing options* (12-12). Students found value in identifying strong ideas from individuals and smaller groups, then sharing these to create one design: *Overall, putting all our 'pros' together, creating a masterpiece was the most exciting part* (12_16). Students felt they had learned something new: *It teaches us different ways of thinking* (12_51). And this student described the advantage of collaborative design as: … *the ability to exploit each other's strengths while simultaneously building one's own skills where they may be lacking* (12.1_04).

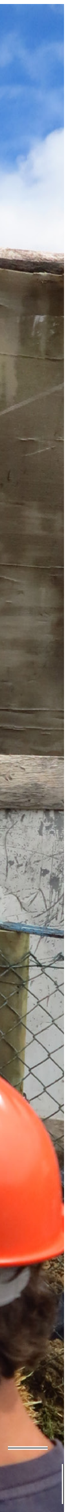
Students were critical of the time allowed for the design exercises: *I feel that the time allowed for design was not enough, but some good designs came from that exercise* (12_51). A student described the process in StM3 of not just laying the different-sized recycled roof sheets, but making decisions on site regarding overlapping and positioning to achieve the best visual result, and then stated that *design doesn't stop till the work is done* (12_50).

Social and communication skills are demonstrated within the collaborative design process, as this student explained how her group had reached consensus on the final design: *We all gave each other adequate time and a chance to speak so that we can all reach a fair decision* (14_05).

The group design exercises were mediated by the tutors, and specifically in one construction (S), where the most time was spent on the conceptual design stage, the tutors had time to mediate both the design task and the group function, a rule that makes collaborative design more accessible to students (Tucker & Abassi, 2012). The amount of time 'allowed' for conceptual design in particular will vary according to construction and the integration into the curriculum. Spending adequate time with conceptual design prevents design-build from becoming mere construction exercises.

Because students focus more on the physical and social outcomes than on their own grades it seems that they are more willing to share ideas, and the idea of the individual and of competition as modes of interaction (Johnson & Johnson, 1994) is replaced by the idea of collaboration towards a bigger goal.

Image 4.11: Site preparation at Hangberg



iii REFLECTION ON COLLABORATIVE CONSTRUCTION

Within collaborative construction, high incidences of positive interdependence and promotive interaction were experienced by the students.

Positive interdependence seems intrinsically linked to the common goal. For positive interdependence to exist there are two aspects to consider. The first is that 'each group member's efforts are required and indispensable for group success', and the second that 'each group member has a unique contribution to make to the joint effort because of his or her resources and/or role and task responsibilities' (Johnson & Johnson, 1994: 38). To complete even a simple physical building task relies on different individual skills coming together at the same time.

A student describes below how, during the building phase, the act of simply moving construction material from one point to another necessitated simple task interdependence through a division of labour: *We worked well as a group forming a chain with everyone having a specific task to get it done faster* (11_60). Other students commented that it requires everyone to make the physical building work succeed: *It was great learning about the coordination, commitment and effort needed from all members of the team to allow a flow of construction* (14_03).

In the prototyping phase (StM3, S, H), either large-scale physical models or full-scale modelling with actual materials informed design decisions. Making mock-ups with the actual materials required constant discussion and feedback between members. Tasks were shared, including keeping record (sketches, photographs), physically manipulating materials and viewing results from different elevational perspectives. Students realised that each individual has a part to play in the whole: ... *everyone has there (sic) own duties on site as everyone was an expert on some or other part of construction* (12_51).

Promotive interaction supports positive interdependence. Promotive interaction requires mutual accountability for team performance and shared responsibility for each other (Tucker & Abassi, 2012), and encouragement and facilitation between members to execute the tasks that will lead to the realisation of shared goal(s) (Johnson & Johnson, 1994). During the prototyping (StM3, S, H) and building phases (StM1, StM2, StM3, S, H) students displayed concern and care for each other: *We need to take into consideration how we will function in a safe and healthy workplace and looking out for each other during this process* (14_04). They were also encouraging each other on site: *Regardless of the bad weather* … *we made the best of the moment*, *singing all the way* … (11_40), and on social media: *Well done group B*, *we did a gr8 job* … *So far so GOOD!* (11_61).

Caring about others you work with increases commitment, responsibility and persistence, even in taking on difficult tasks to achieve the common goal and 'long-term and persistent efforts to achieve do not come from the head; they come from the heart' (Johnson & Johnson, 1994: 47).

The challenge would be to construct the design-build experience for promotive interaction to be present in more stages of the project, not just in the physical building part. In the two constructions (StM3, S) where group work was used during the design process, including the full-scale mock-ups, it contributed considerably to positive interaction. All students could take an active part in the design development beyond the initial conceptual exercise.

To a minor extent collaborative construction was present in the fundraising, material sourcing and administrative aspects of one construction (StM1). Students had to share these tasks, as it was a substantial amount of work.

During collaborative construction the small groups were able to self-manage tasks independently of supervision: ...*it was left completely upon (the group) to reach the goal of that particular day, thus learning the value of time and task completion* (11_16). The bigger groups needed guidance for reflection. Here tutors took an active part in organising reflective feedback and planning sessions in the afternoons and/or mornings. To optimally function on a building site, this type of meeting is a necessity and again there is an almost inherent opportunity to practise self-evaluation and reflection. It would be possible to give control of these meetings over to students and to minimise the role of the tutors. However, these meetings provided an opportunity to model good teamwork through team teaching (Tucker & Abassi, 2012: 7). The question as to whether to model or give over control to students would depend very much on where in the curriculum each construction is situated.

Image 4.12: Planting the primary pole structure at Hangberg

4.2.5.2 REFLECTION ON THREE INHERENT PATTERNS THAT EMERGED

During the last stretch of the respective constructions, on-site collaborative construction became the dominant activity. This was also where the presence of collaborative rules and tools was most explicitly indicated as depicted on Table 4.2.3.

Through the interpretation of students' written feedback a strong pattern that emerged, but that is not a specific rule or tool in the conceptual framework, is the value students themselves placed on the collaboration during the constructions. The value placed on collaboration seems part of the intrinsic motivation within the design-build activity and in terms of this research an underlying incentive for developing a collaborative framework.

Two further patterns emerged as inherently present within the design-build constructions. The two patterns are two tools in the collaborative framework, namely a common goal and a shared reward. These three patterns, the value students placed on collaboration, a common goal and a shared reward, are discussed next:

i PATTERN 1: THE VALUE STUDENTS PLACED ON THE COLLABORATION

The value students placed on the collaboration experience was evident in the students' behaviour, and in their written and verbal reflections. Although group work is often frowned upon by students in the conventional studio, in the design-build constructions students engaged with group work head-on, realising that the execution of the project was not possible without it: *This project could never have been completed without the teamwork and willingness to work by everyone* (11_60). Students showed an understanding of the importance of team work for their future practice: *I am gaining more and more knowledge with regards to team work, this is a tough issue as everyone has their own ideas and thoughts, yet is very much a part of life and the working profession* (11_42). Students also acknowledged that group work was not positive all the time, but saw the value in the process: *I am delighted at how everything went accordingly even though some group members were unbearable at times but this was a learning process* (11_40). They realised that their individual contribution was important to the group function: *I like to think I played my part as a good team member* (14_05). They also enjoyed learning about group work: … *the best learning experience was working well in a group* (14_04). It seems that group work is not only inherently part of design-build activities, but students realise the value on a variety of levels.

ii PATTERN 2: A COMMON GOAL

The idea of a common goal that provides direction and motivation for the students as a unified body is expressed by this student in anticipation of the upcoming project (StM1): *This experience will unify us …. towards achieving a common goal which is to make a success of the St Michaels design-build project* (11_16).

Students also experienced a sense of accomplishment in doing their work, which in itself is a reward: On site was great. … *We did a good job and i am proud of my team. Feels good solving problems on site instead of doing it on the computer* … (12_51). This all contributes to a very positive attitude on site: *The students' approach to this project was amazing* (14_03).

iii PATTERN 3: A SHARED REWARD

Students measured the success of the activities in the physical outcome of the built structure, but also through the social outcome. The contribution that they made to the community provided a sense of pride and motivation and became the shared reward that motivates collaborative activity. The importance and contribution of a shared reward was specifically evident in two activities (StM1, H), as both activities culminated in a proper ceremony that was celebratory as well as reflective and involved the client/community. In both these activities the client/community was also present during the building stage, providing a physical and visual motivation and impersonation of the social outcome, that of doing good to others. Garraway and

Morkel (in Bozalek, Ng'ambi, Wood, Herrington, Hardman, *et al.*, 2014: 26), drawing on the work of Stetsenko, explain that where 'the purpose of activity … is one of social upliftment or social justice … [it] becomes the main driving force for engagement in the activity'. Johnson and Johnson (1994: 42) explain that an 'important aspect of both small-group and whole-class processing is group and class celebrations. It is feeling successful, appreciated, and respected that builds commitment to learning'.

A student's reflection (StM1) supports this motivational feeling: … *one thing stands out for me: the little girl who thanked us, and painting everyone's hand to handprint the wall we painted. Now the hard sweating on that ladder wasn't just for nothing. That was the proudest moment of my two weeks, in fact the whole year. We were there and we made that change* (11_40).

The significance of the three entrenched patterns is that they position design-build projects as collaborative activities even before the implementation of specific collaborative rules or tools. Simply put, they provide a context that lends itself to collaboration. The three patterns are also very much connected, especially in the design-build constructions set in a social upliftment context (StM1, StM2, StM3, H). A physical context, such as a design-build construction, that promotes positive interdependence resonates with what Johnson and Johnson (1999: 100) term 'environmental interdependence'.

4.2.5.3 REFLECTION ON THE ROLE OF THE TUTOR IN THE DESIGN-BUILD ACTIVITY SYSTEM

The design-build activity requires tutors to adapt their role and take an active part in managing collaboration by mediating both task and group function. This role change is indicated graphically in Figure 4.2.4. In design-build projects the tutor is not just a knowledge informer, but also a facilitator, consultant, mentor and adviser (Chiles & Till, 2004; Tovivich, 2009; Van der Wath, 2013). This section presents identified incidences of the tutors facilitating collaboration in the design-build constructions .

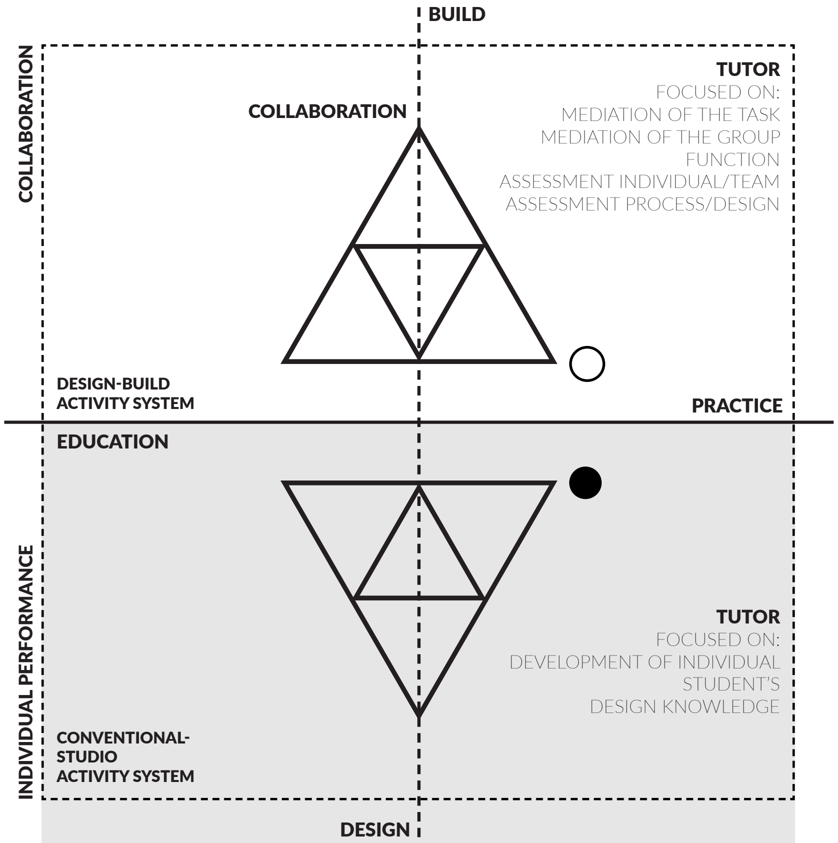


Fig 4.2.4 The role of the tutor in collaborative activities

i MEDIATION OF THE TASK

Mediation of the task is present in the collaborative construction stage, simply by the tutor being present on site and needing some sort of control of the built object and outcome and the safety of students and community.

ii MEDIATION OF THE GROUP FUNCTION

Canizaro (2012: 33) says that ‘architecture students are … unaccustomed to working in groups, and with any group projects, the interpersonal dynamics must be managed’. More mediation of the group function might require more tutor presence or more tutors becoming involved, and depending on whether design-build activities are integrated over consecutive years or are just free-standing ad hoc projects, the tutor might be able to minimise interpersonal management as students learn from one project to another how to manage this themselves. Mediation of the group function must also be extended to the other stages of the project.

The input on group function by tutors was already present in the design-build constructions and acknowledged by the students: *When we had communication problems* … *a simple action from one of the lecturers* … *made the process faster* (14_02). To help students with collaboration it is important to explain the value of teamwork. This is evident in the collaborative construction phase (H): *From my lecturers I learned that group work is best to get more work done than pulling on your own* (14_01).

iii
COMMUNICATION AND SOCIAL SKILLS

Communication and social skills need to be actively taught. Although teaching this formally was not done in any of these activities, students acknowledged that communication is important and some experienced learning in this regard: *Team work and communication are key when working in groups* (14_02), and *I have learnt that through good communication a lot can be achieved* (14_04). Communicating to accomplish a collective task is an important skill to learn as 'negotiation ... [can be] ... the object of tension between individuality and collectivity' (Türkkan *et al.*, 2012: 8).

iv
ASSESSMENT

One of the principles of successful collaboration is the assessment of the individual and team for both the collaborative process and the physical outcome. Collaboration is one aspect that was not assessed formally during any of the design-build activities. Active participation and reflection were evaluated, but not in a manner that gave feedback on whether students acquired collaborative knowledge and skills during the process.

The flexibility of the curriculum allowed design-build activities to be introduced into the course, even if in an ad hoc manner. This same flexibility could introduce a formal assessment of collaboration, even if the current curriculum does not specifically mention collaboration as a key competency.

4.2.6 SUMMARY

It is posited that from the reflection presented here, evidence indicates that design-build constructions and the physical space they occupy provide a receptive environment for collaboration. Although design-build projects inherently offer opportunities for group work, group work does not necessarily constitute collaboration. Even though the design-build constructions explored in this window were not designed specifically for collaboration, instances of collaboration were observed and collaborative opportunities were identified. Some rules of collaboration, a common goal, supported positive interdependence and a shared reward, are all inherently situated within design-build activities, positioning design-build constructions as ideal contexts for teaching collaboration.

Whether it is necessary to embed the strengths of all three collaborative activities in each of the conceptual stages and physical settings of each design-build construction is debatable. Some stages of the project lend themselves better to collaborative learning, some to collaborative design and some to collaborative construction. What is significant is that most of the inherent collaboration was observed in the collaborative construction phase of the design-build constructions. Collaborative construction was linked in this window to notions of model making and the physical act of building. Would it be possible to posit that to physically make something real together as the underpinning support of the strong collaborative potential observed?

In the conventional architectural studio 'conflicts in negotiation processes are seen as matters to be put down, settled and absorbed in order to reach a final as soon and as seamlessly as possible. It is important to question what is at stake when modes of collectivity are rigidly formed into a determined singular path and what might have been triggered by more vigorous negotiations ongoing in every level of the design process' (Türkkan *et al.*, 2012: 7).

Brown (in Harriss & Widder, 2014: 57) states that one of the greatest opportunities in a live project 'is not that it is a place to reflect on one's own learning but that it is a place to share that learning and reflection with others'. Sharing and reflection are as important to the tutor as to the students; the design-build construction becomes a collaborative place, an immediate present space for students, but also a retrospective space for staff, to share and build knowledge. As architectural educators we need to make active use of the inherent opportunities to embed aspects of collaboration throughout design-build constructions.

