An exploration of the student-tutor interaction in the live online architectural design critique

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DECLARATION

I declare that this thesis is my own work and has not been submitted for examination towards any qualification. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of refences given.

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ABSTRACT

This research explores the student-tutor interaction in the live online critique, also known as the design crit, which is a prominent formative design studio activity in architectural education. The purpose of this exploration was to develop an understanding of the student-tutor interaction in this learning setting to guide the development of design expertise of students in online and blended studio contexts. The research method employed for this study is a qualitative exploratory or hypothesis-generating method. The study sought to identify the characteristics of the live online crit setting, the types of student-tutor relationships in the live online crit, and to explore how students and tutors interact in the live online crit. It aimed to uncover the moves that students and tutors make, the modes through which they make them and the methods that they use. The concepts of the moves, modes and methods were drawn from Conversation Theory, Experiential Learning Theory, and Cognitive Apprenticeship, respectively, to explore the learning mediated through conversation, facilitated through experience, and supported through cognitive apprenticeship by the student-tutor interaction in the live online crit. These theories on which the conceptual framework was built, were selected for their close association with the respective practices of the architectural design crit, which feature prominently in the literature. The data includes online surveys completed by graduates, students and tutors, a focus group interview with graduates, and three online crit protocols. I formulated ten characteristics of the live online crit that include internet reliance, participant invisibility, ubiquity, media-intensity, multi-communicability, resource-efficiency, formality, accessibility, work-orientation, and inclusivity. The four types of student-tutor relationships that emerged from the data, are the novice-expert, architect-client, mentee-mentor, and the parent-child relationship. Four dimensions describe the student-tutor interaction in the live online crit namely formative, iterative, formal, and immersive. The student-tutor interaction in this learning setting resembles an assessment, comprises iterative interactions; it is formal and focused, and it extends beyond the live online event. The study contributes to the limited body of knowledge on the student-tutor interaction in the architectural design crit generally, and the live online crit specifically, in the context of a blended undergraduate architectural technology programme in South Africa.

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friend, Dr Hermie Delport, who inspired and supported me throughout this journey. Finally, I wish to thank my dedicated, brave, and inspirational students over the years.

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CHAPTER 1: INTRODUCTION

1.1 Personal rationale

This research was prompted by my practice as studio tutor in an undergraduate programme in architectural technology at a large University of Technology in South Africa. Moving from a traditional full-time to a part-time studio allowed me to explore ways to better support a diverse body of mature and working students to be successful in their pursuit to developing design expertise whilst working.

I was interested to understand how studio teaching can be mediated with technology and facilitated online, allowing students to study remotely, and supporting flexibility in a blended learning design. My research was conducted concurrently with experiments in the architectural design studio, which led to the learning design of a blended programme in architectural technology, which forms the context of this exploration.

1.2 Research aim

The aim of the study was to explore the student-tutor interaction in the live online crit. Although this study was conducted in a specific cultural setting, namely a blended undergraduate programme in Architectural Technology at a University of Technology in South Africa, the findings should inform blended learning designs in architectural education specifically, and design education more broadly. When this research was conducted, online learning in architectural education was limited (Salama & Crosbie, 2020). In the meantime, the sudden shift to online learning globally, in response to the coronavirus pandemic, has highlighted the need for a better understanding of how learning happens in these online spaces and how they should be mediated (Delport *et al.*, 2020; 2021; Morkel *et al.*, 2021).

1.3 Research focus

The research focus is the student-tutor interaction in the live online critique. This teaching and learning practice is at the heart of architectural education, and commonly referred to as the signature pedagogy. Because this practice is widely known as the 'crit' rather than the 'critique', all references in this thesis are made to 'crit' (instead of 'crtique'). However, these terms are often used interchangeably.

I explored the interaction between the student and the tutor, considering that students also learn from their peers, employers and other practitioners and mentors. However, the study focuses on this particular interaction, in a blended studio of an undergraduate programme in architectural technology at a University of Technology in South Africa. The study was conducted in the years preceding the

covid-19 pandemic, during which time online architecture and design studios were limited. The case focuses on a particular timeframe, involving students, recent graduates and tutors, and exploring three crit instances near the end of a project at the start of the academic year.

1.4 Context

The context of this study is the undergraduate architectural studio, and specifically the part-time studio, focusing on the student-tutor interaction in the live online crit that represents a prominent practice of studio pedagogy.

1.4.1 Architectural Education in South Africa

The unique challenges associated with Higher Education (HE) in South Africa and the global South, 'worldwide growth and increasing demand for access to HE, changing learner demographics, the need for changes in cost, affordability and economic models for HE' (Cronjé, 2016:135) are well documented. This study is based in the context of a developing country where 'the relevance of current HE structures is questioned through student protests and decolonisation of education practices is called for' (Gachago *et al.*, 2017:1).

1.4.2 The architectural design studio

The architectural design studio is the signature pedagogy of professional architectural education (Cuff, 1992; Brown, 2020; Crowther, 2013; Shulman, 2005). Referring to Shulman's work, McLain (2022:1630) writes that signature pedagogies focus 'on the shared assumptions and practise in the wider educational communities, beyond the individual classroom or institution.' He further states that it 'is concerned with what is at the heart of a discipline, as exemplified by how subject teaching is framed at the macro level', revealing its 'assumptions and biases'.

The signature pedagogy of architectural studio dates to the studios at *Ecole Des Beaux Arts* (1819–1914) that employed the 'atelier' method. Students developed their design skills under the supervision of professional architects (Anthony, 1991; Schön, 1984), through a process of projects, problem-solving and learning by doing (Buchanan, 1992). In the period from 1919 to 1932 the studio was adapted by the *Bauhaus School*, and in the 1970s Donald Schön presented design studio learning as simulating real professional action (1983, 1985, 1987) where learning happens by doing through the experiential learning model (Kolb, 1984).

1.4.3 The architectural design crit

The well-established studio practice of the crit, also known as the design critique, review, seminar or tutorial, is associated with the mastery of architectural design expertise (Kuhn, 2001; Voulgarelis & Morkel, 2010). In this study, crit refers to the tutorial

or seminar or desk crit, located in the 'protected' space of the studio (Winberg, 2004:326); and not the design review that is an assessment, in the 'contested' space of the public review (p. 327). According to McCarthy (2011:2):

> 'The aim of the design crit is to provide ungraded oral formative or summative feedback, depending on when the crit occurs in relation to the design exercise, and to prepare students for their careers as professional designers presenting their designs to clients.'

1.4.4 The live online crit

In this study, the live online crit is mediated through a webinar or web seminar (refer to Figure 1). It is a synchronous online presentation, seminar, lecture or workshop (Humphrey *et al.*, 2013, cited in Zoumenou *et al.*, 2015:62) that comprises of visual and audio components. In this context it is used, not for direct instruction through information transmission, but for knowledge construction (Wallace, 2003). Wang and Hsu (2008) listed the advantages of using webinars as affordable, enabling synchronous communication and facilitating real-time multimedia demonstrations. Furthermore, they facilitate multilevel interaction and provide environments in which participants can archive seminar content for personal review or for people who missed the real-time sessions.
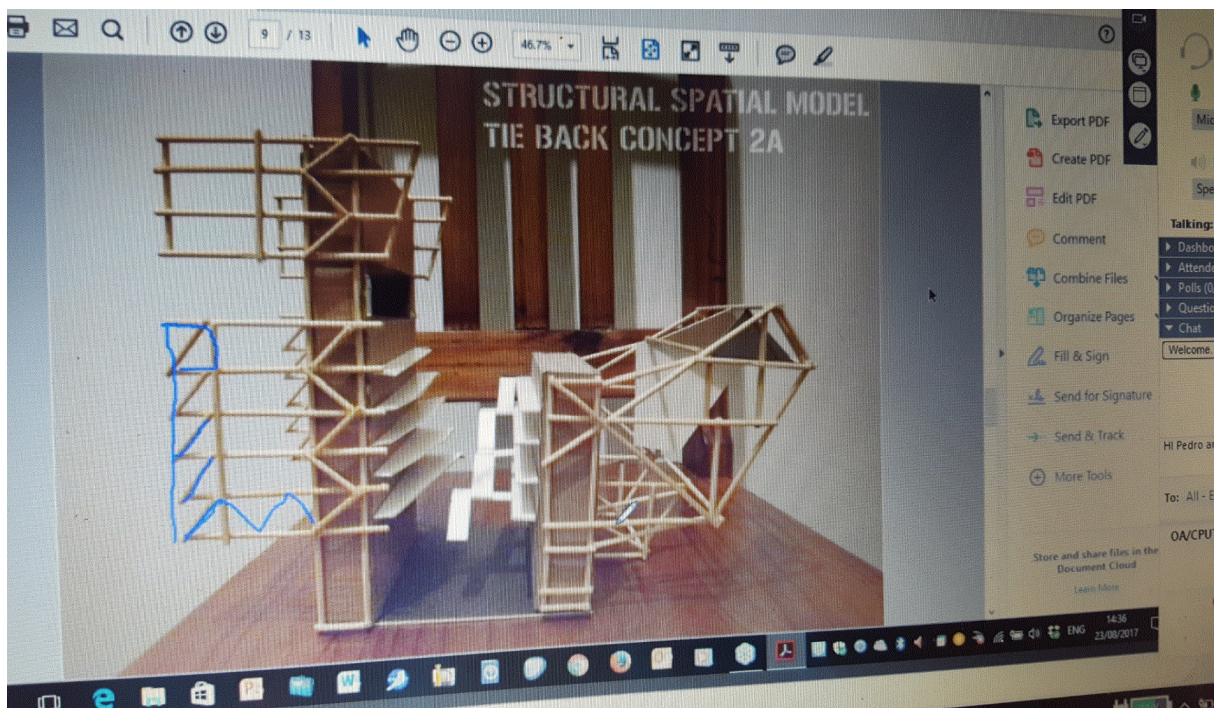
Figure 1: Screenshot of crit in progress

1.4.5 Student-tutor interaction

According to Ferreira, Christiaans & Almendra (2016) the student-tutor interaction forms the key to the design studio setting.