Image 4.13: The Hangberg site

EXPLORATIVE WINDOW 3

TOWARDS DESIGN-BUILD INTEGRATION IN ARCHITECTURAL EDUCATION AND PROFESSIONAL PRACTICE

4.3.1 INTRODUCTION

Architecture has always been a service profession, but it has too often served only those who can afford it (Wu, 2007: 12).

Change Practice is not a conventional kind of architectural practice. It is a young, small practice that does a range of work, including much-needed work (Bennett & Osman, 2013) for underprivileged communities* who do not under normal circumstances have access to professional architectural services. *Change Practice* does this work through a design-build approach. In this context, design-build is defined as a hands-on approach where the practitioners get involved with the design and physical making of the building.

This explorative window tells the story of a path followed by the practitioners who initiated *Change Practice*. I believe that the practitioners of *Change Practice* are not only making a difference through how they practise, but also have the ability to act as change agents in the broader landscape of the architectural body of knowledge. If we as architectural educators knew more about their journey, we could perhaps learn about the shaping of their identity as social architectural practitioners. Knowing what shaped their identity could help us to structure architectural education experiences to be more oriented towards social practice.

As a trajectory through a social landscape, learning is not merely the acquisition of knowledge. It is the becoming of a person who inhabits the landscape with an identity whose dynamic construction reflects our trajectory through that landscape (Wenger-Trayner, 2014: 29).

[1]*Change Practice* is a nom de plume for the professional practice that is the subject of this paper.

In this explorative window 'community' is used to make reference to predominantly underprivileged communities in South Africa that do not have the financial means to afford architectural services. Where only the word 'community' is used, it is used in reference to a concept within activity theory, which refers to all role players taking part in an activity.

Although many professional architectural practices in South Africa are involved with upliftment work in underprivileged communities*, the design-build practice explored in this window was initiated and structured with the premise of prioritising design-build community* projects in their scope of work. These young practitioners are part of a growing global consciousness among architects 'of their ability to promote justice within their social climate' (Rosenthal, 2013: 1). In answering the question as to what a new architectural professional in the current social climate might look like (Fisher in Bell & Wakeford, 2008) *Change Practice* can serve as precedent.

Social forms of practice are not only about being socially responsible, but also about growing the scope of professional architectural practice (Tovivich, 2010). Tovivich also suggests the importance of 'promoting alternative architectural practice and education to become mainstream' (Tovivich, 2010: 273) and maintains that in order to do this, there is a need for 'more research on exploring the new architectural professionalism in different contexts' (Tovivich, 2010: 273). He recommends that 'more analysis in terms of architectural curriculum reform could be conducted in order to propose changes in conventional architectural education at the structural level' (Tovivich, 2010: 273).

The story of *Change Practice* can help us to explore the possible changes needed in conventional architectural education to prepare students for alternative social architectural practice.

Architectural schools will have to change their curriculum in response to global change, but are currently still preparing students to serve the minority elite (Fisher in Bell & Wakeford, 2008). The minority elite is typically financially strong enough to afford architectural services, but many people from the rest of the population cannot afford much-needed architectural services that will improve their living conditions. If we want our students to consider pursuing social forms of professional practice, we would need to develop an understanding of how to equip them to do this in a socially, economically and environmentally viable way. Introducing design-build projects into the curriculum might be one way to achieve this. Giving students the skills to become social entrepreneurs managing their own design-build practices might be another. Saidi writes that architectural education in South Africa

> must seek relevance by training professionals who must be capable of addressing the social and economic ills of the South African society ... a major task is to identify gaps in the curriculum ... and new information will have to be included as a result of new relationships in society ... enabling this new knowledge requires that architectural educators have to change their ways of teaching (Saidi, 2005: 7).

Architectural learning sites in South Africa are already engaging in socially relevant and real hands-on design-build and live projects. However, the question is: is this also changing our professional practice and the scope of what feasible practice is?

The question of what feasible practice is revolves around being socially, environmentally and financially viable. The meaning of financial viability to an architectural practitioner is debatable, and the scope of this debate falls outside this research. The concept of viability should be seen in relation to a global social and environmental consciousness and awareness of the shortcomings of a capitalist society. For the purpose of this explorative window a financially viable social architectural practice is defined as being able to continuously prioritise doing socially relevant work.

4.3.1.1 READING THIS EXPLORATIVE WINDOW

The story of *Change Practice* is contextualised by viewing descriptions of alternative architectural practice and by discussing alternative architectural practice as a form of social entrepreneurship (Kumar & Gupta, 2013; Bernhard & Taylor, 2014) where a conceptual framework for sustainable architectural practice is developed. Conventional professional practice, alternative design-build professional practice, conventional studio and design-build studio are also positioned as activity systems, and design-build professional practices in South Africa are examined.

After the contextualisation, the exploration traces the story of *Change Practice* through a series of activities. The activities commence where the practitioners, at that stage as students, were positioned in the conventional studio, move to where they were participating in their first design-build academic project, then on to where they, still as students, were completely managing their own design-build project. The story ends with them practising as recent graduates in their own professional practice.

The window closes with a discussion that explores the practitioners' journey to gauge how they moved from being students in a conventional-studio system to becoming professional design-build practitioners. The discussion is structured from an activity-theory perspective by looking at changes in values, rules and outcomes, at the development of tools and at an expansive learning cycle. Finally a conceptual framework developed under the discussion of social entrepreneurship is used to position the work of *Change Practice*.

4.3.1.2 ACTIVITY THEORY AS THEORETICAL PERSPECTIVE

Activity theory, and specifically learning by expanding within activity systems, as defined by Engeström (1987), is used as a descriptive theory to focus on the learning of the practitioners in their journey through the series of activities. Learning is an inherent part of an activity (Arnseth, 2008) and activity systems 'reflexively reproduce the individuals, communities, roles and means by which they are productive' (Wortham, 2008: 24). Activity theory allows us to view the underlying operations, tensions, mediation and hierarchy involved in these systems that contribute to the learning experience.

The data collected includes open-ended interviews with the three practitioners (which were coded inductively in Atlas.ti), follow-up clarifying questions, a review of some of *Change Practice*'s documentation, and an in-depth literature study. Morkel and Garraway (in Bozalek *et al.*, 2014) introduced the idea of activity theory to explore the learning of architectural students at different sites of practice, including the conventional studio, the design-build studio and the architectural office. The research in this explorative window builds further on the idea of using activity theory to explore architectural students' learning. The window introduces further activity systems in the landscape of architectural practice and specifically focuses on developing the identity of the architectural practitioner and the development of the alternative architectural practice.

4.3.2 CONTEXT

This section provides a background against which to contextualise the practitioners' journey.

4.3.2.1 VIEWING DEFINITIONS OF ALTERNATIVE ARCHITECTURAL PRACTICE

Internationally, numerous alternative practices have emerged as legitimate professional practices in the past few years. This is in response to changing global economic and social circumstances and through a consciousness of responsibility towards people who are most often called 'the other 90 percent' (Lepik, 2010: 21).

The other 90 per cent refers predominantly to the almost one billion people worldwide who live in informal settlements, often without access to basic infrastructure and in poor living conditions (Smithsonian, 2012).

Alternative architectural practice has been described in the literature in various ways, and some of these descriptions are listed in Table 4.3.1:

	Description of alternative practice as:	**Author**
1	non-traditional forms of practice	Schermer (2001)
2	public interest design	Anderson (2012)
3	social architecture	Tural (2011); Rosenthal (2013)
4	activist architectural practice	Delport-Voulgarelis and Perold (2014)
5	activist architecture	Tural (2011)
6	community* architects	Tovivich (2010)
7	a new professionalism	Tovivich (2009)
8	new architectures of social engagement	Lepik (2010)
9	citizen architect	Douglas (2010)
10	insurgent architect	Harvey in Corser and Gore (2009)
11	public-interest architecture	Fisher in Bell and Wakeford (2008)
12	development practitioners	Hamdi (2010)
13	public architecture	Cary (2010)

Table 4.3.1: Descriptions of alternative architectural practice

The definition of an alternative practice in this explorative window is that of a design-build practice that prioritises empowering architectural services for the under-privileged and marginalised.

Community* work is often viewed as being done as a free service, but some of the recently formed alternative practices are 'redefining the perception of such work from being necessarily pro bono or charity to being a profitable enterprise' (Lepik, 2010: 17). Alternative practice promises to open new avenues for architectural professionals and 'it may eventually become a primary career track for many people' (Fisher in Bell & Wakeford, 2008: 9) and even allow existing practices to 'expand both their the scope and impact' (Anderson, 2012: 274). The question is how these practices can be viable if the client cannot pay for the service.

Image 4.14: Tutors on site: at St Michael's discussing architectural education and professional practice

4.3.2.2 SOCIAL ENTREPRENEURSHIP

To establish a financially sustainable alternative architectural practice one cannot do work on a pro bono basis only. Definitions of social entrepreneurship incorporate the idea of social justice, of being a provider of services with the intention of empowering and improving the lives of the underprivileged community*. Social entrepreneurs also 'aim to produce solutions which are sustainable financially, organizationally, socially and environmentally' (Thake & Zadek in Kumar & Gupta, 2013: 10).

The values of social entrepreneurship and the values of alternative architectural practice are closely intertwined. Tovivich (2010) suggests that in order to be an alternative architectural practitioner one needs to be not only a provider, as one usually is as a conventional architectural practitioner in a service-to-client model (Ripley, Thün & Velikov, 2009), but also a supporter and a catalyst. This role change also suggests a change in identity.

As a provider a conventional practitioner often makes design decisions for the client. Tovivich (2010) explains that the role of provider remains in place in alternative practice, but that in alternative practice the architect also needs to adapt their role and identity to be both a catalyst and a supporter. The 'supporter role involves design and employing the design process as a tool to support community* members to make decisions for themselves, the catalyst role employs the design process as a tool for encouraging community* empowerment' (Tovivich, 2010: 263). These values resonate with Perkes, who attributes the three similar values of 'service, proximity, and experience' (Perkes, 2009: 64) to the alternative architectural practitioner.

Ontologically the values of social entrepreneurship and the values attributed to the alternative practitioner are very similar. Together these values provide a conceptual framework (Table 4.3.2). In this framework the work of Tovivich (2010) and Perkes (2009) address the sustainable social practice, and the definition of social entrepreneurship introduces the aspects of sustainable environmental practice and sustainable financial practice. Without sustainable financial practice neither the social nor environmental practice would be possible. The conceptual framework provides another context for the discussion of the design-build practice in this explorative window.

From an activity-theory perspective the conceptual framework suggests a number of rules for an alternative design-build activity system. These rules are sustainable social practice with the underlying aspects of community* service, community* engagement, community* empowerment and sustainable financial and sustainable environmental practice.

Cuff believes that in 'architectural practice, the reasons why architects act and believe as they do are framed fundamentally by the architectural profession' and that 'practice is the embodiment of professional ethos bound to circumstance' (Cuff, 1991: 20). Is it possible for the value of the profession, that of acting as provider, to adapt in a changing social world? If the values under which the profession operates can change, so can the beliefs and actions.

	Authors				
	Tovivich (2010) New professionalism of community architects	**Perkes** (2009) Alternative practitioner	**Thake and Zadek** (in Kumar & Gupta, 2013) Social entrepreneurship	**Consolidated values/rules for sustainable alternative design-build architectural practice**	
	Values/rules by Tovivich, Perkes, Thake and Zadek				
Conventional practitioner*	Provider*	Service*	Provider of services*	**Sustainable social practice**	Community* service
Alternative practitioner	Supporter (to the community*)	Proximity (to the community*)	Socially sustainable		Community* engagement
	Catalyst (to the community*)	Experience (to the community*)			Community* empowerment
			Environmentally sustainable	**Sustainable environmental practice**	
			Financially sustainable	**Sustainable financial practice**	

Table 4.3.2: Conceptual framework for sustainable alternative architectural practice

4.3.2.3 VARIOUS ACTIVITY SYSTEMS

Juxtaposing conventional professional practice and alternative design-build professional practice as well as conventional studio and design-build studio allows an exploration of the differences and provides further context for reflecting on the story of *Change Practice*.

i CONVENTIONAL PRACTICE AND ALTERNATIVE DESIGN-BUILD PRACTICE

The two practices are compared graphically in Figure 4.3.1 and Figure 4.3.2.

Clear distinctions are drawn between conventional professional architectural practice and the alternative design-build professional practice. Each of these practices has its own participating community and its own objectives, means for mediation, rules, tools and division of labour. Perkes (2009) is of the opinion that the values of a conventional architectural practice, which include business procedures and an interest in profit, can distance the professional from the underprivileged community*, and that it is the inherent values that clearly distinguish alternative architectural practice from conventional architectural practice.

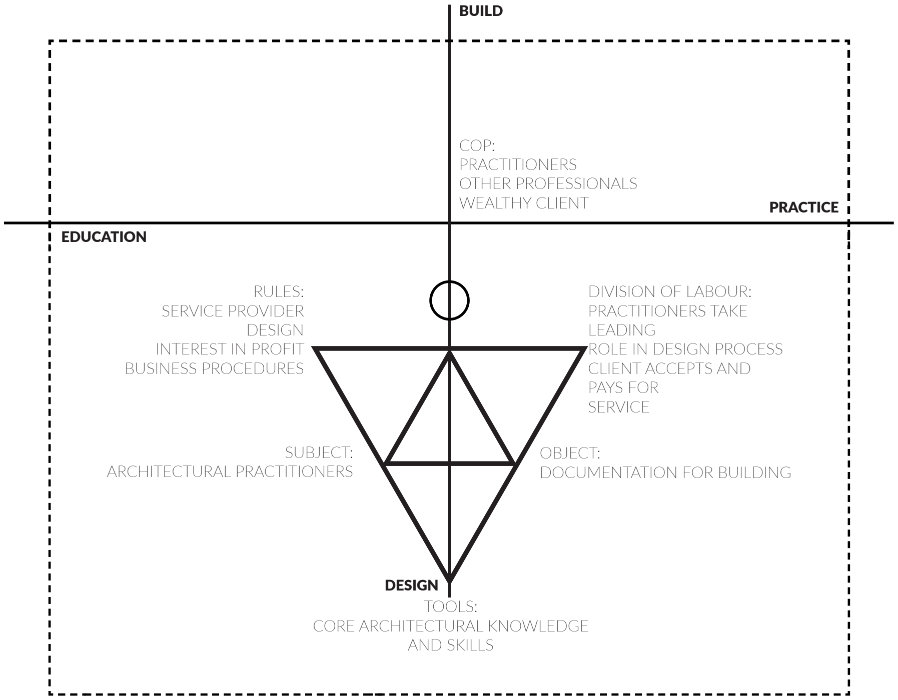


Figure 4.3.1 Conventional architectural practice and alternative design-build architectural practice

In the alternative design-build practice a service is provided to the underprivileged community*. The funder of the project, usually a third party, typically wants to see building progress as fast as possible. This can lead to tension between the practitioner and the funder, as the community* process is not always predictable and clear (Tovivich, 2010). Because community* members do not contribute financially to the project, tensions that could arise between the community* and the professional team include the community* not feeling empowered to demand quality work of the professional service, or not having a choice in the professionals who work for them. Further, if professionals are not adequately remunerated to keep the architectural practice financially sustainable, the project could become a burden. This could lead to the project team possibly changing more than once, which would contribute to the entire process being time consuming .