1.5 Research questions

The research questions that guide this research are:

RQ1:   What are the characteristics of the live online crit setting?

RQ2:   What are the types of student-tutor relationships in the live online crit?

RQ3:   How do students and tutors interact in the live online crit?

RQ3.1:   What are the moves that students and tutors make in the live online crit and how are they employed in learning through conversation?

RQ3.2: What are the modes of student-tutor interaction in the live online crit and how are they employed in learning through experience?

RQ3.3:   What are the methods of student-tutor interaction in the live online crit and how are they employed in learning through cognitive apprenticeship?

1.6 Conceptual framework

The three most prominent types of student-tutor interaction and ways to learn, that emerged from the literature, describe the conceptual framework employed in this study. The moves were drawn from Conversation Theory, the modes from Experiential Learning Theory and the methods from Cognitive Apprenticeship. These three theories were chosen based on their prominent association with the practice of the design crit, as set out in the conceptual framework (see section 2.4).

Considering Diana Laurillard's Conversational Framework (1883), Kolb's Experiential Learning Cycle (1984), and Collins, Brown and Holum's Cognitive Apprenticeship model (1991), the moves (learning through conversation), modes (learning through experience) and methods (learning through Cognitive Apprenticeship), were compiled, as discussed below.

1.6.1 Moves: Learning through conversation

This research draws on literature on learning through conversation (Laurillard, 2002, 2013; Blair, 2006; Lam, 2011) to explore how students and tutors interact in the live online crit. Conversation theory is a cybernetic and dialectic framework that offers a scientific theory to explain how interactions lead to 'construction of knowledge', or 'knowing' through social constructivism (Laurillard, 2012:98).

Although there is limited reference to Laurillard's Conversational framework in architectural education research, an increase can be observed in recent literature, for example Burton (2018) and Iftikhar, Crowther and Burton's (2018) research on student engagement in the architecture studio.

The moves extracted from the theory and incorporated in the conceptual framework are *present, question, comment, adapt* and *reflect*.

1.6.2 Modes: Learning through experience

This research draws on literature on learning through experience (Kolb, 1984; Lewin, 1957; Dewey, 1938; Carey *et al.*, 1999; Blair, 2006; McLeod, 2013; Gunawardena, Lowe & Anderson, 1998).

The architectural studio, through its origins in the *beaux-arts* tradition, focuses on learning by doing (Dewey, 1938) and solving problems of varying complexity (Steinø & Khalid, 2017). Drawing on Kolb's Experiential Learning Cycle, therefore, is appropriate.

The 'thought and act processes' of designing are 'interconnected' as suggested by Belkis Uluoglu (2000:35), 'linking doing and thinking' (Maftei & Harty 2015:54) and bringing about 'discovery of new meanings' as suggested by Schön and Wiggins (1992:154).

The modes identified from the theory, and included in the conceptual framework are *negotiation, exploration, reflection*, and *application.*

1.6.3 Methods: Learning through cognitive apprenticeship

The third theme is based on learning through cognitive apprenticeship. It is a process by which learners learn from a more experienced person by way of cognitive and metacognitive skills and processes (Dennen & Burner, 2007).

This study draws from the Cognitive apprenticeship (CA) instructional design model, originating from situated theory, which was introduced in 1989 and developed by Allan Collins and John Seely Brown (Collins, Brown & Newman, 1989). The model presents learning occurring as experts and novices interact socially, focused on completing a task. Collins, Brown and Newman (1989:456) define CA as 'learning-through-guided-experience on the cognitive and metacognitive, rather than physical skills and processes'. The concepts of situatedness and legitimate peripheral participation (Lave & Wenger, 1991) are key to CA as a method of learning. Situated learning occurs through students' active participation in authentic contexts. Cognitive skills are developed through participation in authentic learning experiences and tasks (Dennen, 2004).

The modes formulated in the conceptual framework include *articulation, exploration, reflection, modelling, scaffolding,* and *coaching.*

1.7 Academic rationale

The need for a unique approach to architectural education in sub-Saharan Africa, which is still largely based on the legacy model that originated in Western Europe (Salama & Crosbie, 2020), is emerging. With reference to recent PhD theses completed by Mark Olweny (2017) reported on an increase in attention paid to architectural education across sub-Sahara Africa. Although the design studio is covered as the context of learning architectural design, none of these studies focus on the online crit specifically.

Furthermore, tutors teach the way they were taught (Blair, 2006), and specifically in sun-Saharan Africa, the uptake of technology for teaching has provided challenges (Olweny, 2017). Epecially in view of the sudden shift to online learning compelled by the pandemic, research to guide the student-tutor interaction and respective crit practices, are much needed in architectural education. This is specifically true for sub-Sahara Africa where resource and proximity constraints (Olweny, M.R.O., Morkel, J. Delport, D. Ndibwami, A. Whelan, D., 2021), and the 'strong influence of tradition' (Olweny, 2017:10) provide prominent barriers to architecture students' academic performance.

Although online learning promises to address a lack of resources and access to experts, in sub-Saharan Africa, at the same time it can be constrained through unastable internet connectivity and power supply.

1.8 Research paradigm

The research paradigm as 'overarching philosophical system' (Lincoln, 2005:230) comprises my ontological, epistemological and methodological premise as a researcher (Denzin & Lincoln, 2005, cited in Lincoln & Guba, 2013).

In this research I take a social constructivist ontological position, adopting social constructivism as a theory about the 'development of knowledge through the interactions that individuals have with each other' (Taylor, 2018:218). This position is based on the premise that 'things and meanings don't exist independently, but that they are socially constructed' and that these 'socially constructed meanings are in a constant state of revision' (Taylor, 2018:218). As a researcher and educational practitioner my own account of the social world is a construction that is presented here as a version of reality.

The epistemological frame that motivated my research approach and actions, is Interpretivism. It considers that the nature of knowledge involves no single reality, but that it must be interpreted. Rather than objective and measurable facts,

'interpretivist epistemology seek out subjective beliefs that are co-created by the researcher and the researched...' (Lincoln & Guba, 2013:88).

These philosophical assumptions framed the research questions, methods, data analysis and the discussion of the findings.

1.9 Theoretical perspective

In this research I adopt social constructivism as a theory about the 'development of knowledge through the interactions that individuals have with each other' (Taylor, 2018: 218). This position is based on the premise that 'things and meanings don't exist independently, but that they are socially constructed' and that these 'socially constructed meanings are in a constant state of revision' (Taylor, 2018: 218). As a researcher and educational practitioner my own account of the social world is a construction that is presented here as a version of reality.

The theories that I employ to explore the student-tutor interaction in the live online crit, namely conversation theory, expertiential theory and cognitive apprenticeship, support this theoretical perspective. The work of Laurillard (2012), Kolb (1984) and Collins *et al*. (1999) build on the work of Dewey (1983) and Vygotsky (1962), who emphasised the role of communication and interaction in learning.

1.10 Research methodology

To investigate the student-tutor interaction in the live online crit, I conducted an in-depth exploration of the live online crit as a bounded activity (Yin 2009). I employed qualitative exploratory or hypothesis-generating research methods in a single case (Yin, 2009), to discover patterns and relationships through analysis and interpretation (Auerbach & Silverstein, 2003; Braun & Clarke, 2006). In the next section, I discuss the Research design, intervention, instruments, and the research process. This section concludes with the analysis and interpretation of the data.

1.10.1 Research design

I explored a single case (Yin, 2009), to discover patterns and relationships through analysis and interpretation (Auerbach & Silverstein, 2003; Braun & Clarke, 2006). The objective of exploratory research is to gather preliminary information that will help define problems and suggest hypotheses. I adopted the two principles for qualitative hypothesis-generating research formulated by Auerbach and Silverstein (2003), namely 'questioning rather than measuring' and 'generating hypotheses using theoretical coding' (2003:17).

These qualitative research methods involved the use of 'research participants as expert informants (Auerbach & Silverstein, 2003:31), and 'reflexivity as the explicit use of the researcher's subjectivity and values', as sources of knowledge (2003:32). In

this research I bring my own values, positioning, and disciplinary traditions to interpret the data.

1.10.2 Research intervention

The research questions and setting informed the exploratory research intervention. To determine the characteristics of the student-tutor interaction in the live online crit, the relationship between the student and tutor, and to explore how students and tutors interact in this learning setting, demanded two sets of data, namely feedback on the experiences of the students and tutors, as well as observations of the live online crit interaction itself. Given that the the live online crit sessions were automatically recorded, allowed the researcher the opportunity to observe and explore the interaction without possible interference. The Crit Notation Method provided a graphic notation schema to explore the crit protocols.

Furthermore, it was important to collect data from the different actors, including current students, graduates, as well as tutors. Both inductive and deductive thematic analysis methods were used to analyse the data.

The conceptual framework guiding the analysis of the data, is constructed of three theories that frame learning as conversation, experience. and cognitive apprenticeship, the refinement of which led to the formulation of the Crit Interaction Model.

1.10.3 Research instruments

The research instruments for this study include online surveys with current students, recent graduates and tutors, a focus group interview, and three crit protocols. The focus group interview was conducted with five graduates and the online survey was completed by 13 graduates, 23 students (year 1 and year 2) and five tutors. Three year-1 online crit protocols were selected to form part of the data set.

The focus group interview and the online survey data were collected to explore the students', graduates' and tutors' perceptions of the online learning setting, the student-tutor relationships, and the student-tutor interaction in the live online crit. The online crit protocol data were collected to explore how the student and tutor interact in the live online crit.

The three crit protocols were selected through purposive sampling, from the repository of recorded crit interactions linked to the case. These recordings were selected based on the degree of student engagement (three highly engaged students were chosen) and the range of different design approaches adopted by the respective students. Student C1 (Architecture and human senses) explored

different sensory strategies, student C2 (Pathways and planes), was interested in design elements for space-making, and student C3 (Duality) wanted to translate an abstract idea into form. The two tutors present (T1 and T2) were constant, with the researcher as participant observer (T2). The crit protocol data set is naturally occurring data (Potter, 2002) because it exists regardless of the research intervention.

1.10.4 Research process

The research process is graphically explained in Figure 10. I employed qualitative exploratory or hypothesis-generating research methods in a single case, to discover patterns and relationships through analysis and interpretation (Auerbach & Silverstein, 2003; Braun & Clarke, 2006).

The objective of exploratory research is to gather preliminary information that will help define problems and suggest hypotheses. I adopted the two principles for qualitative hypothesis-generating research formulated by Auerbach and Silverstein (2003), namely 'questioning rather than measuring' and 'generating hypotheses using theoretical coding' (2003: 17).

These qualitative research methods involved the use of 'research participants as expert informants (Auerbach & Silverstein, 2003:31), and 'reflexivity as the explicit use of the researcher's subjectivity and values', as sources of knowledge (2003:32). In this research I bring my own values, positioning, and disciplinary traditions to interpret the data.

Two categories of data were gathered and analysed; the first to establish what the students and tutors say about the student-tutor interaction in the live online crit, and second, what their practice shows, in other words, what they do. For the former, a focus group interview and online surveys were employed, and for the latter, crit protocols were analysed.

1.10.5 Analysis and interpretation of the data

To find the answers to RQ1 and RQ2, I used inductive reasoning to thematically analyse the focus group interview and online survey data. To find the answers to RQ3 (RQ3.1 – RQ3.3), I applied deductive reasoning to thematically analyse the same focus group interview, online survey, and the online crit protocol data.

I followed a reflexive thematic analysis (TA) approach as described by Braun and Clarke (2006). The purpose of TA is to identify patterns of meaning (Braun & Clarke, 2014) across a dataset in response to a research question. Through a rigorous process of 'data familiarisation, data coding, and theme development and revision', patterns are identified (Braun & Clarke, 2006:79). Braun and Clarke (2006; 2014) posit

that, rather than codes and themes emerging from the data, they are actively generated and constructed by the researcher, through various iterations.

1.11 Rationale and significance

This research explores the student-tutor interaction in the live online critique, also known as the design crit, which is a prominent design studio activity in architectural education. The purpose of this exploration was to develop an understanding of the student-tutor interaction in this learning setting, to guide the development of design expertise of students in online and blended studio contexts. At the time of the study, online crits were novel and rare. However, since the outbreak of the pandemic, the live online crit as a learning setting has grown in popularity. This has exposed the need for further research in this field.

This research draws on Conversation Theory, Experiential Learning Theory, and Cognitive Apprenticeship, to explore the learning mediated through conversation, facilitated through experience, and supported through cognitive apprenticeship by the student-tutor interaction in the live online crit. These theories have not been employed extensively in architectural education research, and the result of this research adds to the limited body of knowledge.

1.12 Role of the researcher

As a social constructivist researcher, I am aware of how my own personal, cultural and historical background informs how I interpret the data. Therefore, I position myself, my experiences, and my personal background in the research, to interpret the meanings that others have about the world (Creswell, 2007; Auerbach & Silverstein, 2003). Moreover, the research says as much about me as it says about the terrain that it maps (Clarke, 2017). My bias is the belief that knowledge is socially constructed and that there should be trust in a student-tutor relationship for learning.

In my role as the University coordinator of the part-time programme, I acted as participant observer in this study. This means that a degree of subjectivity was inevitable. However, it equipped me with valuable perspectives and insights (Creswell & Poth, 2017). I employed verification strategies, including triangulation using multiple data sources, namely a focus group interview, online surveys and crit protocol analyses; and peer review by a colleague not involved in the programme, who checked the research process and coding samples. Furthermore, to balance my input as a tutor in the crits, another colleague performed the role of tutor 1.

1.13 Limitations of the study

Although peer to peer learning is acknowledged as a valuable component of the studio, this study focuses exclusively on the important learning interactions between the student and the tutor (Quinlan, Corkery & Marshall, 2007). Therefore, Diana Laurillard's Conversational Framework captures what it takes to learn, involving the student, tutor and peer, but in this study the role of the student peer is purposefully excluded.

The limitations of the study are mainly related to the size of the study group, and the specifics of the context. The findings are based on a single case and therefore these cannot be generalised to all cases and situations. The size of the student group was limited (40 in total) and although the online surveys were completed by a good representation of the total group, the protocol analyses focused on three students only, and the face-to-face focus group interview, because of the location, was limited to students residing in Cape Town.

A larger and more varied study group would have allowed more variation and depth in the findings. For example, compared to this study that is focused on mature part-time students, future research could focus on a younger and perhaps also full-time student population.

In view of the subsequent sudden pivot to remote and online learning and teaching in 2020, that amplified problems with student inequalities in the architecture studio globally (Morkel *et al.*, 2021), the research results should be even more widely transferrable.

In this research I did not attempt to compare online learning with the traditional onground alternative, and I did not evaluate its success. Through the qualitative exploratory approach, I sought to provide a deep understanding of the student-interaction in the live online crit, that was the most prominent synchronous learning interaction component of the blended learning design. Therefore, although I noted the instances when certain behaviours were observed, I did not measure the frequency of these occurrences.

Furthermore, although I used the crit graphics to support the audio data, in my analysis I focused on the concepts and meaning expressed and communicated via the audio that was recorded and transcribed, and I did not analyse the graphic content that was exchanged between the student and the tutor.

In a future study, rather than Thematic Analysis, Content Analysis might be employed as a methodology to reveal a broader range of textual matter, symbols, messages, information, mass-media content, and technology supported social

interactions (Krippendorff, 2004; Hsieh & Shannon, 2005), that were mediated between the student and the tutor. Finally, Discourse Analysis through which detail like gestures and pauses would be recorded, can also be considered.

1.14 Contribution of the research

Considering the moves, modes, and methods, I formulated five ways that the student and tutor interact, namely through tutor feedback on student presentation, interconnected thinking and doing, student support through modeling and cognitive scaffolding, limited socialisation, coaching and supportive scaffolding; and frequent online navigation. When these five ways that students and tutors connect in the live online crit are considered in the context of the characteristics of the live online crit and the most prominent student-tutor relationships present in the live online crit, four dimensions can be identified namely formative, iterative, formal and immersive. The student-tutor interaction in the live online crit resembles an assessment (formative), comprises complex iterative interactions (iterative); it is formal and focused (formal), and it extends beyond the live online event (immersive).

The student-tutor interaction in the live online crit is formative: it is more like a formative assessment than a design session, and more like a student presentation than a lecture. In this study I found that this kind of crit does not resemble a lecture, nor a 'tutor monologue', that is often associated with the traditional crit (Blair 2006:33). Instead, through its focus on the student's performance 'judged' by the tutor, the interaction resembles an assessment. These findings are broadly in line with those of Iftikhar, Crowther & Burton (2021), who, based on blended studio interactions during the pandemic, identified the student in presenter and reflector roles. However, I found in this study that the student's behaviour was dominated by present moves, and less so reflective. This finding supports the literature that '(d)esign critiques set an environment for students to get feedback on their design (Milovanovic & Gero, 2018:2). A similar protocol followed in an online studio that was the object of a recent study by Ceylan *et al*. (2020:207), revealed that 'in order not to waste time during the lesson… studying of uploads by the instructors before design studio and discussing of the proposals during the studio' formed the focus of the live online crits.

Because the tutor is not lecturing, the student does not typically ask questions. However, instead, the tutor may ask questions to prompt student reflection. Furthermore, the tutor may provide hints, comments, and explanations. Because it is not a design session, there is no reflection-in-action. In the first half of the crit the student would mostly employ negotiation of meaning around the theory by

presenting, and in the second half of the crit she will typically switch to application, which is more like a demonstration, in other words, to show how the theory would be applied.

Because the student-tutor interaction in the live online crit is more like a formative assessment than a design session, there is limited potential for creating and making. This finding is in line with recent studies that found that the making aspect of the online studio is lacking and needs further investigation (Fleischman, 2021).

The live online crit demonstrates the capacity for complex iterative transactions that involves exploration and reflection, to alternate working on concepts and experience (Laurillard, 2002, 2013; Lam, 2011). These design crit behaviours of students and tutors echo what McDonald, Michele and Rich (2021:n.p.) describe as 'navigat(ing) the complex worlds of significance associated with studio pedagogy.' However, the results confirm Christine Percy's (2004) concern that the crit lacks opportunities of sensemaking through reflection. In her work on the asynchronous online crit, she found that 'students privileged description and explanation of process and technique over a demonstration of their command of critical exposition and an ability to conceptualise' (p. 147).