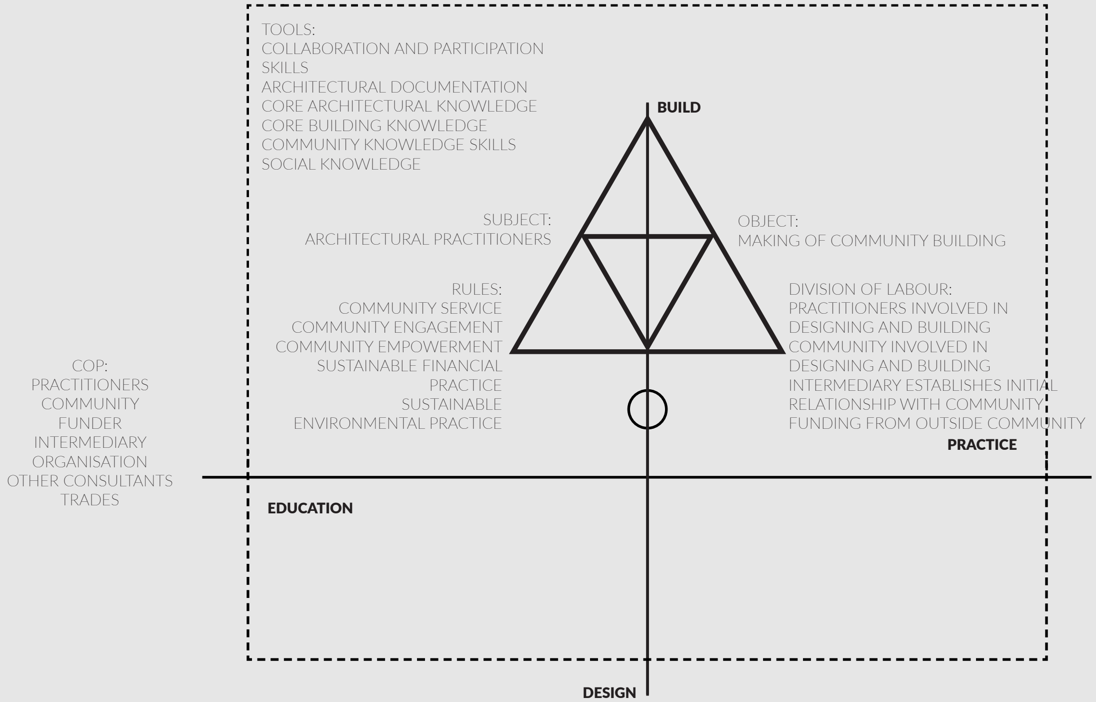


Figure 4.3.2 Conventional architectural practice and alternative design-build architectural practice

In the alternative design-build practice the activity focuses on the physical making of a community* building and the activity is ultimately motivated by making a difference in the underprivileged community*. Designing and building are mostly intertwined in this action, with the practitioners often being involved equally in both. The underprivileged community* can be intimately involved in the designing and the building aspects and has an inherent interest in the realisation of the building. The building has the potential to not only improve the community's* spatial conditions, but also to contribute something beyond the physical building to the community*. The building can both serve and empower the underprivileged community* (Rosenthal, 2013). Empowerment can be in the form of assets provided to the community*, which can include physical capital, human capital, social capital, financial capital and political capital (Wu, 2007).

In the conventional practice the activity focuses on designing a building and producing a set of documentation necessary for approval by the authorities and for the contractor to build the building (Garraway & Morkel in Bozalek *et al.*, 2014). The tools are the architectural and professional knowledge and skills and the physical tools in the office. In order to realise the final building, other professionals need to get involved, like building contractors, quantity surveyors, engineers, etc. The rules in activity theory describe the underlying assumptions that give meaning to the activity. In a conventional practice the rules are the creation of architectural solutions, upholding the design idea and creating a professional practice. The architect acts as a service provider.

The primary motivation in conventional architectural practice is to make a profit and design for a client from an authoritative perspective, often imposing design values. The client is typically financially privileged, has an interest in profit and approaches a professional out of choice and not out of necessity, and therefore has certain demands and expectations. The client most often does not get involved in the designing or building process. During the building stage the architectural practitioners inspect the physical building and instruct the building contractor accordingly. To enable the design of the building the architectural professional has to make certain assumptions of the skills level and competency of the contractor, who must then perform accordingly. The architectural professional has to negotiate predominantly with other professionals who already have an understanding of the tools of the profession.

In addition to the architectural design and documentation that conventional practitioners use, alternative practitioners require the specialised tools of collaborative and participatory design skills to enable community*engagement. These specialised tools are typically lacking in conventional architectural education (Tovivich, 2010). Working closely with the underprivileged community* could reveal various opportunities that could enrich the design and building process. Existing local skills and resources can be identified and incorporated into the design and making of the building. Community* members may be both motivated and eager to learn, but possibly unskilled. For the alternative architectural professional to go through the consultation and education process takes time and gives a whole new perspective to the process of developing a design for a building. Anderson (2012) refers to the need for social knowledge beyond just technical and aesthetic knowledge to solve these complex architectural problems in an inventive manner. In alternative architectural practice, the architect acts not only as service provider, but as supporter and catalyst too.

In both the conventional practice and the design-build practice, the development of the professional and of the professional practice itself is also part of the outcomes of the activity. Without the development of a sustainable professional practice, practices would work on one project and then not have the means to continue with their work.

The table below compares the two practices from an activity-theory perspective.

	Conventional practice	Design-build practice
Object	Documentation for a building	A community building
Outcome	Building for business purposes Building a professional practice	Developing community assets Empowering community Improving spatial conditions Shaping identity of future practitioners
Subjects	Architectural practitioners	Architectural practitioners
Rules/values	Service provider Design Interest in profit Business procedures	Sustainable social practice • Community* service • Community* engagement • Community* empowerment Sustainable financial practice Sustainable environmental practice
Motivation	Competition Achieving marks Becoming the best designer	Making a difference in the community*
Tools	Core architectural knowledge and skills	Core architectural knowledge and skills Collaboration and participation skills Core building knowledge and skills
Community	Practitioners Other professionals Contractor Client that can pay	Practitioners Community Funder Intermediary organisation Other consultants Trades
Division of labour	Practitioners take leading role in design process Client accepts and pays for a service	Practitioners are involved in designing and building Community is involved in designing and building Funding obtained from outside community

Table 4.3.3: Comparison of conventional practice and the alternative design-build practice

ii CONVENTIONAL STUDIO AND DESIGN-BUILD STUDIO

The conventional studio and the design-build studios are graphically compared in Figure 4.3.2 as juxtaposed activity-systems.

> If students investigate society without questioning the position they occupy in doing so, the role of the distanced expert is reinforced rather than questioned (Harriss & Widder, 2014a: 56).

The values of the architectural profession as they are instilled by the conventional education system perpetuate the notion of the individual hero designer 'largely through socialisation and affiliation with peers and faculty in studio' (Bachman & Bachman, 2009: 316). As Jann (2009: 47) puts it, 'too often architectural education establishes a set of remote values which then go to define the profession; these centre on the myth of the architect as individual, male, hero-genius clinging to a set of ideals that are often removed from the concerns of the everyday world'.

For most architectural students the journey starts in the conventional architectural studio. The main activity in the conventional studio is the design of (mostly fictional) buildings in a project-based environment. There are two main outcomes of this activity: the one is physical and involves the presentation of a designed building through graphic means, and the other is the forming of the identity of the future architectural practitioner.

In the conventional studio the relationship between the actual built object and the design process is removed from reality, enforcing the notion of a hands-off approach to actual construction for the soon-to-be conventional practitioner. The tools that students have available are their theoretical knowledge of design and technology, and their representation skills such as model making and drawing. The student is very much a subject on their own, having to adapt to a studio culture that is both lauded (Kuhn, 2001) and criticised (Bachman & Bachman, 2006).

The dominant power relationship in the conventional studio is between the tutor and student, with very little group work. The tutors are viewed as the expert designers and the students follow their lead to become master designers. The rules within which they have to operate are often vague and unclear (Koch, Schwennsen & Dutton, 2002). Group work is most often experienced as preparation work 'with the final design invariably produced and assessed on an individual and competitive basis' (Nicol & Pilling, 2000: 8). Students are motivated by competition, grades and becoming the best designer.

The sense of identity formed during conventional architectural education is that of the provider to the client and that of the knowledgeable expert who provides ideas to the architecturally uneducated client (Tovivich, 2010). The conventional system produces a theoretically strong thinker but not necessarily a practice-ready, collaboration-oriented individual.

In the design-build studio, passion and making a difference motivate learning (Garraway & Morkel in Bozalek *et al*., 2014). The object of the activity is focused on creating an actual built structure for a community*. The activity moves beyond the production of documentation, which is the object of the conventional studio. In the design-build studio the documentation becomes a tool in the design and making process. Maistre and Paré (2004: 45) write that the 'transformation of objects into artifacts (tools), whereby the focus of learning becomes the means of practice' is the critical difference between education and practice and that which often makes transition from academic to applied practice difficult. The design-build studio allows for this transformation. In the design-build studio students get a glimpse of what a professional design-build practice could be like. This includes the authentic application of core architectural skills and an introduction to the values prevalent in design-build practice, which Feuerborn calls the ‘social ethics of professionalism, volunteerism, individual responsibility, and community service (Feuerborn, 2005: 2).

To design and build a structure as a group of students requires active collaboration. Collaboration is one of the most valued aspects of learning and working in the design-build studio. This includes collaboration among students, with other professionals and with the underprivileged community*. Collaboration with the community* allows for communal development of the brief. Anderson (2012) points out that this is different from the conventional studio’s self-generated concepts and it gives students a sense of commitment to the community* and exposes the students’ personal biases and assumptions.

Image 4.15: Design-build constructions: painting a different picture of the conventional studio (at St Michael’s 2)

4.3.2.4 DESIGN-BUILD PRACTICES IN SOUTH AFRICA

It is argued that the purpose of university education in developing countries is to produce graduates who will not only acquire technical skill but also effect broader change in their societies based on critical understanding of the knowledge and the context in which it is generated and organized resulting in a cultural synthesis of the built environment that is unique to and responsive to its context (Saidi, 2005: 8).

Garry Stevens (1995) argues that architectural education is less about educating students for practice, but inculcating them with a professional value system. Brown (2013: 3) writes that the 'live project[2] offers educators and students an opportunity to become aware of and even subvert the influence of the conventional value systems'. Denicke-Polcher and Khonsari (in Harriss & Widder, 2014b: 22) furthermore say that live projects allow students to reconsider 'the traditional role of the architect as a service provider'. It seems that architectural education could provide a place to teach alternative values, but where would students practise these alternative values?

There are few, if any, design-build professional architectural practices in South Africa where graduates can apply to do their in-service training. Introducing design-build projects in the architectural curriculum may challenge students' existing perceptions of professional practice, but what happens when they leave university for the conventional workplace? Maistre and Paré (2004) posit that young professionals as new entrants to the workplace are vulnerable, tend to become conservative and will not easily suggest radical change. Once in conventional architectural practice, would young architectural professionals be able to introduce any of their social design-build ideas and ideals?

[2]'Live projects' is a broad term for projects where students engage with real clients. Design-build projects are a type of live project, but with a specific built outcome.

4.3.3 THE STORY OF A PRACTICE

Change Practice has three partners. We view these three practitioners (S1, S2, S3[3]) as the subjects in the different activities that we follow chronologically in their story. All three practitioners are young, white males in their early twenties. Both S1 and S2 have a history of growing up around the making of buildings.

> My dad's a carpenter, my uncle's a welder. I've got other uncles that are engineers ... I've been on site since I was very small (S1).

The three of them started their studies together in 2007. After their third year, S3 took a break and worked for a large international firm in Europe, getting a completely different exposure to the architectural profession from that of S1 and S2, who became involved in design-build projects during that time. After they had completed their master's degree studies at university, S1 and S2 asked S3 to join them in starting *Change Practice*. The three had previously worked well together in their undergraduate years and thought that their different skills would complement one other.

4.3.3.1 STARTING IN THE CONVENTIONAL STUDIO

The practitioners' first two years in architectural school were spent in very conventional studio environments, very much as described in Section 2.3.2. All three of them had commenced their studies with the idea of one day working in the corporate world in a conventional architectural practice.

[3]Quotes are verbatim for S1 and translated from Afrikaans to English for S2 and S3.

4.3.3.2 THE FIRST DESIGN-BUILD STUDENT PROJECT, THE AFDAK[4]

During S1 and S2's third year of study they both took part in a community* project in a neighbouring country. At first they were really reluctant to even go on this trip. But, after having been persuaded by their lecturers, they went along. There they met with the community*, the funder and a man named Guy[5]. They ended up building, together with the community*, their lecturers and Guy, 'a very ridiculous project' (S1).

> We built a roof, an afdak, and it was quite interesting to see how that little afdak changed the whole space of the clubhouse and everybody and that's where it started … while we were there, I mean, it made a big impact on us and we decided round about then to start Change Practice, to start building things, to start to actually make a difference (S1).

S1 and S2 initiated a further trip to the same site in their fourth year, and most of the class then went along and built an ablution block. In his master's-degree year S1 used the same community* site for his thesis, starting out with the intention of actually building the proposal, but ending up only testing full-scale construction prototypes of regional bamboo.

[4]An afdak is the Afrikaans term for a lean-to roof.
[5]Guy is a nom de plume.

4.3.3.3 MANAGING THEIR OWN DESIGN-BUILD PROJECT, THE BLT BUILDING[6]

In their fourth year S1 and S2 designed and built the blt building in a township in their city. The two of them were approached by an NGO to help with this community* initiative. They became involved with the project through their passion for community* work. They designed and physically built, with the exception of the foundations and the concrete floor, a small community* building that served as an entrepreneurial hub. They involved the community* intensively in the making of the building. Some of their fellow students helped out as well. This was the first time S1 and S2 worked with lightweight steel construction, which now features prominently in the work *Change Practice* does. The blt building was executed independently of the university and the design and building work were done completely pro bono.

Although this work was parallel to their studies, time consuming and very stressful for that reason, both of them commented that this project was really the first project of *Change Practice*.

The blt building is for me a personal initiation to *Change Practice* (S2).
To be honest, I don't think if S2 and myself didn't do this project we would be where we are today (S1).

After this community* building, one of the funders involved also involved the two of them in working on a children's home in another township nearby.

[6]blt is a nom de plume.

4.3.3.4 GRADUATED PRACTITIONERS IN THEIR OWN PROFESSIONAL PRACTICE

At the beginning of 2013 the three subjects started *Change Practice* together under the mentorship of an architect. *Change Practice* was founded as a private company and it has a community*, a manufacturing and a corporate side. *Change Practice* gets involved in the whole range of architectural services.

> We decided to break the company into two sections to have the corporate side and then the NGO or the community based side. So that we can still obviously make enough money with the corporate side and survive … we did it on purpose, we did. Otherwise we'd never survive; we'd all be starving somewhere (S1).

Change Practice relies on working with intermediary organisations to secure funding and often works with corporate social responsibility funds. This is one reason they opted to be a private company and not an NGO. They prefer to concentrate on their core skills that involve the architectural side of design and making, and to leave the fundraising to a third party.

Change Practice also prefers to work in communities* through an intermediary, an organisation, sometimes an NGO, that already has an established relationship with the community* concerned. *Change Practice* forms part of the community* discussions from the beginning stages of a project, involves and trains the community* during the process and forms long-lasting relationships with the community*.

> After the blt building everything made a bit more sense to me, the process of building, construction and design, but also the process of having a third party involved that can handle the funding and oneself can concentrate on the other (i.e. your own skills) (S2).

The technology and conceptual reasoning that they employ in their social work have also influenced their commercial work. They have used light steel construction in a number of their social projects. This they can manufacture beforehand and then assemble on site, which leads to the possibility of building incrementally in larger-scale projects. Their way of working and their knowledge of this type of building method in social work have won them some corporate work ahead of more conventional architectural firms.

4.3.4 DISCUSSION

> Within an activity, the events that occur and the consequences the participants experience can qualitatively change the participant, his/her goals and motives for participation, the environment, and the activity itself (Yamagata-Lynch, 2010: 21).

The subjects had entered university with the idea of working for and ultimately having their own high-end commercial practices. How then did these young practitioners opt for a different kind of practice? How did they become social entrepreneurs in an architectural design-build practice?

It seems that their initial perceptions of what practise entails was altered through a series of experiences. In this discussion these experiences are viewed through the lens of activity theory. The discussion focuses on the role of the community and the tutors in changing the values, rules and outcomes and the accompanying idea of learning by expanding. 'In an expansive learning cycle, the initial simple idea is transformed into a complex object, into a new form of practice' (Engeström, 1987: 11). Finally the link to the conceptual framework is discussed.