The iterative dimension of the student-tutor interaction in the live online crit describes the interconnected thinking and doing where exploration happens as the testing of alternatives by both the students and the tutor and reflection is about making sense during and after the crit. Reflection during the crit is generally dominated by the tutor, who would typically model reflective behaviour to the student to make problem-solving visible. This involves reflection-on-action, in response to the work that students prepared for the crit, and reflection-in-action, which was limited because the live online crit has shown to be less of a design session than an assessment. An added reflection dimension discovered in this study, is reflection-on-interaction through the students' viewing of the crit recording. This finding is supported in a recent study by Ceylan *et al.* (2020), who found that students valued the availability of recordings of online sessions to revisit important discussions and feedback. In fact, they found that students wish to view these recordings repeatedly, to make sure they don't miss any important guidance, and to galvanise their understanding.

In this study I found that, similarly to Milovanovic and Gero (2018:11) that 'students present and defend their design solution while tutors analyze and question the design situation.' These findings further correlate with a recent study by Nespoli, Hurst and Gero (2021) who studied verbalisations of tutors' and students' discussions in 13 weekly sessions using topic modelling and Function-Behaviour-Structure (FBS)

ontology analysis. This research focused on movements in the problem-solution continuum, and interactions between student and tutors. They found that tutors' cognitive behaviour was more focused on the theoretical abstraction of the design challenge and its communication and students' cognitive behavior more concrete and focused on the practical considerations of the project.

The crit (C2) that best performed in terms of student reflection, was also the one that contained the largest variety of media, including photos of physical models. This student's crit behaviour demonstrated the crit strategy described by Cindioglu (2021: n.p.) as 'taking advantage of digital design tools in the early design phase to reduce their fear of failure and their procrastination tendencies related to perfectionism.' Milovanovic and Gero (2018:11) refers to the work of Nigel Cross (1982) suggesting that, in the context of the design studio, the challenge is for students to learn how to reflect in creative designerly ways. This remains a challenge in the live online crit and requires further investigation.

Compared to the traditional desk crit, described by Shrand and Eliason (2011: 60) as 'a private conversation with a tutor' and as 'informal', the live online crit is particularly formal. The student-tutor engagement displays limited social and informal interaction, coaching or small talk, and serendipitous interaction is largely absent. This finding is supported by a recent study by Yu *et al*. (2021:2) that 'it may be difficult to translate the socialisation component of the studio into an online form.'

The formal and focused, structured, and systematic protocol associated with the present study is mimicked by the evaluation by Ceylan *et al*. (2020:210) of the online architectural design studios during the pandemic outbreak:

> 'The organization of table critiques is revised as online critiques that of the student works pre-evaluated by the instructor, which may give opportunity to the instructor to think about the students works in a wider perspective. In that case, the pre-evaluations are transferred verbally to the students one by one and questions have been answered by instructor during online studio hours. That conversion might have brought a more systematic approach for students to develop their works'.

The live online crit provides opportunity for cognitive apprenticeship to promote the development of expertise (Collins, Brown & Holum, 1991:14) in a structured and systematic fashion, but it does not normally include social and informal interaction with the tutor, not coaching or extensive scaffolding methods. Yet, several authors emphasise the importance of social interaction with the teacher or tutor as a critical part of online learning, that should not be neglected (Offir & Lev, 2000; Salmon, 2000;

Lotz, Jones & Holden, 2015), and requires further investigation (Fleischman, 2021; Ceylan *et al.*, 2020).

The student-tutor interaction in the live online crit is immersive, accommodating different media and multiple channels of communication, and it extends beyond the crit through reflection-on-interaction by viewing of the recording after the session. These findings contradict the assertion by Yu *et al.* (2021:2) that '… virtual studios tend to prioritize digital presentation techniques at the expense of hand drawn presentations.' However, they also admit that '(I)n architectural studios, Blackboard Collaborate Ultra is particularly popular since it allows tutors to draw on top of students' work, which to a large extent simulates the sketching process of traditional face-to-face studios' (p.3).

The online medium of the live online crit requires, for example, time for navigation and internet-reliance which can cause stress for students. On the other hand, it promotes inclusivity, through students' ability to study remotely and whilst working, making use of workplace resources. Wayfinding and navigation can be time-consuming, but these can be managed through assigning screensharing roles and responsibilities and negotiating efficient online 'housekeeping' rules. These aspects, too, require further exploration.

This research contributes to the limited body of knowledge in the field of online architectural design education generally, and the student-tutor interaction in the live online crit specifically. Although research in this domain is growing, there is limited empirical research on synchronous online learning facilitated through the webinar platform, and less so focusing on the ways that students and tutors interact. In this section I reflect on two scientific contributions that resulted from this research, in addition to the findings prompted by the research questions.

The development of the crit notation method (CNM) as research visualisation is discussed in section 3.7. I used this graphic instrument to represent the different moves, methods, and modes of the student-tutor interaction, thereby developing a graphic language or syntax that can be employed to 'read' such interactions, to map them and reflect on them.

Drawing on Laurillard's Conversational Framework, Kolb's Experiential Learning Cycle and Collins, Brown and Newman's (1989) Cognitive Apprenticeship model, has proven to be useful. These three models have not been combined in this way before, to explore the student-tutor interaction in the live online crit. A recent study by Iftikhar, Crowther, and Burton (2018) draws on Laurillard's Conversational Framework to explain the dialogic interactions between the students, design tutors and unit

coordinators. However, this framework has not yet been used to explore the student-tutor interaction.

I mapped the data to a large extent over the conceptual framework, in terms of the moves, modes, and methods associated with the student-tutor interaction. It provided a useful tool to analyse the complex interactions between the student and tutor. The diagrams below show the evolution of the conceptual framework, into a provisional Crit Interaction Model (CIM), that represents the different dimensions of the student-tutor interaction in the context of this study. The CIM should be tested with other sets of data to establish whether it can be further developed into a tool to guide explorations of student-tutor interactions in the future, ideally at different levels of study, and in a range of different learning settings.

1.15 Definition of key terminology

Architectural Design Studio	The space in which architectural design is mastered, the method that is used and the culture that it represents
Asynchronous interaction	Interaction that happens over time, in other words not at the same time
Blended learning	Appropriate use of a mix of theories, methods, and technologies to optimise learning in a given context (Cronjé, 2020)
Critique	Learning engagement between a student and a tutor – sometimes with peers in attendance. It also known as the desk crit, or crit
Design tutor	Architectural design tutor can be an academic or a practiioner
Learning Management System (LMS)	The major online learning platform that determines a student's learning journey
Methods	Articulation, Exploration, Reflection, Modeling, Scaffolding, Coaching, Navigation, and Socialisation are methods developed from Cognitive Apprenticeship theory
Modes	Negotiation, Application, Exploration and Reflection, developed from experiential theory

Moves	Present, Question, Comment, Adapt, and Reflect, developed from conversation theory
Signature Pedagogy	Pedagogy that is typically associated with a discipline or profession
Synchronous interaction	Interaction that happens at a specific time, in other wordsm in realtime
Studio	It is a learning setting, a mode of learning and teaching, a practice, and a culture that promotes interaction, active learning, as well as social engagement.
Webinar	Web seminar

1.16 Structure of this thesis

This thesis comprises five chapters, as follows:

Chapter 1 introduces the research, and it provides a summary of the literature review, the methodology, findings, and the main contributions of the research.

Chapter 2 comprises a review of the literature in two parts, namely my experience and, secondly a discussion of the literature. The chapter concludes with an overview of the conceptual framework constructed from and employed in the research.

Chapter 3 focuses on the methodology employed in the study, including an overview of the research paradigm and setting, the research sample and data sources, the data collection process, the research methods, authenticity and ethics, and limitations and delimitations.

Chapter 4 includes a discussion of the findings, structured according to the research questions, namely the characteristics of the live online crit setting (RQ1), the types of student-tutor relationships in the live online crit (RQ2), and the interaction of the students and tutors in the live online crit (RQ3), in terms of learning through conversation, learning through experience, and learning through cognitive apprenticeship

Chapter 5 is the final chapter in which I present a summary of the research findings, the contribution of the research, the limitations of the study and recommendations for future research.

1.17 Summary

In this chapter I introduced the research, starting with a personal rationale for conducting the study, explaining the research aim, focus and the context of the study, including the architectural design studio, the architectural design crit, the live online crit, and the student-tutor interaction. Next, the research questions were presented, followed by the conceptual framework developed from the literature. The academic rationale is explained, the research paradigm and the theoretical perspective of the research. Next, the research methodology was covered in terms of the research design, intervention, instruments, process and the analysis and interpretation of the data. The rationale and significance were covered, followed by the role of the researcher, the limitations of the study, the contribution of the research, and the definitions of key terminology. An overview of the structure of the thesis concludes chapter 1. In chapter 2 the literature review is presented.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this chapter I present my experiences and the viewed literature that informed this research. My personal story is followed by a review of the literature comprising three parts namely characteristics of the live online crit setting, the student-tutor relationships in the live online crit and the student-tutor interaction in the live online crit. The student-tutor interaction section covers literature linked to learning through conversation, learning through experience, and learning through cognitive apprenticeship. The chapter concludes with the conceptual framework that was developed based on the literature review. It is followed by a summary of the chapter.

2.2 Transformation

In the next section I share the background to my study, starting with my first encounter with online learning, followed by my exploration of digital technologies in architectural education, followed by a description of the blended learning design on which this thesis is focused.

2.2.1 Introduction to online learning

My learning journey at the intersection of architecture, higher education and Information and Communication Technology (ICT) was more than a decade ago when I was first introduced to the WebCT Learning Management System (LMS) at my university. I tried to use it for the upload of learning material for a first-year Architectural History course that students could access at any time and from anywhere. However, I was soon informed that the server could not cope with the large graphic file sizes. Despite the friendly support by the staff at our eLearning unit, I eventually reverted to a 'manual' system by uploading the material to a central PC on campus, from where students could download when and what they needed. It served the same paperless purpose, except that it was now time-and place bound. Students could only access the material from a single designated computer, and only during office-hours. Although the use of WebCT in this case saved on the cost of printing, it did not do much to enhance the learning experience!

I remained curious about the potential of digital technologies for learning and teaching in architectural design and wanted to explore how it could support student learning, especially for non-traditional architecture students. I was inspired by my dean, an acclaimed Professor of Computers in Education, who would later also become my supervisor. At the time, architectural education globally was bound by the rules, conditions, and practices of the 200-year-old legacy architectural education model (Salama & Crosbie, 2020). Considering the impact of social media

and its potential to make learning and teaching more accessible and drawing on inter-disciplinary exposure at eLearning and computer startup events and symposia, I was ready to challenge these practices by the introduction of innovative educational technologies my studios.

In response to a communication efficiency problem in the third year of the Diploma programme, my colleague and I created a blog to move class announcements and notifications from the campus passage walls into cyberspace. Students had to check the blog daily for announcements and arrangements related to studio-based on-campus learning activities. Soon after this arrangement was implemented, one of my students asked why we didn't consider a closed facebook group 'because', she said, 'we're on facebook all the time anyway'. And that is how one of the first closed facebook groups for voluntary informal learning and teaching was created at our university. The blog served as a noticeboard in the cloud, and the closed facebook group became a digital lounge. These online spaces became active learning settings for student interaction, including lively conversation and sharing (Morkel 2011a, 2011b, 2011c, 2011d, 2012, 2013).

By the time the university moved to Blackboard as the official LMS, a range of free Web 2.0 tools were already employed in the studio for digital storytelling (photostory and moviemaker), QR codes, design journaling (blogger, wordpress and carbonmade) and synchronous and asynchronous interaction (Skype and Facebook).

2.2.2 Exploration of digital technologies

Based on the results of the 2010 third-year experiment, my colleague and I recognized an opportunity to use digital media to allow students to perform their Work-Integrated Learning employment commitments in outlying areas where they had a better chance of securing work. And so, the first blended learning blocked release solution was conceptualized. Instead of weekly visits, students were required to attend quarterly on-campus workshop-type blocks. Technology was introduced in the on-campus sessions (Hitge, 2016), and the off-campus learning activities would be mediated and facilitated online, using available digital technologies (Morkel, 2011a). The proposal was approved and the first cohort to follow this model, was in 2011. My colleague developed an interest in design-build methodology as a hands-on Work Integrated Learning approach and the final block of the year was dedicated to a Service-Learning project based at the St Michael's School in Elgin, near Hermanus, South Africa (Garraway & Morkel, 2014).

The blended model was refined to comprise on-campus blocks, workplace mentoring and online support, through blogging for content and organisation,

student blogs for student-generated content, podcasts for design tutor feedback and a closed facebook group for informal learning and encouragement. Through this project, the online and onsite blended model of teaching and learning was piloted. The University eLearning unit, Fundani, reviewed the student experience of the redsigned programme (Gachago & Ivala, 2012), and concluded that:

> *Results showed that the partly bold and innovative changes in the course design have been welcomed by the students, especially the tools implemented by lecturers to establish a students' community of inquiry during their workplace experience and will support students' future development, such as their ePortfolios.*

2.2.3 Design for blended learning

In the meantime, the South African Institute of Architects (SAIA) established a transformation unit, Open Architecture, to address the demographic inequalities in Architectural education in South Africa. They invited me to serve on the steering committee, to consider how Open Architecture might collaborate with an existing Architectural Learning Site (ALS) at a Higher Education Institution (HEI) to offer blended and flexible part-time studies in Architecture in South Africa, to accommodate non-traditional students, for example those who are working, and mature students returning to university to further their qualifications. At the time, the ALS at the CPUT was the only one actively adopting online learning and teaching strategies for architectural education. When none of the other South African HEIs showed an interest, Open Architecture agreed to shift their focus from the master's qualification to the undergraduate level. This was necessary if Open Architecture wanted to collaborate with the CPUT because, at the time, the CPUT did not offer a professional master's programme. The university-industry collaboration was formalised between the CPUT and Open Architecture as the first of its kind at the CPUT (Morkel *et al.*, 2021b).

During a period of six years, this programme produced 78 BTech Architectural Technology graduates in 5 two-year cohorts, of which 80% were from the previously disadvantaged community. In 2020 the BTech programme was replaced by the Advanced Diploma in Architectural Technology programme when the BTech degrees were phased out as part of a national directive. Building on the track record of the part-time BTech programme, the new Advanced Diploma programme could be offered independently by the CPUT, and the University-Industry collaboration was concluded (Morkel & Cronjé, 2019). When the COVID-19 pandemic demanded a global shift to remote and online teaching and learning, the blended Advanced Diploma programme offering continued online, largely uninterrupted.

Throughout my explorations with digital technologies, whether to enhance onground learning experiences or to expand learning into online and distributed spaces, I acknowleged the importance of the student-tutor interaction, regardless of the mode. Blending office-based mentoring, on-campus block sessions and online support relies on the live online crit as a prominent synchronous online learning setting.

2.3 Review of the literature

The literature reviewed and discussed below, comprise three contextual sections namely the characteristics of the live online crit setting, the student-tutor relationships in the live online crit and the student-tutor interaction in the live online crit.

2.3.1 Characteristics of the live online crit setting

In this section I review literature that describe the characteristics of the live online crit setting, starting with the architectural design studio, followed by the architectural design crit and the live online architectural design crit, specifically. The following section covers literature on the student-tutor relationships in the live online crit.

Architectural design studio

The architectural design studio is the signature pedagogy of professional architectural education (Cuff, 1992; Brown, J. 2020; Crowther, 2013; Shulman, 2005; McLain, 2022). Architectural studio pedagogy dates to the studios at *Ecole Des Beaux Arts* (1819–1914) that employed the 'atelier' method. Students developed their design skills under the supervision of professional architects (Anthony 1991; Schön, 1984), through a process of projects, problem-solving and learning by doing (Buchanan, 1992). In the period from 1919 to 1932 the studio was adapted by the Bauhaus School, and in the 1970s Donald Schön argued that design studio learning simulated real professional action (1983, 1985, 1987) where learning happens by doing through the experiential learning model (Kolb, 1984). Shulman (2005:52) note that 'Signature pedagogies are the types of teaching that organize the fundamental ways in which future practitioners are educated for their new professions'. McLain (2022:1630) postulates that:

> *Signature pedagogies have evolved over time in attempts to bridge the gap between theory and practise, but the conditions (e.g. forms and environments of practise) and the technologies (e.g. affordances facilitated by new tools and techniques) of professions change over time; sometimes requiring that pedagogical approaches adapt and change to reflect the new educational or societal landscape. Whilst change threatens disciplinary*

coherence, it also presents opportunities for both professional learning and general education.

The studio refers to a physical space for learning and teaching, a mode of learning and teaching, a program of activity, and a culture (Brown, 2021) that promotes interaction, active learning, as well as social engagement (Crowther, 2013; STP, 2009). This traditional model builds on a master-apprenticeship relationship where the student takes on the role as the apprentice and the tutor the master. As a signature pedagogy the architectural design studio pedagogy 'implicitly define(s) what counts as knowledge… and how things become known'. It 'define(s) the functions of expertise in (the) field, the locus of authority, and the privileges of rank and standing' (Shulman, 2005:54).

Studio learning is characterised by 'project-based work on complex and open-ended problems, very rapid iteration of design solutions, frequent formal and informal critique, consideration of a heterogeneous range of issues, the use of precedent and thinking about the whole, the creative use of constraints, and the central importance of design media' (Kuhn, 2001:349). Students work towards producing a design proposal, presented in the form of process diagrams, scale drawings in two and three dimensions as well as scale models and a verbal presentation. Their designs develop in response to regular interactions with fellow students and design tutors.

In the studio, design expertise is acquired through the application of theory in practice and involving elements of design thinking and design making (Anderson, 2011). The practice through which this learning is facilitated, the studio critique, also known as the crit or design review (Murphy, Ivarsson & Lymer, 2012.; Attoe & Mugerauer, 1991), is 'characterised by the Socratic traditions of lively and robust questioning and discussion between students and teachers' (Lymer, 2010:6).

Until the recent pandemic necessitated a shift in thinking about how education is offered globally (Salama & Crosbie, 2021), the architectural design studio has been largely unchanged for more than two hundrend years (Webster, 2008).

The architectural design crit

The well-established studio practice of the crit, also known as the design critique, review, seminar or tutorial, is associated with the mastery of architectural design expertise (Kuhn, 2001; Voulgarelis & Morkel, 2010). In this study, crit refers to the tutorial or seminar in the 'protected' space of the studio (Winberg, 2004:326); and not the design review that is an assessment, in the 'contested' space of the public review (p. 327). According to McCarthy (2011:2):

'The aim of the design crit is to provide ungraded oral formative or summative feedback, depending on when the crit occurs in relation to the design exercise, and to prepare the student for their careers as professional designers presenting their designs to clients. This research project sought to test the validity of new design crit types in the context of architectural and design education. This ambition is contextualised by research which has located pedadogical difficulties with the Traditional Crit form, which has been central to architetectural and design education since the nineteenth Century.'