The subjects went through a learning cycle of induction into pressing social issues and social design-build projects. This learning cycle influenced a change in their perception of the impact, possibilities and motivation of professional architectural practice and equipped them with the confidence and agency to start their own alternative design-build practice. What started out during their education as making for the community became the making of a professional practice so that they could continue making for the community.

In describing their story we saw the subjects moving through a series of activity systems. They started their journey in the first activity system, the conventional architectural studio. They were then introduced by their university to design-build projects, and later – still as students – they managed their own design-build project independently of the university. After completing their studies they started their own design-build professional practice. The object of these activity systems changed from producing representational documentation on fictional buildings in the conventional studio to producing real buildings for the community in the design-build activities. As the original object became a mediating tool in the design-build activity system, the rest of the activity also adapted.

The most significant adaption was the change in the values and rules of the system, as some of the rules and values in the conventional system directly contradicted the rules and values in the design-build system. Tovivich writes that

> the most important barrier is the values of architectural insiders – architects, architectural educators and students – who often perceive slums [the underprivileged community*] negatively or as irrelevant to architectural practice … considering values, conventional architectural education focuses on the provider role of architects who design to control the client and the environment
> (Tovivich, 2010: 269, my insertion).

What changed these values and rules? Was it simply the design-build community experience the young students had? What role did the tutors play? And did the young students need new tools to negotiate within this activity system?

4.3.4.1 CHANGES IN VALUES, RULES AND OUTCOME

It is actually neither the building nor the technical detailing, nothing to do with construction … the only way that you find that passion is through that first project … how you actually see what difference it can make (S3).

Image 4.16: Alternative architectural education: wearing a different hat (at St Michael's 1)

i THE ROLE OF THE COMMUNITY* IN CHANGING VALUES, RULES AND OUTCOMES

As young students our subjects' initial perceptions of architectural practice were influenced by the values of the conventional studio, which is the dominant identity of individual provider, with the design outcome as the ultimate underpinning. They were then introduced to community* work in their first design-build project. They started working collaboratively with each other and with the community*. S1 reflected that this project taught him to engage with the client, who in this instance was the community*, and to not 'just force your ideas as an architect onto someone else' (S1). S2 mentioned that he realised in this project that one cannot keep on ignoring informality and poverty and that finding solutions is not the responsibility of the government only. S2 also stated that during this first project he realised that 'providing a sense of ownership (to the community*) is a bigger outcome than the building itself'.

Once they started working with the community* their focus shifted from the building as the end product to the building as a catalyst for the community*. S1 commented on being able to see the difference that the afdak had made to the community* and to the space it created. This was the first time he could personally see a physical design making a social change. This rather small reality was changing his perceptions. The rules for making a community* building were becoming a little clearer in the afdak project. The subjects needed to meet a real deadline and change the quality of the lives of others with a building intervention. The rules now included a collaborative urgency, not just an individual pursuit of design, it was now more 'we need to get this built, this is the time frame and the budget, our clients are real people with real needs' (S1). The first design-build encounter made such a significant impression on them that during the project they were already thinking of starting *Change Practice*.

ii THE ROLE OF THE TUTORS IN CHANGING VALUES, RULES AND OUTCOMES

> If it wasn't for the lecturers [tutors] we wouldn't, we wouldn't be here (S1, my insertion).

In the conventional studio the tutor has a significant amount of power, being an instructor and design mentor to individual students. In the design-build project academic power still exists. However, the power shifts to become the power of introducing students to alternative practice, of suggesting a change in professional values. All three subjects mentioned that the tutors had been instrumental in their (the subjects') decision to pursue a professional path away from the conventional. S3 believed that the tutors had pushed a specific agenda to get students out of their comfort zones. And S2 openly said that he had been reluctant at first, being naïve and feeling pushed into an uncomfortable situation. But he added that 'you need that push, most of the time you have preconceived notions about places' (S2). S1 acknowledged that he almost had to be forced to go on his first community* project. All the subjects expressed gratitude at having been given the opportunity and experience to do design-build community* work.

The subjects were also able to experience the tutors on a more equal footing as they started working together physically (S1). This changed relationship gave the subjects the confidence to ask the tutors to go back to their first design-build project after a year to do a further built project. The students felt empowered to start pushing for changes within the academic structure. They were now working towards a different outcome, not just the completion of representational documentation for a fictional building, but a real building that impacted on people's lives.

4.3.4.2 DEVELOPING NEW TOOLS

To negotiate within the changed values and rules, the subjects needed new tools. The major tool they had brought from their academic background was the object of the conventional studio, which was their knowledge and skills to design and use representational means to communicate the design of buildings. What they had learned in the conventional studio was now applied to facilitate and negotiate within a real situation.

However, they would need to develop further new tools to communicate with the community* and also collaborate with one another. They would need hands-on building and project-management skills. S1 and S2's history prior to tertiary education provided them with hands-on skills that proved valuable to their design-build activities both in and out of university. In working with very small budgets they would need to develop funding and source-finding skills.

In the first design-build project, the afdak building, their tutors accompanied and assisted the subjects and they met Guy on site. He had a lot of knowledge about the local community* and about physical building. Through direct exposure the subjects were able to learn through observation as well as participation, and developed new skills and knowledge while they were supported by more experienced others.

However, when they were involved in the blt building, they were completely on their own. The facilitating and supporting role that tutors had played in the previous system was no longer there. The two subjects were now the only architectural practitioners responsible for designing and making the blt building. Their responsibility became much greater than with the afdak building. They needed to negotiate all aspects of the making of the building: the funding, liaising with and training the community, managing the entire building process. They had to learn quickly how to negotiate and mediate within this activity system. Their learning here was necessitated by direct need and they had to adapt as they negotiated through the process. This possibly led to an accelerated understanding of the design-build process. Being intimately involved, taking responsibility for not only the built object but also for the accompanying participation of the community helped them to develop tools to mediate this activity system.

The absence of the tutors from the community of the activity system was rather significant. It is presumably because the tutors were not there to support and provide assurance that these subjects were able to gain the necessary confidence and tools.

4.3.4.3 AN EXPANSIVE LEARNING CYCLE

None of the subjects commenced their studies with the intention of doing social upliftment work. Upon leaving the university these young practitioners-in-training opted to start their own small professional practice under the mentorship of a professional architect. Although they had all worked in large offices as part of their in-service training, their design-build experiences during their education prompted them to create a professional practice that would invest in the making of social architecture.

These subjects moved in relatively quick succession from being supported in an educational activity system to being completely on their own, having to act as professionals with little previous experience. The most powerful relationship in the blt building was with the community*, and their biggest responsibility was to complete a useful building for the community*. Instead of being single subjects focused on individual creativity in the conventional studio, they were now working collaboratively towards the same object.

This journey provided them with both material and conceptual tools. They learned, among other things, about physical building, managing finances and communication, and they grew in confidence. They were also present in more than one activity system at a time, being immersed in a design-build project with a huge responsibility to the community*, and being students studying in a more conventional studio setting. Through their experience of the different systems they developed a broader understanding of the contradictions between the individuality and more commercial values of the conventional studio and the collaborative and socially oriented values of the design-build studio. The scope of their architectural knowledge and the possibilities of professional practice were expanded. This expanded knowledge provided them with a broader basis from which to make decisions about their future. They were now aware that there are alternative options to conventional professional practice.

The three practitioners deliberately chose to set up the structure of *Change Practice* not as a non-profit organisation but as a private company in order to have both a social side and a corporate side. This allows them to transfer money and knowledge between the two sides and to survive financially. They realised that it was not possible to work pro bono as they did when they were students and created the blt building.

They also chose to engage with the community* through intermediary parties that had already established relationships with the community*. They were clear about their own role in the relationship with others within this activity system. They chose to concentrate on their core skills and engaged with others collaboratively to reach the outcome of contributing to the community*.

4.3.4.4 LINK TO THE CONCEPTUAL FRAMEWORK FOR SUSTAINABLE ALTERNATIVE ARCHITECTURAL PRACTICE

The three practitioners were essentially acting as social entrepreneurs. The conceptual framework developed in Section 2.2 provides rules for alternative architectural practice. Table 4.3.4 illustrates the rules and how *Change Practice* corresponds to the rules.

The conceptual framework does not provide specific rules for design-build practice. The rules for design-build practice are well established in the literature and can be found in the broader research in which this explorative window is situated.

			How *Change Practice* corresponds
RULES	**Sustainable social practice**	Community* service	Provides an architectural service to the community*
		Community* engagement	Engages the community* in the design and making of the building
		Community* empowerment	Builds knowledge and skills in the community*
	Sustainable environmental practice		Uses local resources and sustainable building practice
	Sustainable financial practice		Created the practice to sustain itself with parallel commercial work and develops relationships with funders for funding community* work

Table 4.3.4: How *Change Practice* corresponds to the rules of the conceptual framework for sustainable alternative architectural practice

4.3.5 SUMMARY

I think the blt building had a bigger impact on me than just an academic project. It is when the project is done and you see the people that gain from this project. I think that is when you really have a mind shift change. Where on academic level you never see that you physically mean something to somebody else. You never see or get that, satisfaction, from the process. So in that regard I think it is very important that, somewhere in your academic career, you do a complete little building, and you can actually see, well, this person that you did it for is really appreciative for what you did with your talents. I think it is rather an ethical decision that people will make about what direction they take, what they will do after they completed their studies. If you get that feeling, wow, that you can actually do more with your talents than just drawing houses or something (S2).

Is it possible to alter the perceptions of students, of young would-be practitioners? According to our three subjects they would not have reached their destination if it had not been for their introduction to community* design-build work while studying. Could it be that through this simple process of making students aware, introducing them to and then letting them manage their own design-build project, these students can develop the knowledge, skills and values to pursue alternative architectural practice?

What we do know is that it seems that the subjects' perceptions changed, they learned through experience and were determined and confident enough to start their own socially oriented design-build architectural practice. But would any other young students follow the same path after the same experiences?

I think it happens often that you have an idea or a dream whilst you are still studying of what you want to do with your career as an architect, and then obviously most students end up working for somebody and they then get out of there with a strong influence of the place they worked at ... I do not believe that is a bad thing, but I am scared the idea of *Change Practice* will vanish once you do that (S3).

Although the perceptions of the subjects in this explorative window changed and they were able to adapt from working individually to working collaboratively and to essentially develop into social entrepreneurs, this was not necessarily the outcome envisioned by their tutors when they introduced the afdak building to their students. Perhaps the object in the academic design-build activity system should become the creation of social architects, and the current object of making a community* building should become the tool in the activity. As Tovivich says,

> the building is not the end of the process ... [the building is] used merely as a tool for empowerment in personal, relation and collective dimensions
> (Tovivich, 2010: 268, my insertion).

Knowing whether similar experiences will lead to similar results will only be possible after these observations have been used to introduce similar experiences to other students. *Change Practice* shows that it is possible establish an alternative design-build practice.

This leads to a number of other questions:

- How can a new set of tools that includes participatory design skills, collaboration skills, understanding of business and funding structures, social communication skills, management and hands-on building skills be formally introduced into the architectural curriculum?
- How does a design-build practice relate to the legislation of the South African Council for the Architectural Profession? Is this opening up a new field of practice that would require specific competencies and recognition with a new kind of professional status?
- Should specific schools focus on this type of work? Should it completely replace the conventional studio? What should the balance be between the alternative design-build studio and the conventional studio?

The outcome of social architecture is measured not in the service of providing the building itself, but in the wider contribution that it makes to the community*.

If architecture is going to nudge, cajole, and inspire a community or to challenge the status quo into making responsible environmental and social-structural changes now and in the future, it will take the 'subversive leadership' of academics and practitioners to keep reminding the students of architecture that theory and practice are not only interwoven with one's culture but have a responsibility for shaping the environment, breaking up social complacency, and challenging the power of the status quo (Mockbee in Dean, 2001: 2).

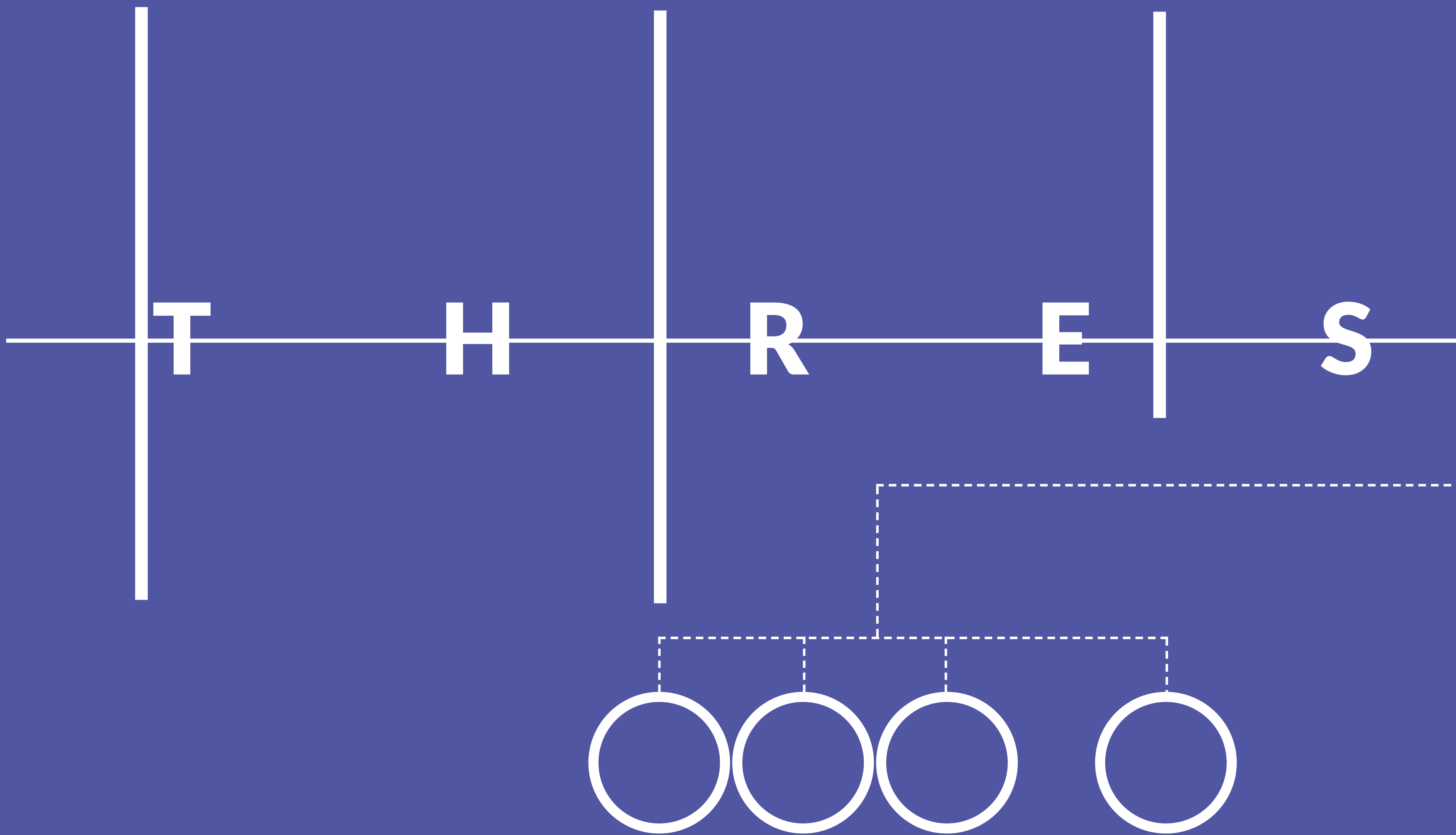
Academics in architectural education should take the opportunity to consider what impact the introduction of design-build projects into the curriculum will have on the development of young students. They should consider the possibilities this introduction holds for professional practice. The opportunity exists to provide students with the necessary knowledge and skills to have the confidence to establish sustainable design-build alternative professional practices.