Although their research on the online crit employing the Function-Bahevior-Structure (FBS) Ontology and focus on the content of the student-tutor interactions, they identify the activities in the design crit 'for students to get feedback on their design' (Milovanovic & Gero, 2018:2).

Although the term 'crit' carries a negative connotation, (Parnell & Sara 2007, cited in Marie & Grindle, 2014), I chose to use it instead of 'critique' because it is widely accepted and recognised in architectural education and practice. The crit takes on many forms, including the desk crit, pin up crit, group crit and other (Lymer, 2010; Blair, 2006; Utaberta *et al.*, 2012), and modes, including face to face and online, in real-time (synchronous) or over time (asynchronous), and involving different parties and media (Kuhn, 2001). Research by Finkelstein (2006), Pilkington (2001), Ng (2007), Cornelius and Gordon (2013), and Cornelius (2014) address the online crit, but these are mainly focused on asynchronous interactions.

The crit is the conversational mechanism (Hasirci & Demirkan 2007; Osborne & Crowther 2011; Pask, 1976) through which a student learns to design. The student formulates a design proposal in response to a project brief, supported by 'a two-way conversation steered by the tutor's comments and question prompts' (Hitge 2016:25). This happens iteratively through 'production, manipulations of, and shifts between different representational forms' (Lymer 2010:44), including language and artifacts. The crit is considered one of the signature pedagogies (Shulman, 2005) and a cornerstone component (Parnell *et al.*, 2007; Smith 2011; Webster 2004) of design education.

However, the design crit it is not without criticism. The crit is widely denounced for its adverse effect on student learning (Pope 2005, cited in Blair 2006; Schrand & Eliason 2012). Although recent studies have shown that some students and tutors still believe that the stress and anxiety associated with the design crit is necessary and provides an effective tool for learning (Blair, 2006; McCarthy, 2011; Schrand & Eliason, 2012), several authors suggest that the design crit is 'pedagogically flawed' (Anthony, 1991;

Mitgang, 1999; Webster, 2004; Hitge, 2016:26). Despite the arguments in its defense as so-called 'initiation ritual' (McCarthy, 2011:27), it is believed to hinder rather than promote learning (Blair, 2006). Quinlan, Corkery and Marshall (2007) suggest that studio methodology produces teacher-dominated pedagogies and Helena Webster (2005:286-287) posits that students are 'coerced into reproducing staff-centred constructions of architectural habitus'. She argues that they are expected to display behaviour that is 'profoundly de-motivating and competitive'. The crit is believed to lead to stress and perpetuate asymmetrical power-relations between students and tutors (Bates, 2016; Blair, 2006; Koch, 2002; Lotz, Jones & Holden 2015; Doidge, Sara & Parnell 2007). Yet, studies have shown that some students and tutors (Blair, 2006; McCarthy, 2011; Schrand & Eliason, 2012) still believe that the fear and stress associated with the design crit is necessary and an effective tool for learning. They defend the so-called 'initiation ritual as part of their identity as architectural and design students' (McCarthy, 2011: 27):

> *The room has four white walls. It is twice as long as it is wide. On a wall at one end of the room a student has pinned up and presented their work. The other end of the room allows through traffic. Immediately at the front of the room, one metre away from the student, sit three academic members of staff who are asking questions about the presentation. There is intermittent coming and going at the back of the room, which distracts the twenty or so students who sit or stand behind the academics. This makes it difficult for them to hear what is being said. This is hard enough already, as staff direct their words only to the student who has presented, who in turn, responds only to the staff member concerned. Eye contact is similarly restricted. (Stuart-Murray, 2010: 7)*

In 'Redesigning the Design Crit', McCarthy (2011:5) identifies student anxiety as one of the main criticisms against the traditional crit, together with the 'student inability to learn from the feedback given due to the heightened atmosphere of the crit'.

This learning event, traditionally hosted in a design studio on campus, is considered patriarchal (Willenbrock, 1991), associated with diminished student agency (Sara & Parnell, 2004), stress and asymmetrical power relations (Salama & Crosbie, 2021; Webster, 2005; Olweny, 2020; Olweny *et al.*, 2021; Till, 2009).

Willembrock asserts that asymmetrical power relationships inhibit dialogue, (Willenbrock, 1991), and that, without dialogue there can be no learning (Dutton, 1991). Furthermore, Oh *et al.* (2013:312) explain that 'digital technology has radically

changed the way studio teachers have conversations with students.' Although they referred specifically to asynchronous engagement, and communicating via text, this statement should be tested in online leaning settings including the synchronous live online medium.

Although the design crit 'forms the backbone of studio-based education' (Oh *et al.*, 2013:321), design educators do not formally learn how to conduct online crits, nor is there a common language to describe what happens in the crit, less so in the live online crit. Oh *et al.* (2013) identify the need for the development of more systematic ways of critiquing (p.321):

> 'While instructors, who are often professional architects, can share their professional insights and practical knowledge, they tend to comment on student work without a clear understanding of critiquing or the pedagogy of critiquing.'

The live online crit

Although a lot has been written about the impact of digital technologies on the generation of architectural CAD visualization, there is limited literature on the impact of technology on the studio learning environment and the characteristics of crits conducted in online settings (Webster 2005), especially synchronous (live and real-time) sessions. There's limited precedent and empirical research to guide tutors on the use of live online technology for learning and teaching (Ochsner 2000; Lowenthal, Dunlap & Snelson, 2017) to enhance learning.

Fleischman (2019:1) suggests that

> *Studio teaching bases a high premium on face-to-face interactions which guide learning through dialogue and feedback on individual work. Many design educators believe it is difficult or even impossible to teach design online because of studio-based interactions. Is design one of those disciplines that cannot be taught online because of the studio culture?*

A lot has been written on the architecture studio, but less so in a blended architectural education context. In his study, blended is defined as 'the appropriate use of a mix of theories, methods and technologies to optimise learning in a given context' (Cronjé, 2020:120).

In this study, the live online crit is mediated through a webinar or web seminar. It is a synchronous online presentation, seminar, lecture or workshop (Humphrey *et al.*, 2013, cited in Zoumenou *et al.*, 2015:62) that comprises of visual and audio components. In this context it is used, not for direct instruction through information transmission, but for knowledge construction (Wallace, 2003). Wang and Hsu (2008)

listed the advantages of using webinars as affordable, enabling synchronous communication and facilitating real-time multimedia demonstrations. Furthermore, they facilitate multilevel interaction and provide environments in which participants can archive seminar content for personal review or for people who missed the real-time sessions.

In a study to investigate how students and staff use webinar technology to communicate, Lieser, Taf and Murphy-Hagan (2018) suggest that webinar technology has the most potential to impact student learning in blended environments. They posit that '(W)ebinar technologies enable the delivery of a web-based, interactive seminar through synchronous communication' (p3). It is a practical technology that provides face-to-face capability for students to interact with their instructor and peers through an enriched virtual medium which allows 'simultaneous participation of students and instructors in real-time' (p2). Lieser, Taf and Murphy-Hagan (2018) and Zoumenou *et al.* (2015) called for research to explore the webinar tool as part of a blended learning design.

Wang and Hsu (2008) identified multilevel interaction as one of the five advantages of webinar tools. Anderson *et al.* (2006), found that the live online learning environment of the webinar platform, provides multiple tools for communication and presentation. However, Ng (2007) posit that the webinar platform is a teacher-led learning environment that works best for one-on-one communication.

Some of the challenges associated with online interaction include poor audio and loss of internet connection (Ng, 2007; Wang & Hsu, 2008). On the other hand, Percy posited that the online environment enables students to learn in their home environment where they are 'more relaxed' (Percy, 2004:151). Wang and Hsu (2008) posit that the webinar works well for real-time multimedia demonstrations, but Wang and Hui-Yin (2008, cited by Zoumenou *et al.*, 2015) argue that hands-on demonstrations were less effective in the online environment.

The crit remains a time-consuming, labour-intensive and costly educational model (Hitge, 2016; McCarthy, 2011). Affordability was identified by Wang and Hsu (2008) as one of five advantages of this medium. Bender and Vredevoogd (2006:119) suggest that 'students hear all critiques of all projects and benefit from feedback to their peers' and whenever they want it (Oh *et al.*, 2013). Students get access to the same tutor feedback 'unlike the front row advantage' in conventional settings (Romiszowski, 1988, cited in Bender & Vredevoogd, 2006:119).

2.3.2 Student-tutor relationships in the live online crit

In this section I review literature that address the student-tutor relationships in the live online crit, starting with the context within which these relationships exist, namely architectural education in South Africa. This is followed by a section on asymmetrical power relations as one of the main criticisms of architectural education and which is specifically evident in the design crit. This section concludes with literature on student and tutor roles. The following section focuses on literature on the student-tutor interaction in the live online crit.

Architectural education in South Africa

The unique challenges associated with Higher Education (HE) in South Africa and the global South, 'worldwide growth and increasing demand for access to HE, changing learner demographics, the need for changes in cost, affordability and economic models for HE' (Cronjé, 2016:135) are well documented. This study is based in the context of a developing country where 'the relevance of current HE structures is questioned through student protests and decolonisation of education practices is called for' (Gachago *et al.,* 2017:1).

In Freire's Pedagogy of the Oppressed (2005) he promotes a model whereby instead of teaching, a teacher is learning alongside a student, whilst engaging with him/her in conversation. In his approach he critiques the outmoded conception of education presenting students as absolute ignorant, or tabular rasa. Although the Socratic learning method in architectural education reminds of this approach, it does notm by default, empowers the student.

Furthermore, although the pandemic has accelerated technology adoption in HE generally, when this study was conducted, its uptake was limited and slow (Cronjé 2016; Ng'ambi *et al.,* 2016) – also in architecture education (IUA 2017). Also, in South Africa, the crit as tutor-dominated learning interaction, should be interrogated (Anthony 1991; Mitgang 1999; Percy, 2004; Webster, 2008).

Asymmetrical power relations

Hierarchy and asymmetrical power relations are highlighted as problematic (Higgins, 2001: 273, cited in Blair, 2006:26) in the crit. A more knowledgeable other (Vygotsky, 1978) is to judge the students' progress (Higgins *et al.*, cited by Blair, 2006; Lotz, Jones & Holden, 2015), making the gap visible through the crit (Marie & Grindle, 2014). It is aligned with Durling's observation that students need to the 'check they are on the right track and 'do the right things' (Ashton & Durling, 2000:3). Christine Percy (2004) asserts that, in the crit, the tutor's roles as assessor and facilitator are often blurred.

In their aspiration to master design expertise, students constantly seek tutor approval; and to establish the 'distance' (Lave & Wenger, 1991; Blair, 2006) that remains, for the novice student to become an expert, 'judgement' is made by the tutor. According to Percy (2004:149) 'Implicit in the students' acceptance of the crit is the silent affirmation of the superiority of their tutors and legitimation of social difference.' The problem with the tutor as expert or 'master' is that students may blindly follow the tutor's direction without proper understanding of the feedback (Oh *et al.*, 2013; Dutton, 1991) or they may feel intimidated by it (McCarthy, 2011; Odgers, 2001, cited in Oh et al., 2013). This phenomenon seems to be particularly pertinent in education in sub-Saharan Africa as suggested by Mark Olweny (2015; 2017) where students aspire to mimic the work of their tutor whose approval they seek as a confirmation of their competence.

In her criticism of Donald Schön's work, Helena Webster (2008) references an example of tutor control of student learning where the tutor takes control by physically moving the student's workbook. From the literature it is evident that the most successful crits are those where power relations are dissolved (Hassanpour, Utaberta & Zaharim, 2010; Willenbrock, 1991).

Although the body of literature on the asymmetrical power relations in the crit is growing, the literature on the crit in the context of the live online learning setting specifically, is largely absent on this issue.

Student and tutor roles

The student and tutor roles described in the literature, speak to the tutor as client surrogate (Goldschmidt *et al.*, 2014), consultant (Mewburn, 2012) or user (Goldschmidt *et al.*, 2014; Goldschmidt, Hochman & Dafni, 2010; Oh *et al.*, 2013; Dutton, 1991). Although Davies and Reid (2000, cited by Blair, 2006) question the tutor's ability to roleplay as client, Dutton (1991) maintains that, in this role, the tutor refrains from judging student work, and instead, acts to represent a user or a group of users, to test, prompt and model their reactions.

The teacher or design tutor is also likened to a guide (Cronjé *et al.*, 2006) or facilitator (Goldschmidt *et al.*, 2014; Goldschmidt, Hochman & Dafni, 2010), prompting students to think critically on their own (Attoe & Mugerauer, 1991).

Whereas Attoe and Mugerauer's (1991) describe the coach (mentor) as an authoritative figure, Cronjé *et al.* (2006) views the coach as guide. Other roles are supportive facilitator (Goldschmidt *et al.*, 2014; Goldschmidt, Hochman & Dafni, 2010; Ligorio, Talamo & Simons, 2002; Burnett, 2003), counsellor (Attoe & Mugerauer, 1991) and social supporter (Cronjé et al., 2006). Lam (2011: 40) emphasises the tutor's role

as dialogue facilitator, rather than direct instructor, through the Socratic learning method and reciprocal learning principles.

On the other hand, as suggested by Anthony (1991) the child-parent relationship in the paternalistic atmosphere of the studio when tutors 'behave like surrogate parents' (p. 8), may intimidate students and hamper learning.

In their framework for critiquing practice: conditions and methods, Oh *et al.*, (2013) include the student-tutor relationship as a component of critiquing methods. This inclusion demonstrates the importance of consciously considering student-tutor relationships in crit practices.

Goldschmidt *et al.* (2014) describe the tutor performing the role of a buddy. It's worth considering here Percy's (2004:149) view that the studio tutor is more able to act as the student's critical friend (buddy) in the 'adversarial setting of the crit', in cases where the tutors were also present in the studio, where the student prepared work for the crit. She found that there was a difference in the student-tutor relationships in cases where students and tutors shared the same (physical) workspace, as opposed to where they didn't. Percy posits that studio-based staff bring the history of the 'casual, open-ended, and serendipitous moments of intervention and informal dialogue that took place with the students in the design studios prior to the crit' (Percy, 2004:149).

Abuse of authority by the tutor (Percy, 2004; Webster, 2008), master and apprentice relationships (Oh, 2010; Oh *et al.*, 2013, 2012; Kvan, 2001; Schön 1987; Ellmers, 2014) and novice and expert roles (Marie and Grindle, 2014; Goldschmidt *et al.*, 2014) are found in the literature. Various authors suggest that the apprenticeship model is associated with asymmetric power relations (Stuart-Murray, 2010; Goldschmidt, Hochman & Dafni, 2010;).

Asymmetrical power relations are reported with tutors in positions of power (Stuart-Murray, 2010; McCarthy, 2011; Oh *et al.*, 2013) through a difference in race, gender or age. Percy's (2004) discovered that conducting crits online reduced the power relations between tutor and student. Although her study focused on a text-based asynchronous online setting, it is relevant to note her observation that students became empowered through having to 'act as narrator and translator of their design process', because the digital interface did not expose it. Through this, 'knowledge and ownership were returned to the student' (Percy, 2004:151). She found that the computer acted as a mediator in the student-tutor interaction, thereby further reducing the power relations between them.

Yet, several authors emphasise the importance of social interaction with the teacher or tutor, and informal exchanges, as a critical part of online learning, that should not be neglected (Offir & Lev, 2000; Lotz, Holden & Jones, 2015; Salmon, 2000; Finkelstein, 2006). According to Finkelstein (2006:4), these social and informal exchanges 'help build community and create a friendly and safe environment in which people can feel like people'.

2.3.3 Student-tutor interaction in the live online crit

In this section I review literature that focus on the student-tutor interaction in the live online crit, including literature on learing trough conversation, learning through experience, and learning through cognitive apprenticeship. According to Ferreira, Christiaans and Almendra (2016) the student-tutor interaction forms the key to the design studio setting. This is the focus of this study, and in the next section I review literature that build up to the conceptual framework employed for this research.

There is limited scholarly discussion on the nature of the interaction between students and tutors (Oh *et al.*, 2013), especially online. Existing research on studio interactions either focus on the design process, for example Goldschmidt's (2014) Linkography (Pauwels, Morkel & De Bod, 2014), that shows the links between design ideas, or the crit content, like Anwar's Cognitive Interaction Matrix (Khaidzir & Lawson, 2012), and the Function-Behavior-Structure (FBS) ontology (Nespoli, Hurst and Gero, 2021), rather than the moves, modes or methods of student-tutor interaction specifically.

Ferreira, Christiaans and Almendra (2016) formulated a Design Grammar (visual design) Language (DGM) model as observational framework for teacher–student interactions. However, this model focuses on the subject content of the conversation rather than how the conversation is conducted, which is the focus of this study. They maintain that student-tutor interaction in the design studio remains difficult to describe and this reveals a gap in the literature that the present study aims to address.

Although peer to peer learning is acknowledged as a valuable component of the studio, this study focuses exclusively on the important learning interactions between the student and the tutor (Quinlan, Corkery & Marshall, 2007).

There is limited literature on student-tutor interaction in the live online crit (Iftikhar, Crowther & Burton, 2018). This section of the literature review includes sources on Conversation Theory (learning through conversation), Experiential Learning Theory (learning through experience), and Cognitive Apprenticeship (learning through cognitive apprenticeship). These three themes were specifically selected for their

prominence in the literature associated with architectural education, their association with socratic learning (Lam, 2011) and formative feedback (Blair, 2006), and specifically the live online crit. For conversation theory I refer to Laurillard (2012); McLeod (2013) and Kolb (1984) helped me to frame experiential learning, and for cognitive apprenticeship, I looked at Collins *et al.* (1989). Refer to Table 1 for a map of the literature, that points to the alignment of concepts across the three themes and linking back to Blair (2006) and Lam (2011). Note that *T* is used to indicate *Tutor* moves and methods, and *S* indicates *Student* moves and methods.

Table 1: Mapping the literature

SOCRATIC LEARNING	FORMATIVE FEEDBACK	EXPERIENTIAL LEARNING		COGNITIVE APPRENTICESHIP	CONVERSATION THEORY
Lam 2011	Blair 2006	McLeod 2013	Kolb 1984	Collins et al 1999	Laurillard 2012
steps	functions		MODES (Q3.c)	METHODS (Q.3b)	MOVES (Q.3a)
clarify	explanation presentation clarification mock real world	conceptualise	Abstract conceptualisation (discursive level)	Articulation (S)	S questioning S presents concept as product
				Modeling articulation (T)	T presents concepts T hints, comments
decide	feedback critical analysis reflection sharing	experience	Concrete experience (experiential level)	Articulation (S)	S action towards goal S revises action
				Modeling articulation (T)	T task goal T feedback on action
elicit		reflect	Reflective observation (moves up from experiential to discursive level)	Reflection (S)	S reflects on feedback
				Modeling reflection (T)	T reflects on learning practice
test		test	Active experimentation (moves down from discursive to experiential)	Exploration (S)	S adapts practice
				Modeling exploration (T)	T adapts task
				Scaffolding: Cognitive support	
				Coaching: Affective support	

Tony Bates' posits that 'academic knowledge requires students to move constantly from the concrete to the abstract and back again, and to build or construct knowledge 'based on academic criteria such as logic, evidence and argument' (Bates, 2016:95). However, literature on design education is silent on the construction of knowledge 'about how thinking and doing, or the thought and act processes of

designing are interconnected' (Uluoglu, 2000:35). With this research I attempt to address this gap.