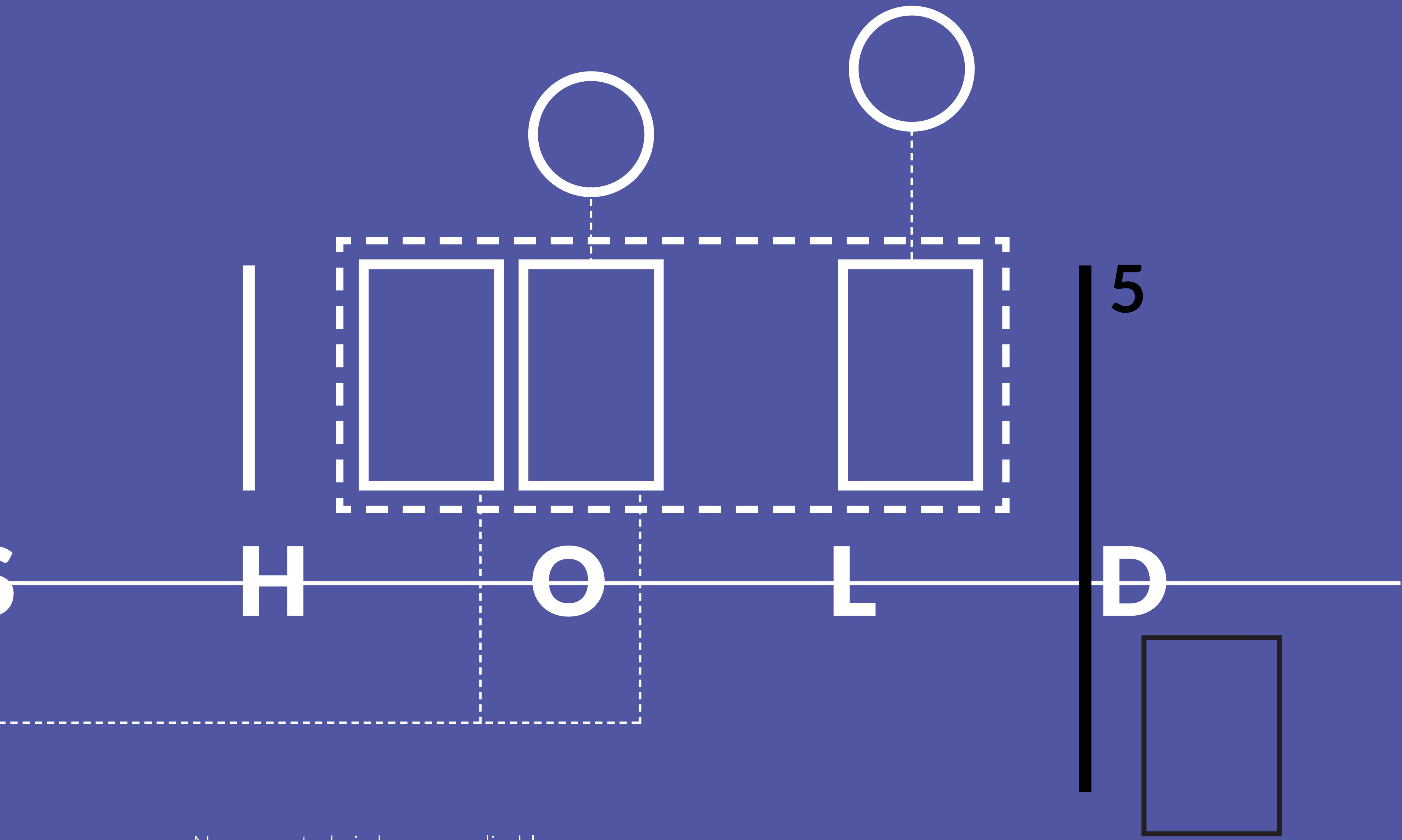
CLOSING THE WINDOWS

Looking back at this project from an architectural point of view I have come to realize that we as future workers in the architectural industry not only have the ability, we should make it our priority to bring about positive change not only in communities* but also toward the environment by applying appropriate use of materials in the structures that we design and built ... I am so proud to have been associated with this project (12_36).

Chapter 4 presented three explorative windows. Window 1 explored collaboration as pedagogical construct in design-build projects and proposed three types of collaboration that are situated in design-build projects. These are collaborative learning, collaborative design and collaborative construction. A conceptual framework was proposed, with tools and rules that can be used to evaluate or conceptualise collaboration in design-build projects. Window 2 explored the five design-build constructions. The conceptual framework proposed in window 1 was used to review the data and it indicated that there were inherent instances of collaboration within the design-build constructions. The conclusion was drawn that design-build constructions and the physical space they occupy provide a receptive environment for collaboration.

Window 3 explored the story of how three young architectural students moved from the conventional studio to become design-build practitioners focused on making a difference in the community*. Their story shared the possibility that exists for perceptions to change. Their story also presented aspects of social entrepreneurship and opened up a number of questions. The introduction of design-build projects into the architectural curriculum has opened up the potential for an alternative type of professional practice. Students should be equipped with the knowledge and skills to sustainably develop such professional practices.


T H R E S



Newacceptedwisdomgeneralisable
useful (after Bachman: 2010).

CHAPTER 5
OCCUPATION

And design is also a form of mapping – a kind of cultural anthropology of the present that, rather than producing hierarchical or goal-oriented knowledge, is process-oriented, ongoing and always incomplete
(Vowles in Nicol & Pilling, 2000: 260).

This chapter represents not the end, but a slight pause in my journey, the culmination of a specific exploration, the crossing of some boundaries in a landscape of architectural practices. I immersed myself physically and mentally in the research process. The premise of design-build projects is learning-by-making or, phrased more theoretically, design-build projects are underpinned by constructionism. Constructionism and a somewhat inverted design process influenced the research design, data collection, methodology and also the construction of this final thesis document.

The chapter commences with an introduction that reminds the reader of the research questions and of what I set out to achieve. The introduction is followed by a reflection on the research journey and method. The contribution to the architectural knowledge landscape follows and the chapter closes with recommendations for practice and future research.

5.1 INTRODUCTION TO OCCUPATION AND HANDOVER

This thesis set out to explore design-build projects in architectural education. The questions that mapped the way for the research were:

1. What are the unique educational opportunities and possibilities present in the design-build project?

AND

2. How do these unique opportunities and possibilities potentially inform

i The development of future design-build projects and the broader architectural curriculum?

ii Professional architectural practice?

5.1.1 BACKGROUND

The relevance of the thesis resides in its aim to investigate the unique educational opportunities of design-build projects and the possibilities that design-build projects hold for professional practice. There is a need to explore design-build as a 'distinct pedagogic practice' (Cavanagh, Hartig & Palleroni, 2014: 6) and to grow 'the scope of professional architectural practice' (Tovivich, 2010: 300). The significance of the thesis lies in its contribution to architectural pedagogy by focusing on collaboration as a pedagogical tool and by exploring an educational journey to design-build professional practice.

Design-build projects in architectural education provide an alternative teaching and learning approach to the conventional architectural studio and are located on several boundaries in the landscape of architectural practices. Internationally there has been a growing emphasis (Canizaro, 2012; Abdullah, 2014b; Cavanagh *et al.*, 2014) on theoretically investigating design-build projects beyond their practice-ready (Erdman, Weddle & Mical, 2002; Harriss, 2012: 7) value. In this thesis, design-build projects are defined as inhabitable full-scale investigations (Christenson & Srivastava, 2005). Most of these educational design-build projects are completed in disadvantaged communities*. Group work and collaboration (Cavanagh *et al.*, 2014) are part of the organisational structure of the projects and are in direct contrast to the individual experience (Jann, 2009) of the conventional studio. However, architectural educators themselves have very little if any training in how to facilitate successful group work or collaboration (Tucker & Abbasi, 2012). Exploring and understanding collaboration can assist architectural educators in designing and developing this pedagogical construct in future design-build projects.

In this thesis 'community' is used to refer to predominantly underprivileged communities in South Africa that do not have the financial means to afford architectural services. Where only the word 'community' is used, it is used to refer to a concept within activity theory that refers to all role players taking part in an activity.

Design-build constructions introduce students to knowledge and skills that they would not gain in the conventional architectural studio (Canizaro, 2012; Abdullah, 2014b). Exposure to design-build projects also has the power to change students' perceptions of what professional architectural practice can be. In South Africa, like in most of the world, the architectural profession is often seen as exclusionary (Cuff, 1991) and set to serve a minority of very affluent people. Architectural services could contribute to improving the living conditions of people who are economically marginalised and disadvantaged. However, these people typically cannot afford architectural services. Internationally there is a movement towards a new kind of architectural professionalism (Tovivich, 2010) that can serve communities* in need. In this research such an alternative design-build practice in South Africa is explored to learn lessons for design-build education and practice from the journey of the practitioners who started the practice.

5.1.2 RESEARCH JOURNEY

The research journey had two main sections, which are reflected in the physical document. The first is an 'expansive analytical and creative philosophical' (Bachman, 2010: 471) section, after which a threshold is crossed to a 'strategic synthetic' and 'generative methodical' (Bachman, 2010: 471) section. In the first section the research clarity of method and process were explored. The research process was influenced by the architectural design process, which was reviewed from the perspective of Bachman (2010) and Hamdi (2011). Principles of educational design research (Van den Akker *et al.*, 2007) were incorporated in conceptualising the process and design of the design-build constructions. The first section of the research contained four design-build constructions as data elements, and also a literature study. The exploration in section 1 led to two midpoint proposals at the threshold positioned between section 1 and section 2. In the second section of the research these two midpoint proposals were further explored in a fifth design-build construction, through an interview with three practitioners and finally by opening three windows onto collaboration and professional design-build practice.

To make the organisation of the physical document clear, the four chapters and the threshold preceding Chapter 5 are outlined below:

Chapter 1 introduced the foundation for the rationale, aim and focus, contextualised design-build as maker culture and as boundary activity, positioned the research paradigm and explained the activity theory as a heuristic framework for the research.

Chapter 2 presented the blueprint for the research process. I applied the principles of constructionism (Papert & Harel, 1991) that are inherent in design-build projects to my research process and immersed myself physically in five design-build constructions. Chapter 2 also presented the research design, data elements (the five design-build constructions and an interview with the practitioners of a design-build professional practice), research methods (the graphic development of the document, the literature study, the threshold and the three explorative windows), and lastly the limitations and the delimitations of the study.

Chapter 3 positioned the research in the literature. The literature study served several purposes. It became context, rationale and data that informed both the midpoint proposals at the threshold in the research. It explored current design-build definitions and proposed six design-build typologies; it introduced activity theory to study the literature. Activity theory helped me to understand the tensions and contradictions in and between activity systems in the architectural landscape and specifically between the design-build activity system and the conventional studio activity system. Through activity theory, collaboration was highlighted as a tool and a rule and as inherently situated in the negotiation within the design-build activity system.

The threshold was part reflection and part rationale. It made two midpoint propositions that were developed during the first section of the research journey. The propositions were developed from the literature study and the preliminary analysis of the data of the first four constructions. The two midpoint propositions were that collaboration as pedagogical concept should be further explored and that the link with professional design-build practice should be further explored. Collaboration was identified as significant since it is mentioned in most literature about design-build projects and was exposed by activity theory as an important construct in the design-build activity system. However, collaboration has not been explored in depth as pedagogical concept in design-build projects. Collaboration was addressed in explorative window 1 and explorative window 2 of Chapter 4.

On the other hand, the link that design-build educational projects have with design-build professional practice is not addressed in the literature at all. This gap in the literature led to further questions. What happens to students after they have experienced alternative practice at educational level and then have to enter conventional architectural practice? Are there any professional alternatives? The link with professional practice was addressed in explorative window 3 of Chapter 4.

Chapter 4 presented three explorative windows.

- Window 1 explored collaboration as a pedagogic tool, defined three collaborative typologies within the design-build activity system, proposed three design-build project stages and three design-build project physical settings. Lastly, an evaluative conceptual framework of rules and tools with which to explore collaboration in design-build constructions was presented in window 1.
- In explorative window 2 the conceptual framework presented in window 1 was used to explore collaboration in the five design-build constructions that were part of this research. Inherent instances of collaboration and the rules and tools that support collaboration were identified within the design-build constructions.
- In explorative window 3 social entrepreneurship, alternative architectural practice and the story of three design-build practitioners were explored. A conceptual framework that relates the values of social entrepreneurship and of alternative architectural practice was proposed.

These three practitioners were introduced to design-build projects while studying at university. Through a series of expansive learning cycles they continued to experience design-build projects and then established their own professional design-build practice. Their series of experiences can serve as an informant for educationally contributing to the development of future design-build practitioners.

The research journey culminates here, in Chapter 5, with the handover of the research and an invitation to the occupation of new knowledge and recommendations.

5.2 REFLECTION ON THE RESEARCH JOURNEY AND METHOD

The approach of immersing myself physically in the research process implies a very subjective viewpoint. I tried to acknowledge this subjectivism rather than aiming to achieve an objective point of view. I found it significant that I could experience design-build projects from the same perspective that a student would. My experiences of and reflections on the design-build constructions resonated with the many accounts by other academics who have participated in similar projects. To me this resonance confirmed the validity of my own experience and implied that I had developed the stance of a design-build academic and that I understood enough of the physical activity to explore the deeper pedagogical and theoretical constructs.

The five design-build constructions included in the research journey allowed me to experience a variety of different approaches to the development of the projects in terms of student participation, design methodology and integration into the curriculum. However, five constructions resulted in complex and extensive data. The extent of the data did prove useful in confirming emerging patterns. Acting as participant observer within the design-build constructions that were also part of my academic workload proved challenging. I had to assess students and generate grades while at the same time observing, taking notes and helping with the physical building of the project. In the Hangberg construction I tried to remove myself more from the academic and participatory role and take on a more observant role, which allowed more time on site for semi-structured interviews with the participants.

The threshold indicated that collaboration and the link to professional practice should be explored further. The five design-build constructions and the literature provided the data for studying collaboration. The link with professional practice was studied through the exploration of *Change Practice*[1]. The interview with the practitioners was not originally part of the research design but was included when the idea was developed in the threshold. Interestingly enough, *Change Practice* was established in the same year in which I started this research journey. Also, during the same time, international interest in design-build as practice, both in education and professional practice, has spiked sharply. It seems that the current world context, the distance between rich and poor and the economic uncertainty are influencing both architectural practice and education. The decision to interview the three practitioners allowed me a glimpse into the development and possibilities of an alternative type of design-build professional architectural practice. Only one practice was explored as they were found to be the only practice in South Africa that deliberately started from the perspective of doing design-build work and making a social contribution. One practice is a very limited example to work from and whether the lessons learned from their journey can be transferred to design-build education and other professional practices requires further research.

Two fundamental rules were proposed in the design-build activity system (Chapter 3, section 3.4.2). These are construction at full-scale and community engagement. I chose not to focus on these two rules in this research. Construction at full-scale and the impact that it has on conceptual design, the technological development, the student and project process and the administration, among other aspects, have been well covered in the literature presented in the literature study in Chapter 3. Although the contribution to the community* is part of the motivation for the design-build activity system, interaction with the community* is a research area on its own. Internationally, Hamdi (2010), Tovivich (2010) and Schwartz, Morthland and McDonald (2014), and locally, Osman and Bennett (2013) and Combrinck (2015) are doing important work in community participation.

[1]Change Practice is a nom de plume.

5.3 CONTRIBUTION OF THIS STUDY

The contribution of this explorative research is the conceptualisation of theoretical, pedagogic and practice constructs that have the potential to inform future design-build educational projects, research and professional practice. The most significant contributions are highlighted in this section.

5.3.1 DESIGN-BUILD TYPOLOGIES FROM LITERATURE WERE CONSOLIDATED AND EXPANDED

Six design-build typologies were proposed in Chapter 3. Various definitions of design-build projects were reviewed. There is still some confusion in the literature between design-build projects and live projects. The difference is mainly that design-build projects always work towards a full-scale physical outcome, where live projects could have other architectural outcomes. Design-build projects are predominantly defined descriptively, with the inclusion of the idea of designing and building at real scale. Some more comprehensive attempts have been made at categorising and defining design-build projects (Abdullah, 2014b; Hartig, 2014; Taylor, 2014). Christenson and Srivastava (2005, 2016) proposed four more theoretically defined definitions. From the literature (Chi, 2002; Fisher in Mackay-Lyons & Buchanan, 2008; Foote, 2012) I proposed two more definitions to arrive at six design-build typologies.

These typologies are:

- Experimental full-scale investigations
- Inhabitable experimental full-scale investigations
- Prototypical experimental full-scale investigations
- Generative experimental full-scale investigations
- Explorative experimental full-scale investigations
- Programmatic experimental full-scale investigations

In the current literature very little differentiation exists between different types of design-build projects when projects are explained and described. Having a range of typologies could allow for the theoretical development of each of these typologies and it could be linked with a theoretical understanding and development of the architectural curriculum and of design-build projects.

5.3.2 ACTIVITY THEORY AS A FRAMEWORK TO STUDY DESIGN-BUILD PROJECTS

Activity theory (Engeström, 1987, 2000; Yamagata-Lynch, 2010) was introduced as a heuristic framework in this research. Activity theory views complex social situations and interactions in context and takes into account history and culture. In activity theory and within activity systems the activity is object-oriented, there is a subject (singular or collective) who acts within rules (norms or values) and negotiates and mediates the activity with the assistance of tools (theoretical or physical). In this thesis the perspective shifts between the academic, the students and the design-build practitioner as subjects.

The use of activity theory in this research was influenced by a small-scale study on different sites of practice of architectural technology students by Garraway and Morkel (in Bozalek, *et al*., 2014). One of the sites of practice was a design-build project. The Garraway and Morkel research and this thesis are, as far as I am aware, the only research using activity theory to study design-build projects. As a contribution to the field I believe that the introduction of the various activity systems and the manner in which the activity theory is graphically presented will find resonance with other design-build researchers, who can in future use this as a theoretical basis. How activity theory contributed to the exploration is described below by referring to each section of the research document.

5.3.2.1
IN THE LITERATURE REVIEW

Activity theory highlighted the contradictions and tensions between the design-build studio activity system and the conventional-studio activity system. The motivation within the systems also distinguishes the design-build activity system from the conventional-studio activity system. In the literature review collaboration was positioned as both rule and pedagogic tool in the design-build activity system, and as inherent in the negotiations and mediations within the system. Collaboration as a pedagogic tool could inform the design and development of design-build constructions and the considered inclusion of collaboration.

Activity theory indicated that the object in the conventional studio, representational documentation, becomes a tool in the design-build studio. This change from object to tool allows the externalisation of theoretical knowledge in a realistic and practical setting – not only in terms of the making of architecture but also in the real relationships created with the community* and fellow practitioners.

5.3.2.2
IN EXPLORATIVE WINDOW 1

Activity theory provided a perspective to view cooperative and collaborative principles from the literature as rules and tools and to explore the development of a conceptual collaborative framework.

5.3.2.3
IN EXPLORATIVE WINDOW 2

A common goal was highlighted as an inherent pattern in the design-build constructions. Activity theory is object-oriented and this concept resonates with the focus of collaboration on a common goal. Similarly, the shared reward as inherent pattern resonates with the outcome and motivation of the design-build activity for the students. Activity theory also highlighted the changing role of the tutor in the design-build activity to become more a facilitator than an informer.

5.3.2.4
IN EXPLORATIVE WINDOW 3

Activity theory revealed the change in tools needed to negotiate from an educational design-build project towards a professional design-build practice, the importance of presence and absence in the activity of the tutor and an expansive learning cycle experienced by the practitioners.

5.3.3 COLLABORATION WAS HIGHLIGHTED AS A UNIQUE EDUCATIONAL OPPORTUNITY

Teamwork is learned quickly when there is too much to do (Mackay-Lyons & Buchanan, 2008: Foreword).

Collaboration was proposed at the midpoint threshold as a unique educational opportunity. Collaboration as recurring concept became evident in the literature review and was explored further in window 1 and window 2 of Chapter 4.

5.3.3.1 IN THE LITERATURE REVIEW: ACKNOWLEDGING THE MEDIATIONAL ROLE OF THE ACADEMIC

Collaboration requires the academic or tutor to take on a mediational role of both task and group function (Johnson & Johnson, 1999). The literature review pointed out that in design-build projects the academic is already positioned in such a mediational role and that this position of the academic offers possibilities and opportunities in the collaborative learning process.

5.3.3.2 IN WINDOW 1: DEVELOPING A CONCEPTUAL COLLABORATIVE FRAMEWORK

Collaboration is conceptualised in the design-build activity system as three separate but interlinked activities:

- Collaborative learning
- Collaborative design
- Collaborative construction

These three activities, along with three project stages (the generative-methodical, the generative-methodical/creative-philosophical and the creative-philosophical) and three physical project settings (studio, workshop and construction site), were positioned in relation to each other. This relationship was combined with collaborative rules and tools to conceptualise a collaborative framework for design-build projects. This conceptual collaborative framework can become a tool in the design, development and research of group work and collaboration in design-build projects in architectural education.

5.3.3.3 IN WINDOW 2: FOREGROUNDING COLLABORATION AS INHERENTLY SITUATED WITHIN DESIGN-BUILD PROJECTS

Collaboration is foregrounded as inherently situated within design-build projects by exploring the five design-build constructions with the conceptual collaborative framework. Three inherent patterns within design-build constructions that resonate with the collaborative framework were identified. These are the value that students themselves placed on the collaboration, working towards a common goal, and receiving a shared reward.

The role of the tutors in the design-build constructions also indicated that they were already in some manner facilitating collaboration. Tutors were mediating task and group function and informally teaching collaborative skills, all of which were necessitated by the nature of the design-build constructions. With more formal knowledge of collaboration tutors could play a vital role in helping students to collaborate successfully.

Exploring collaboration in window 1 and window 2 essentially indicated that design-build projects are ideally situated for teaching collaboration since the activity system inherently has opportunities for collaborative interaction among students and collaborative facilitations by tutors.

5.3.4 THE LINK BETWEEN DESIGN-BUILD EDUCATIONAL PROJECTS AND DESIGN-BUILD PROFESSIONAL PRACTICE

A path from design-build education to design-build professional was traced to extract methods, skills and attributes that can be introduced for nurturing future design-build practitioners.

5.3.4.1 IN EXPLORATIVE WINDOW 3

The story of three practitioners was investigated with the idea of learning from their journey to inform the design and development of future design-build educational constructions.

Explorative window 3 showed us that it is possible for very specific perceptions to change and that young practitioners are willing and able to take make changes and take chances. When they commenced their studies, the practitioners of Change Practice all had the aspiration to become part of or to own a commercial, high-end practice. During participation in their first educational design-build project they already started to think about creating a different kind of professional practice. A series of experiences, conceptualised as expansive learning cycles (Engeström, 1987), equipped them with the skills, knowledge and confidence to pursue and open their own design-build professional practice. While they were still students they completed a design-build project on their own without the assistance of their tutors. This experience gave them the determination that empowered them to start their own design-build practice. As academics we may have to step away at times from being there for students. This, the idea of stepping away, of course leads to questions involving responsibility, indemnity and assessment.

5.3.4.2 SOCIAL ENTREPRENEURSHIP FOREGROUNDED

To be a social entrepreneur requires 'solutions which are sustainable financially, organizationally, socially and environmentally' (Thake and Zadek in Kumar & Gupta, 2013: 10). The values of social entrepreneurship resonate with the values of alternative practice as proposed by Tovivich (2010)and Perkes (Perkes, 2009). A conceptual framework that relates to these values was developed and could be used as a tool in future research.

The practitioners of Change Practice acted and are still essentially acting as social entrepreneurs. The three practitioners understood that their practice had to be financially viable in order for them to be able to concentrate on working in communities* and they deliberately created a practice with a social and a corporate/commercial side. With the skills and knowledge they acquired during their design-build experiences they conceptualised a professional practice that would design and build with, for and in communities with money received mainly through funding. On the other side they would have corporate and commercial work that could help to sustain the practice. One of the interesting aspects of their practice is that their community work and the conceptualising of construction systems for community work have caught the intention of their commercial clients, who want similar architectural solutions.

5.3.4.3 POSSIBILITY OF ALTERNATIVE TYPE OF PRACTICE HIGHLIGHTED

The three practitioners have shown that it is possible to create a design-build professional practice focused on working in communities*. The practice is still young and follow-up work will be necessary to see how their practice develops and whether they are able to continue with the intent with which they started.

Exposing students to community* work has the power to change their perception of how a professional can practise in the architectural environment. Teaching architectural students social entrepreneurship skills has the potential to equip them with the necessary knowledge to develop their own professional practices. How to develop their determination and confidence is not necessarily clear. Were these three practitioners unique in their experience and development, or is it possible to create something similar for other students?

5.4 RECOMMENDATIONS FOR POLICY, PRACTICE AND FURTHER RESEARCH

The order of the subheadings below relates to that of the subheadings under point 3 above with an additional point, research practice, at the end.

5.4.1 DESIGN-BUILD TYPOLOGIES

The value of hands-on full-scale exploration in architectural education is much broader than 'student[s] learning activities in which they design and construct a small building or structure with their own hands' (Abdullah, 2014b: vi) or, phrased in another way, activities focusing on completing small inhabitable structures. The six proposed design-build typologies, four from Christenson and Srivastava (2005, 2016) and two developed from the literature (Chi, 2002; Fisher in Mackay-Lyons & Buchanan, 2008; Foote, 2012), are an attempt to not only clearly define different types of full-scale hands-on investigations, but also to propose these as pedagogic and research tools.

Pedagogically these tools can be utilised to define and develop different types of design-build projects and situate these design-build experiences within the curriculum. The typologies can also be used to reflectively explore design-build constructions. Such further research could validate, critique and/or expand on these typologies.

5.4.2 ACTIVITY THEORY

Various activity systems were proposed in this research, each with their own object, outcome(s), rules, tools, community and division of labour, and each motivated and negotiated in different ways. By viewing the interactions and contradictions between these systems and mediation within the systems many lessons were learned. Activity theory has been a powerful tool to use in exploring design-build projects.

The activity systems proposed and the understandings arrived at in this research could guide future researchers in the use of activity theory to explore design-build projects. Activity theory can be used analytically (Torres, Buchem & Attwell, 2011; Abdullah, 2014a) and also to conceptualise and redesign (Engeström, 2000, 2001) new activities and activity systems. The activity theory graphics that depict the opposing system as mirrored across the midpoint or boundary is there for further development and critique.

5.4.3. COLLABORATION

The proposed conceptual collaborative framework can be used to develop collaboration as a specific pedagogic tool in future design-build projects. However, the framework does not have to be used only in design-build projects, but can find a place in the conventional studio to re-conceptualise studio projects for collaborative action. The framework could be evaluated in further research and also guide research on collaboration in architectural education.

The relationship between the changing role of the tutor and the student, as pointed out in the literature review (3.3.5.1) and the influence that this role change has on the collaborative process, could be investigated further.

5.4.4 PROFESSIONAL PRACTICE

The feasibility of small-scale design-build professional architectural practices that work in communities in the South African context warrants further research. Such design-build practices could prove valuable alternative avenues for architectural practitioners and contribute to social upliftment.

A comparative study with similar practices internationally could provide valuable ideas for incorporation in the South African context. Finding students that were introduced to social design-build work in their education and that continued to establish their own practices could be part of such a study.

Social entrepreneurship could be included in the architectural curriculum. Further research on design-build architectural practices as social entrepreneurial enterprises could reveal further appropriate lessons that can be fed back into the curriculum and design-build projects.

Further research is necessary to determine what other aspects are currently absent in the curriculum that students would need to develop sustainable, small-scale professional design-build practices.

To practice as a professional architect in South Africa requires registration with the South African Council for the Architectural Profession. Currently there are four main categories of registration, and all are focused on the production of documentation for buildings, not on building these buildings too. Is there a place for a different professional category where being part of the actual building work is recognised professionally? What would such a category entail? Further research into the viability and possibility of such professional recognition is essential.

5.4.5 RESEARCH PRACTICE

The role of the academic as researcher within the design-build projects needs investigation. How and why research is conducted and what it can contribute to the broader discourse on design-build projects remains a field for further study.

5.5 HANDOVER

Design-build projects offer opportunities for architectural education and practice and with each research endeavour we learn more. I believe that, to fully engage in the research of design-build projects, any researcher should be immersed within the design-build process and the research process. I am still roaming the landscape of architectural practices and my research exploration will continue along both conceptual and practical avenues. With this thesis I have discovered new paths and possible trajectories and have mapped out new courses to question.

EPILOGUE

In the not too distant future, I see many architectural students who have just graduated and are about to enter the architectural profession. These soon-to-be architects know how to engage meaningfully with a community, how to collaboratively generate solutions, how to manage a project from inception to completion, how to physically contribute to the making of a building, how to sustainably implement technology, where to find funding, how to set up an entrepreneurial business and know that the future of their country depends on their actions. They want to pursue a career in public architecture, both the building of the community and building for the community. They are ready to make a difference in the lives of those who, under normal circumstances, could not afford their architectural services. They know they cannot not sit and wait, but have to go out and get started.

VIDEO OF HANGBERG

https://vimeo.com/122326209

(Epitome. 2015)

Image 5.1: Author at St Michael's handover

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF IMAGES

All images used are by the author or with permission of the students that took the photographs. All images of the Hangberg design-build construction are used with permission of Stephen Lamb.

REFERENCES

Abdullah, Z.B. 2011. Getting Their Hands Dirty: Qualitative Study on Hands-on Learning for Architectural Students in Design-build Course. *Journal of Design and Built Environment*, 8(1).

Abdullah, Z.B. 2014. *Exploring the evolution of design-build courses in architectural schools: a qualitative study*. Faculty of The Graduate College at the University of Nebraska. Published doctoral dissertation. Ann Arbor: Proquest.

ACSA. 2014. *ACSA 2014 Fall Conference, Project Proceedings*. [Online]. Available: http://www.acsa-arch.org/programs-events/conferences/fall-conference/2014-fall-conference [2015, March 12].

ACSA. 2014. ACSA *2014 Fall Conference, ABSTRACTS*. [Online]. Available: http://www.acsa-arch.org/programs-events/conferences/fall-conference/2014-fall-conference [2015, March 12].

Anderson, J. & Priest, C. 2012. The Live Education of an Architect: John Hejduk and Oxford Brookes Year One Live Projects. *Journal for Education in the Built Environment*, 7(2):50–62.

Anderson, J. & Priest, C. 2015. Live Projects Network. [Online], Available: http://liveprojectsnetwork.org/ [2015, January 22].

Arnseth, H.C. 2008. Activity theory and situated learning theory contrasting views of educational practice. *Pedagogy, Culture & Society*, 16(3): 289-302. [Online] Available: http://www.tandfonline.com/loi/rpcs20 [2016, February 11].

Bachman, C. & Bachman, L. 2009. Self-identity, rationalisation and cognitive dissonance in undergraduate architectural design learning. *Arq: Architectural Research Quarterly*, 13(3):315–322

Bachman, L. & Bachman, C. 2006. Student perceptions of academic workload in architectural education. *Journal of Architectural and Planning Research*, 23(4):271–304.

Bachman, L. 2010. The Teaching of Research and the Research on Teaching: Two Frameworks and Their Overlay in Architectural Education, in R. Klein (ed.). *Proceedings of the 2010 International Conference on Architectural Research: The place of research / the research of place.* 23-26 June, Washington DC. Architectural Reserach Centers Consortium [Electronic]. 470-478. Available. http://arcc-arch.org/wp-content/uploads/2014/12/ARCC2010 [2014, March 5].

Barab, S. a., Barnett, M., Yamagata-Lynch, L., Squire, K. & Keating, T. 2002. Using Activity Theory to Understand the Systemic Tensions Characterizing a Technology-Rich Introductory Astronomy Course. *Mind, Culture, and Activity*, 9(2):76–107.

Barcon, L. 2010. Cargo Collective. [Online]. Available: http://cargocollective.com/louisbarcon/Ithuba-Africa [2016, February 15].

Bell, B. & Wakeford, K. (eds.). 2008. *Expanding architecture: design as activism*. New York: Metropolis Books.

Bennett, J. & Osman, A. 2013. Critical engagement in informal settlements: lessons from the South African experience. In *World Building Congress 2013*, In K. Kajewski, K. Manley, K. Hampson (eds.). *Proceedings of the 19th CIB World Building Congress, Brisbane 2013: Construction and Society*. 5-9 May, Brisbane. Host School, The School of Civil Engineering and Built Environment. Queensland University of Technology. Page missing

Bernhard, S. & Taylor, E. 2014. The Grow Dat Youth Farm: Design-Building a Non-Profit, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 53-55.

Blake, J. 2014. Design-Build is During, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 23-24.

Boling, T. 2014. Case study: Five points Alley, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 15-16.

Boyer, E.L. & Mitgang, L.D. 1996. *Building Community: A New Future for Architecture Education and Practice: a special report*. [Princeton, NJ]: The Carnegie Foundation for Advancement of Teaching.

Bozalek, V., Ng'ambi, D., Wood, D., Herrington, J., Hardman, J. & Amory, A. (eds.). 2014. *Activity Theory, Authentic Learning and Emerging Technologies: Towards a transformative higher education pedagogy*. London and New York: Routledge Taylor & Francis Group.

Bradbury, S. & Papaefthimiou, E. 2013. Live projects don't work. So why bother? Unpublished paper delivered at the Association of Architectural Educators International Conference on Architectural Education. 4-5 April, Nottingham.

Brillhart, J.L. 2014. A Machine to Reflect on the Infinite City, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 3-4.

Brown, J.B. 2012. A critique of the live project. Unpublished doctoral thesis. Belfast. School of Planning, Architecture & Civil Engineering, Queen's University Belfast.

Brown, J.B. 2013. 'An output of value' - exploring the role of the live project as a pedagogical, social and cultural bureau de change. Unpublished paper delivered at the Association of Architectural Educators International Conference on Architectural Education. 4-5 April, Nottingham.

Bruffee, K. 1995. Sharing Our Toys: Cooperative Learning Versus Collaborative Learning. *Change*, 27.1(Jan-Feb):12–18.

Burrell, G. & Morgan, G. 1979. *Sociological Paradigms and organisational analysis*. London: Heinemann Educational Books.

Buthelezi, S.S. 2014. Student charter on architectural education, in the *XXV International Union of Architects World Congress*. 7 August, Durban. [Online]. Available: www.uia2014durban.org/resources/media/UIA2014studentcharterspeech.pdf [2016, February 11].

Canizaro, V.B. 2012. Design-build in architectural education: motivations, practices, challenges, successes and failures. *International Journal of Architectural Research*. 6(3):20–36.

Carpenter, W.J. 1997. *Learning by Building: Design and Construction in Architectural Education*. Van Nostrand Reinhold, ITP.

Carpenter, W.J. (ed.). 2011. Design Build Studio. Decatur: Lightroom Studio.

Carter, F. 2013. Structures of Knowledge and Pedagogy. *Journal of the South African Institute of Architects*, (61) May|June: 36–45.

Cary, J. (ed.) 2010. *The Power of Pro Bono: 40 Stories About Design for the Public Good by Architects and Their Clients*. New York, USA: Metropolis Books.

Cavanagh, T., Hartig, U. & Palleroni, S. (eds.). 2014. *Working Out: thinking while building*, in *Project Proceedings from the 2014 Fall Conference*, Halifax, NS: ACSA Press.

Cavanagh, T., Kroeker, R. & Roger, M. 2005. For Want of Wind. *Journal of Architectural Education*, 58(4).

Challis, D. 2002. Integrating the conceptual and practice worlds: A case study from Architecture, in *Quality Conversations, proceedings of 25th Annual Conference of the Higher Education Research and Development Society of Australasia (HERDSA)*, 7-10 July, Perth, Western Australia: 105-113.

Chi, L.H. 2002. Building Speculations: Introduction. *Journal of Architectural Education*, 55(3):161–162.

Chiles, P. & Till, J. 2004. Live Projects: an inspirational model. The student perspective. Funded Case Study, *Centre for Education in the Built Environment*: 1–7.

Christenson, M. & Srivastava, M. 2005. A Proposal for a Cross-Disciplinary Design Pedagogy: Generative Full-Scale Investigations. *International Conference on Design Education: Tradition and Modernity*. Ahmedabad, India: 95:231–238.

Christenson, M. & Srivastava, M.2016. Passive House Design - Build : Generative Full-Scale Pedagogy. Unpublished manuscript. North Dakota State University.

Cook, E. & Stephenson, K. 2014. Carton House, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press: 13–14.

Corser, R. & Gore, N. 2008. Long Distance Design-Build : Learning from the Challenges of Helping to Rebuild a Sustainable Community in New Orleans' 7th Ward University of Kansas, in Dietmar Froehlich & Michaele Pride (eds.). *96th ACSA Annual Meeting Proceedings, Seeking the City*. ACSA Press: 712–718.

Corser, R. & Gore, N. 2009. Insurgent Architecture An Alternative Approach to Design Build. *Journal of Architectural Education*, 62(4):32–39.

Corser, R. 2014. Wedge Sheds-An Example of the Collab/Fab Approach, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 61–62.

Community Projects Office (CPO). 2000. Bellville: Peninsula Technikon, Faculty of Engineering.

Creswell, J.W. 2009. *Research design. Qualitative, quantitative, and mixed methods approaches.* Los Angeles: SAGE Publications

Cricchio, A. & Butko, D. 2014. KoRuRaP Playhouse (Kit-of_Re-Used_Re-adapted-Parts), in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 31–32.

Cronjé, J. 2012. What is this thing called 'design' in instructional design research? - The ABC instant research question generator. in M. Antonio, B. Otto, & M. Jose (eds.) *Media in Education: Resluts from the 2011 ICEM and SIIE joint Conference*, 28-30 September, University of Aveiro, Portugal: 15-28

Cuff, D. 1992. *Architecture: The Story of Practice.* 1st ed. Cambridge, Mass.: MIT Press.

Dagg, C. 2014. The Safe Room: Building Just One Part, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 55–56.

Day, J.L. 2014. Bemis Ground, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 7–8.

Deal, T.B. 2014. Convergent Canopies: The Huckleberry Trails Pavillion, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 19–20

Dean, A.O. & Hursley, T. 2002. *Rural Studio: Samuel Mockbee and an Architecture of Decency.* New York: Princeton Architectural Press.

Dean, A.O. 2001. The Hero of Hale County: Sam Mockbee. *Architectural Record*. [Online]. 2:78. Available http://archrecord.construction.com/people/interviews/archives/0102mockbee-2.asp. [12 June 2014].

Deetz, S. 1996. Crossroads – Describing Differences in Approaches to Organization Science: Rethinking Burrell and Morgan and Their Legacy. *Organization Science*. 7(2):191–207.

Delport-Voulgarelis, H.E. & Perold, R. 2012. Creating a new curriculum. *Journal of the South African Institute of Architects*, 58, Nov|Dec: 50–51.

Delport-Voulgarelis, H.E. & Perold, R. 2014. Towards Entrepreneur-Activist Architectural Practice. In *International Union of Architects (UIA) 25th World Congress of Architecture conference proceedings*.

DesignBuildBluff. 2015. *DesignBuildBLUFF*. [Online]. Available: www.designbuildbluff.org. [2016, February 11].

Doan, P. & Seavy, R. 2014. Learning from the Cube, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 33–34.

DOMUS. 2013. Ukuqala 2: House for Village of Hope. *Domus* [Online], Available: http://www.domusweb.it/en/news/2013/01/10/ukuqala-2-house-for-village-of-hope.html. [2016, February 12].

Doolittle, P.E. 1995. Understanding Cooperative Learning through Vygotsky's Zone of Proximal Development, in *Lilly National Conference on Excellence in College Teaching*. 2-4 June, Columbia SC. [Online]. Available: http://files.eric.ed.gov/fulltext/ED384575.pdf [2016, February 12].

Douglas, S.W. 2010. Citizen Architect_Samuel Mockbee and the Spirit of the Rural Studio. United States of America: Big Beard Films.

Drever, E. 1995. *Using Semi-Structured Interviews in Small-Scale Research. A Teacher's Guide.* Edinburgh: Scottish Council for Research in Education.

Ellis, V. 2011. Reenergising Professional Creativity from a CHAT Perspective: Seeing Knowledge and History in Practice. *Mind, Culture, and Activity*, 18(2):181–193.

Engeström, Y. 1987. *Learning by Expanding*. Helsinki: Orienta-Konsultit Oy.

Engeström, Y. 2000. Activity theory as a framework for analyzing and redesigning work. *Ergonomics*, 43(7):960–974.

Epitome. (2015). Design-Build Research Studio - The Lighthouse. [Online Video]. Available from: https://vimeo.com/122326209. [12 September 2015].

Erdman, J., Weddle, R. & Mical, T. 2002. Designing/building/learning. *Journal of Architectural Education*, 55(3): 174–179.

Faculty of Architecture RWTH Aachen. 2015. *Design.Develop.Build* [Online], Available: http://gbl.arch.rwth-aachen.de/ddb/?page_id=2. [2016, February 12].

Feuerborn, G.J. 2005. Making Architecture, Making Community. The Pedagogy of an Urban 'Rural Studio'. Research paper. Human Factors and Architectural Research Methods 407/507.Oregon: University of Oregon.

Fisher, R.C. 2015. Architecture and the Academy - the research imperative. *Journal of the South African Institute of Architects*, 76, Nov|Dec:51–52.

Fisher, T. 2008. Foreword. Public- interest architecture: a needed and inevitable change. In Bell, B. & Wakeford, K. (eds.). *Expanding architecture: design as activism.* New York: Metropolis Books.

Foote, J. 2012. Design-Build: Build-Design. *Journal of Architectural Education*. 65(2):52–58.

Gaber, T. 2014. The Agency of Making and Architecture Education: Design-Build Curriculum in a New School of Architecture. *International Journal of Architectural Research*, 8(3):21–31.

Gelpi, N. 2014. On the Edge of Failure Unflat Pavilion, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 41–42.

Gelpi, N. 2014. Table-Distortions, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 51–52.

Gjertson, W.G. 2011. House Divided : Challenges to Design / Build from Within University of Louisiana at Lafayette. *ACSA Fall Conference Local Identities / Global Challenges*. Houston: ACSA Press. 23–35.

Gray, T. 2014. The urbaRn Project: We Are What We Grow, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 59–60.

Grieb, B. 2014. Destination 1, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 27–28.

Grocott, L. 2010. Design Research & Reflective Practice: the facility of design-oriented research to translate practitioner insights into new understandings of design. Unpublished doctoral dissertation. Melbourne RMIT University [Online] Available: https://researchbank.rmit.edu.au/eserv/rmit:10830/Grocott.pdf [2016, February 12].

Hamdi, N. 2010. *The Placemaker's Guide to Building Community*. London & Washinton: Earthscan.

Hamdi, N. 2011. Architecture, Improvisation and the Energy of Place. *RSA Design & Society*, [Online]. Available: http://architecture.brookes.ac.uk/research/cendep/media/The%20Resourceful%20Architect_RSA%20(Nabeel%20Hamdi).pdf [2016, February 12].

Hands-on-Bristol. 2015. *Hands-on-Bristol*. [Online], Available: http://www.hands-on-bristol.co.uk/ [2015, April 21].

Harriss, H. & Widder, L. (eds.). 2014. *Architecture Live Projects: Pedagogy Into Practice*. Oxon: Routledge Taylor & Francis Group.

Harriss, H. (ed.). 2012. Architecture live projects Oxford School of Architecture 2010-2012. Oxford: Oxford Brookes University.

Hart, J. 2015. *Learning in the Modern Workplace, Jane Hart's blog*. [Online], Available: http://www.c4lpt.co.uk/blog/ [2015, February 23].

Hartig, U. 2012. Symposium DesignBuild Studio: New Ways in Architectural Education. *CoCoon Contextual Construction* [Online], Available: http://cocoon-studio.de/portfolio/symposium-designbuild-studio-new-ways-of-architectural-education/ [2015, December 01].

Hartig, U. 2014. DesignBuild Projects. *CoCoon Contextual Construction* [Online], Available: http://cocoon-studio.de/design-build/ [2014, September 30].

Hill, L.M. & Beaverford, K. 2007. Service Learning in the Global Community : A Collaborative Process. Unpuplished paper delivered at the MX Design Conference. 29-31 October, Sante Fe.

Hinson, D. 2007. Design as Research_Learning from Doing in the Design Build Studio. *Journal of Architectural Education*, 61(1):23–26.

Hoffman, P. 2014. Truly accommodating homes. *Cape Times (Cape Town)*, 25 March: 9.

Huang, L.S. & Belton, S. 2014. The Digital Joint: The Evolution of the Craft Through Mediated Material Processes, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 57–58.

Huge, E. 2008. Study as a course of practice: The work of north studio at Wesleyan University. *Journal of Architectural Education*, 62(3):65–70.

James, C. 2014. Re-scripting education Interspatiality: Space, the environment and architectural pedagogy. *Journal of the South African Institute of Architects*, (68), Jul|Aug: 44–50.

Jann, M. 2009. Revamping Architectural Education: Ethics, Social Service, and Innovation. *International Journal of Arts and Sciences*, 3(8): 45–89.

Johnson, D.W. & Johnson, R.T. 1999. *Learning together and alone: cooperative, competitive, and individualistic learning*, 5th ed. New Jersey: Prentice-Hall Publishing.

Johnson, D.W., Johnson, R.T., Holubec, E.J. & Roy, P. 1984. *Circles of learning. Cooperation in the classroom*. Alexandria, VA: Association for Supervision and Curriculum Development.

Johnson, R.T. & Johnson, D.W. 1994. An Overview of Cooperative Learning, in J. Thousand, A. Villa, & A. Nevin (eds.). *Creativity and Collaborative Learning*. Baltimore: Brokkes Press: 37–50.

Kansley, L. 2011. School makeover thanks to CPUT students. *CPUT Media and Events*. [Online], Available: https://www.cput.ac.za/newsroom/news/article/1646/school-makeover-thanks-to-cput-students-. [2016, February 12].

Kaptelinin, V. 2005. The Object of Activity: Making Sense of the Sense-Maker. *Mind, Culture, and Activity*, 12(1):4–18.

Kellum, A.S. 2010. *On the design-build of small pavilions*. Published MLA thesis. Mississippi: Mississippi State University.

Kleining, G. & Witt, H. 2001. Discovery as Basic Methodology of Qualitative and Quantitative Research. *FQS Forum: Qualitative Social Research*. 2(1)

Kober, R. 2014. Research Terrain: 2D, 3D, 4D at 1:1, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 43–44.

Koch, A., Schwennsen, K., Dutton, T.A. & Smith, D. 2002. *The Redesign of Studio Culture. A Report of the AIAS Studio Culture Task Force.* The American Institute of Architecture Students: AIAS Studio Culture Task Force.

Kolb, D.A. 1984. *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall, Inc.

Kuhn, S. 2001. Learning from the Architecture Studio : Implications for Project-Based Pedagogy. *International Journal of Engineering Education*. 17:349–352.

Kumar, S.S. & Gupta, K. 2013. Social Entrepreneurship: A Conceptual Framework. *International Journal of Management and Social Sciences Research (IJMSSR)*. 2(8):9–14.

Lai, E.R. 2011. *Motivation: A Literature Review*. Pearson Research Report.

Lave, J. & Wenger, E. 1991. *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

Lawson, B. & Dorst, K. 2009. *Design Expertise*. Oxford: Elsevier Ltd.

Le Grange, S. 2014. Teaching architecture in South Africa today. *Journal of the South African Institute of Architects*, 67, May|June: 42–48.

Lepik, A. 2010. *Small Scale Big Change: New Architectures of Social Engagement*. New York: The Museum of Modern Art.

Lotz, N., Holden, G. & Jones, D. 2015. Social engagement in online design pedagogies, in *LearnxDesign, the 3rd International Conference for Design Education.* The Open University: 1645–1668.

Luescher, A. 2010. Concrete geometry: Playing with blocks. *International Journal of Art and Design Education*, 29(1):17–26.

Lutz, M., Paddicombe, M. & Schmeckpeper, E. 2014. Speaking Up: Conservation-Based Design-Build as Policy Maker, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 47–48.

Mackay-Lyons, B. & Buchanan, P. 2008. *Ghost: Building an Architectural Vision*. New York: Princeton Architectural Press.

Maistre, C. Le & Paré, A. 2004. Learning in two communities: the challenge for universities and workplaces. *Journal of Workplace Learning*, 16(1/2):44–52.

Mc Millan, J. 2009. Through an Activity Theory Lens: Conceptualizing service learning as "boundary work". *Gateways: International Journal of Community Research and Engagement*. 2:39–60.

Melcher, K. 2013. Leaving the Drafting Table: Students' Perspectives on the Design-Build Experience, in Ming-Han Li, (ed.). *Landscape Research Record*, No 1, 2013: 72-81 [Online]. Available: https://www.thecela.org/pdfs/Landscape_Research_Record_No.1.pdf [2016,February 14].

Miettinen, R. 2006. Epistemology of Transformative Material Activity: John Dewey's Pragmatism and Cultural-Historical Activity Theory. *Journal for the Theory of Social Behaviour*, 36:389–408.

Miller, J. & Hinson, D. n.d. DESIGNhabitat: design/research + design/build: Expanding the Design//Build Model, Auburn University. [Online]. Available: http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aiab087197.pdf [2016, January 15].

Mills, A. 1990. Gareth Morgan: Sociological Paradigms and Organizational Analysis. *Aurora Online* [Online], Available: http://aurora.icaap.org/index.php/aurora/article/view/61/73 [2014, November 14].

Morton, K. & Troppe, M. 1996. From the margin of the mainstream: Campus Compact's project on integrating service with academic study. In M. Troppe (ed.). *Two cases of institutionalizing service learning.* Providence: Campus Compact. 3–16.

Mullin, R. 2010. The Uncertain Centre of the Mary Celeste Spencer's Island, Nova Scotia, Canada. *Made at WSA (Welsh School of Architecture)*, (6):66–75.

Nason, J.M. 2014. Building Community: The Ark on Noah Street, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 9–10.

Nepveux, N. 2010. A New Perspective for Architectural Education : A Performance Art University of Kansas, in B. Goodwin & J. Kinnard, (eds.). 98th ACSA Annual Meeting Proceedings, Rebuilding. ACSA Press. 77–85.

Nicol, D. & Pilling, S. (eds.). 2000. *Changing Architectural Education: Towards a new professionalism*. New York and Oxon: Spon Press.

Nulman, E. An Alternative Model for Undergraduate Thesis Instruction: Using Collaborative Full-Scale Design Exercises To Supplement Individual Research Projects, in X. Costa & M. Throne (eds.). *Change Architecture Education Practices: Papers from the 2012 ACSA International Conference*. Barcelona: ACSA Press: 189-195.

Oakley, D.J. & Smith, R.E. (eds.). 2008. Proceedings of the 2006 Building Technology Educators' Symposium held at the University of Maryland School of Architecture, Planning and Preservation, in *Building Technology Educators' Symposium Proceedings*. [Online]. Available: http://www.btesonline.org/maryland.html [2016, February 14].

Ockman, J. & Williamson, R. (eds.). 2012. *Architecture School: Three Centuries of Educating Architects in North America.* Cambridge, Mass: The MIT Press.

Osman, A. 2015. What architects must learn from South African student protests. *The Conversation* [Online]. Available: https://theconversation.com/what-architects-must-learn-from-south-african-student-protests-50678 [2015, November 28].

Pallasmaa, J. 2009. Mental and existential ecology. In R. Bhatt (ed.). *Rethinking aesthetics: The role of body in design.* London: Routledge.

Panitz, T. 1999. *Collaborative versus Cooperative Learning - A comparison of the two concepts which will help us understand the underlying nature of interactive learning*. ERIC Document Reproduction Service No.ED 448 443. Massachusetts: Cape Cod Community College.

Papert, S. & Harel, I. 1991. *Constructionism.* Norwoord NJ: Ablex Publishing Corporation.

Parnell, R. 2003. Knowledge skills and arrogance: Educating for collaborative practice, in *Writings in Architectural Education: EAAE Transactions*. Copenhagen: EAAE. 58–71.

Perkes, D. 2009. A Useful Practice. *Journal of Architectural Education*, 62(4):64–71.

Peshkin, A. 1990. *The relationship between culture and curriculum: A many fitting thing*. *Washington: Project Report*. The National Center for School Leadership: Urbana, IL. [Online]. Available: http://files.eric.ed.gov/fulltext/ED359667.pdf [2016, February 12].

Polizzi, J. 2014. DESIGN-BUILD: A VEHICLE FOR SELF DISCOVERY, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *ABSTRACTS from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press.18.

Rambhoros, M., Delport-Voulgarelis, H.E. & Perold, R. 2013. Ethical teaching, learning and collaborating. *Journal of the South African Institute of Architects*, (64), Nov|Dec: 21–23.

Rice-Woytowick, P. 2011. Academic design/build programs as mechanisms for community development. Unpublished masters thesis. Manhattan: Kansas State University [Online]. Available: http://krex.k-state.edu/dspace/handle/2097/9208 [2016, February 12].

Ripley, C., Thün, G. & Velikov, K. 2009. Matters of Concern. *Journal of Architectural Education*. 62(4):6–14.

Roome, J. 2014. Creative Applications of Basic Computer Software: A Practice-led Exploration of Visual Art and Design Thinking through Drawing and Animation. Unpublished doctoral thesis. Durban: University of Technology.

Rosenthal, H. 2013. Expanding architectural practice to advance social justice: Social architecture creates equitable shelter. Unpublished master's thesis. Ames, Iowa: Iowa State University.

Roth, W.-M. & Lee, Y.-J. 2007. “Vygotsky’s Neglected Legacy”: Cultural-Historical Activity Theory. *Review of Educational Research*, 77(2):186–232.

Roth, W.-M., Radford, L. & LaCroix, L. 2012. Working With Cultural-Historical Activity Theory. *Forum: Qualitative Social Research*, 13(2):art. 23.

Rural Studio. 2015. Rural Studio. *Rural Studio* [Online]. Available: http://www.ruralstudio.org/. [2016, February 14].

Ryder, M. 2015. What is Activity Theory? [Online] Available: http://carbon.ucdenver.edu/~mryder/itc/act_dff.html [2015, January 23].

South African Council for the Architectural Profession. 2010. *Competencies for the Architectural Professions*. Johannesburg: Steyn.

South African Council for the Architectural Profession.. 2014. SACAP Vision, Mission and Values adopted by Council on 26 and 27 June 2014. *SACAP Official Website*. Available: http://www.sacapsa.com/?page=Mission&hhSearchTerms=%22collaboration%22. [2015, August 25]

Saidi, F.E. 2005. Developing a Curriculum Model for Architectural Education in a Culturally Changing South Africa. Unpublished doctoral thesis. Pretoria: University of Pretoria. [Online]. Available: http://repository.up.ac.za/bitstream/handle/2263/27969/Complete.pdf?sequence=4 [2016 February 14].

Salama, A.M. 1995. *New Trends in Architectural Education*. Raleigh, N.C.: Tailored Text.

Salama, A.M. 2015. *Spatial Design Education: New Directions for Pedagogy in Architecture and Beyond*. Farnham: Ashgate Publishing Limited.

Salama, A.M. & Wilkinson, N. (eds.). 2007. *Design Studio Pedagogy: Horizons for the Future*. Gateshead: The Urban International Press.

Sara, R. 2004. Does The Live Project Have a Future in Architectural Education? In *Studio Culture 2: Touching the Real*. Edinburgh: 1–3.

Sara, R. 2006. Live Project Good Practice: A Guide for the Implementation of Live Projects. *CEBE Briefing Guide Series*, 8:1-7.

Sara, R. 2011. A studio between: Positioning the design-build studio as educational praxis. In Carpenter, W.J. (ed.). Design Build Studio. Decatur: Lightroom Studio.

Schermer, B. 2001. Client-Situated Architectural Practice: Implications for Architectural Education. *Journal of Architectural Education*, 55(1):31–42.

Schön, D.A. 1983. *The Reflective Practitioner*. New York: Basic Books.

School of Architecture Design and Planning. 2014. Graduate Studies in Design-Build Architecture. Kansas: The University of Kansas.

Schwartz, C., Morthland, L. & McDonald, S. 2014. Building a Social Framework: Utilising Design/Build to Provide Social Learning Experiences for Architecture Students. *Architectural Theory Review*, 19(1): 76–91.

Slovo Park. 2010. *Slovo Park*. [Online]. Available: http://www.slovo-park.blogspot.co.uk/p/slovo-park-project-2010.html [2016, February 14].

Smidt, S. 2013. *Introducing Vygotsky: A guide for practitioners and students in early years education*. London, New York: Routledge.

Smith, M.K. 2010. David A. Kolb on experiential learning. *The encyclopedia of informal education* [Online]. Available: http://infed.org/mobi/david-a-kolb-on-experiential-learning/ [2015, May 21].

Sokol, D. 2008. Teaching by Example: Design-build educators talk pedagogy and real politick. *Architectural Record*. [Online]. Available: http://www.architecturalrecord.com/articles/6443-teaching-by-example?v=preview [2016, February 14].

Sommerfeld, R. & Galarza, J.R. 2014. Skow Residence "El Sombrero", in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 45–46.

Sommerfeld, R. 2014. WEEP (Waterton Environmental Education Pavilion), in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 63–64.

Sommerfeld, R., Galarza, J.R. & Paddock, A. 2014. Hozho House, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 29–3o.

Stevens, G. 1995. Struggle in the studio: a Bourdivin look at architectural pedagogy. *Journal of architectural education*, 49(2):105–122.

Stevens, J. 2014. Movable Silence, Digital Design-Build in the Academy, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 39–40.

Sutter, M.K. 2014. Design/Build in Architectural Education: studying community-focused curriculum. Unpublished master's degree. Amherst: University of Massachusetts-Amherst

Swartz, A.M. 2014. Building Opportunity: A Canvas for Learning, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 11–12.

Taylor, E. 2014a. Mixing Design-Build Models: Stitching Community and Technology, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 37–38.

Taylor, M.S. 2014b. Designing and Building for the Long-term, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 25–26.

Torres, R., Buchem, I. & Attwell, G. 2011. Understanding Personal Learning Environments: Literature review and synthesis through the Activity Theory lens, in *PLE Conference 2011*. Southampton: 1–33.

Tovivich, S. 2009. Learning from Informal Settlements: the New 'Professionalism' for Architectural Practice. *CEBE Transactions*, 6(1): 62–85.

Tovivich, S. 2010. Architecture for the Urban Poor, the 'New Professionalism' of 'Community Architects' and the Implications for Architectural Education: Reflections on Practice from Thailand. Unpublished doctoral thesis. London: University College of London [Online]. Available: http://discovery.ucl.ac.uk/1306880/1/1306880.pdf [2016, February 14].

Tucker, R. & Abbasi, N. 2012. Conceptualizing teamwork and group-work in architecture and related design disciplines, in *ASA 2012: Proceedings of the 46th Annual Conference of the Architectural Science Association*, *Building on knowledge, theory and practice*, Griffith University, Gold Coast, Queensland. 1-8. [Online]. Available: http://hdl.handle.net/10536/DRO/DU:30051739 [2016, February 14].

Tural, E. 2011. Public Service, Activist Architecture or Social Justice? A Typology for University-Based Community Design Centers and Success Lessons from Different Models. Unpublished doctoral thesis. Arizona State University. [Online]. Available: https://repository.asu.edu/attachments/56845/content/Tural_asu_0010E_10813.pdf [2016, February 14].

Türkkan, S., Sönmez, N.O. & Kürtüncü, B. 2012. Neither individual nor group: A first year desgin studio experiment, in X. Costa & M. Throne (eds.). *Change Architecture Education Practices: Papers from the 2012 ACSA International Conference*. Barcelona: ACSA Press: 7–14.

UCT. 2012. University of Cape Town. [Online], Available: http://www.uct.ac.za/dailynews/?id=8211 [2015, March 25].

UJ. 2015. UJ Unit 2. [Online], Available: http://uj-unit2.co.za/ [2016, February 14].

Van den Akker, J., Bannan, B., Kelly, A.E., Plomp, T. & Nieveen, N. 2007. An introduction to educational design research, in T. Plomp & N. Nieveen (eds.). *Proceedings of the seminar conducted at the East China Normal University.* Enschede Netherlands: Netzodruk: 9-104.

Van der Wath, E. 2013. Design/build and interior design: engaging students in technical development. *South African Journal of Art History*, 28(3): 181–195.

Vienna University of Technology. 2015. design.build. [Online]. Available: http://www.design-build.at/orangefarm1.html?&L=1. [2016, February 14].

Vlahos, E. 2000. Serving Communities: Learning in the Real World, in L.V. Wells-Bowie (ed.). *88th ACSA Annual Meeting*. ACSA Press. 95–100.

Voulgarelis, H. & Morkel, J. 2010. The importance of physically built working models in design teaching of undergraduate architectural students, in *Connected 2010 - 2nd International Conference on Design Education*. [Online]. Available: http://connected2010.eproceedings.com.au/index.html [2016, February 14].

Voulgarelis, H. 2012. Investigating Design-Build as an Alternative Model for Architectural Education, in X. Costa & M. Thorne, (eds.). *Change Architecture Education Practice*s. Barcelona: ACSA Press: 263–267.

Voulgarelis, H.E.D. 2010. Design-build – towards an optimum platform for meaningful part-time architectural studies. Unpublished manuscript. Cape Town: Cape Peninsula University of Technology.

Waddell, T. 2014. Is this the architecture. [Online], Available: https://situatedarchitecture.wordpress.com/2014/10/23/architecture-improvisation-and-the-energy-of-place/ [2014, October 25].

Warmoth, A. 2000. Social Constructionist Epistemology. [Online], Available: http://www.sonoma.edu/users/w/warmotha/epistemology.html [2014, October 23].

Weber, E. 2014. Connecting to the Real: Digital Fabrication, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 22–23.

Weber, E. 2014. Desert Oasis: A Design-Build Project in the Mojave Desert, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press. 21–22.

Weber, E. 2014. Connecting to the Real: Digital Fabrication, in T. Cavanagh, U. Hartig, & S. Palleroni (eds.). *Project Proceedings from the 2014 Fall Conference*, 16-18 October, Halifax, NS: Host School, Dalhousie University: ACSA Press 17–18.

Webster, H. 2008. Architectural Education after Schön: Cracks, blurs, boundaries and beyond. *Journal for Education in the Built Environment*. 3(2):63–74.

Wenger, E. 2010. Communities of practice and social learning systems: the career of a concept, in C. Blackmore, (ed.). *Social Learning Systems and Communities of Practice*. London: Springer. 179–198.

Wenger-Trayner, E. & Wenger-Trayner, B. 2013. Learning in a landscape of practice, a framework. In E. Wenger-Trayner, M. Fenton-O'Creeve, M. S. Hutchinson, C. Kubiak, & B. Wenger-Trayner (eds.) *Learning in Landscapes of Practice*. London and New York: Routledge Taylor & Francis Group.

Wengraf, T. 2001. *Qualitative Research Writing*. London: SAGE Publications.

Werner, C. & Mayer, S. 2005. Addon 20 Höhenmeter. [Online]. Available: http://www.add-on.at/cms/cat17.html [2016, February 29].

Williams, A. Henry, L. Tucker, R. Abassi, N. 2013. Group-Work: Does It Have To Be That Bad? In AUBEA 2013: *Proceedings from the 38th Australasian Universities Building Education Association Conference*, 20-22 November, Auckland, New Zealand. AUBEA

Wortham, D.W. 2008. *Activity Systems in the Inquiry Classroom*. Published doctoral thesis, University of Wisconsin-Madison. Ann Arbor: Proquest.

Wu, S. 2007. A New Trend of Architectural Practice and Education: Community-Based Design/Build Programs. Montreal Quebec: McGill University: [Online]. Available: https://www.mcgill.ca/mchg/files/mchg/wu_isd_essay.pdf [2016, February 14].

Yale School of Architecture. 2015. The Jim Vlock First Year Building Project. [Online]. Available: http://architecture.yale.edu/student-life/vlock-building-project [2016,February 14].

Yamagata-Lynch, L.C. 2010. *Activity Systems Analysis Methods: Understanding Complex Learning Environments.* New York: Springer.

Zander, R.S. & Zander, B. 2000. *The art of possibility*. Boston: Harvard Business School Press.