Learning through conversation

This research draws on literature on learning through conversation (Laurillard, 2002, 2013; Blair, 2006; Lam, 2011) to explore how students and tutors interact in the live online crit. Conversation theory is a cybernetic and dialectic framework that offers a scientific theory to explain how interactions lead to 'construction of knowledge', or 'knowing' through social constructivism (Laurillard, 2012:98).

Although there is still limited reference to Laurillard's Conversational Framework in architectural education research, an increase can be observed in recent literature, for example Morkel's (2017) and Iftikhar, Crowther, and Burton's (2018) research on student-tutor interaction and student engagement in the architecture studio, respectively.

The present study draws on Diana Laurillard's Conversational Framework (2012) inspired by Gordon Pask's Conversation Theory, a cybernetic model of teaching and learning (Pask, 1976). The Conversational Framework was formulated formulated for socio-cultural learning, that prioritizes the value to articulate an idea and building an argument, 'negotiated in the continual iteration of discussion' (2009:9).

Diana Laurillard's Conversational Framework (2012) captures what it takes to learn, involving the student, tutor and peer, but in this study the role of the peer is excluded. The Conversational Framework identifies a set of 14 conversational activities or 'moves' used by the student and tutor that capture the learning process. These 'moves' negotiate understanding between the student and the tutor in terms of both theory and practical application. Laurillard posits that continuing iterative dialogue between student and (design) tutor (teacher) is associated with all learning (see Figure 2). The Conversational Framework includes the student, tutor and student peer, but this study focuses on the student-tutor interaction specifically, and it does not consider the role that the student peer plays.
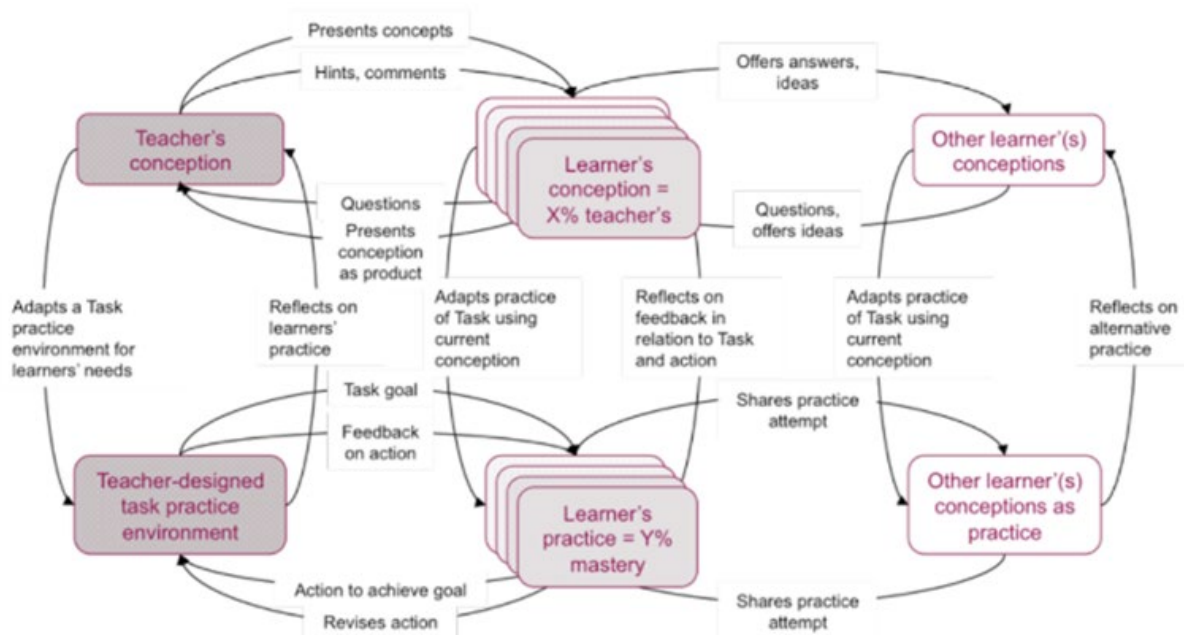
Figure 2: Conversational Framework. Source: Laurillard, 1993

According to Laurillard, the conversation is structured into four phases namely:

-Discursive phase: here the tutor presents a new concept, and the students enter a dialogue with the tutor, trying out the idea and its corresponding language, questioning and clarifying,

-Interactive phase: here students interact with teacher-constructed tasks, trying to apply the new concept, and getting feedback on their performance,

- Adaptive phase: here students try to apply their ideas, modify their ideas and adapt their actions according to what they have learned, and make their own links between ideas and events; and

- Reflective phase: here learners consider their interactive and adaptive experiences, reflecting on their learning, relating the theory back to the practice, adjusting their thinking in response to their reflection and formulating future actions to be more successful.

She distinguishes between the 'discursive, articulating and discussing theory and ideas, concepts and forms of representation' and the experiential which is 'experimenting and practicing goal-oriented tasks' (2009:8). These two levels of discursive engagement need to be connected, and in repeated iterative interaction, for learning to take place.

> ...*Learning is a process of using concepts and practice to generate articulations and actions that elicit communication from the teacher and*

information from the environment to modulate those concepts and practice.
(Laurillard 2013: 121)

Carey, Harrigan and Holland (1999) depicted this concept in Figure 3, that shows the expert (tutor) and learner (student), operating on concepts and application, and moving between.
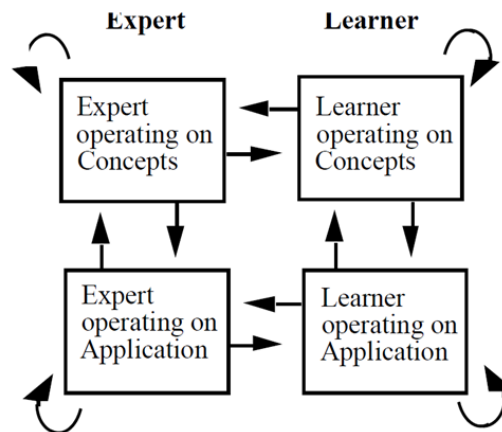
Figure 3: Conversational Framework. Source: Carey, Harrigan & Holland, 1999

Table 2 sets out how the five moves (Present, Question, Comment, Adapt and Reflect) were formulated for this study, based on an alignment of the 14 Conversational Framework activities (moves), the four communication forms identified by Laurillard (2002, 2013), the respective crit functions (Blair, 2006) and Lam's (2011) Socratic Learning steps.

The Socratic method is when teaching happens through questioning rather than through lecturing. Exploratory questions can invite futher elaboration, reactions, or justification – the Socratic tutor builds a chain of reasoning. In the end the main objective is to teach the student how to question her work by knowing how to ask questions, and how to respond.

According to Attoe and Mugerauer (1991:46) the Socratic method, [is] 'teaching through questioning rather than through exposition and lecturing. Through the discipline of exploratory questions which ask for further information, relations, and judgements, rather than through assertions or self-defensive justification, the Socratic teacher builds a chain of rationality – of linked reasons'.

Laurillard describes learning as a process of 'using concepts and practice to generate articulations and actions that elicit communication from the teacher and information from the environment to modulate those concepts and practice' (2013:121).

Vygotsky (1962) argued, in an approach that has been termed 'social constructivism', that learning through discussion is important, and distinct from learning through practice, because the act of articulating an idea is itself a contribution to what it means to know that idea. As students discuss their ideas with their tutor, they develop their ideas in ways that are unlike the learning they do through practice and experience.

Laurillard's (2002) Conversational framework offers four communication forms namely discussion, adaption, interaction, and reflection. The fourteen learning activities/ moves contained in this framework, that were used in this study to explore the three live online crit cases, were the following: Student (S) presents conception as a product, Tutor (T) presents concepts, Student (S) questioning (questions), Tutor (T) hints and comments, Student (S) adapts practice, Tutor (T) adapts task, Student (S) action (acts) towards goal, Student (S) revises action, Tutor (T) (sets) task goal, Tutor (T)(gives) feedback on action, Student (S) reflects on feedback and Tutor (T) reflects on learning practice.

Drawing on Blair's (2006) crit functions, and Lam's (2011) Socratic Learning Steps, Laurillard's learning activities were grouped and translated into five main categories of activities (moves), as follows:

- Present ('say' if operating on the discursive/ abstract/ conceptual level and 'show'/ demonstrate if operating on the interactive/ concrete/ experiential level)

- Question (including prompts)

- Comment (including hint/answer)

- Reflect

- Adapt / Explore (Explore drawing on Gunawardena, Lowe & Anderson's (1997) online interaction phases)

The first three operate on both the discursive and interactive levels.

Table 2: Learning through conversation: Literature

LEARNING THROUGH CONVERSATION						
CONVERSATIONAL FRAMEWORK			FORMATIVE ASSESSMENT IN DESIGN	SOCRATIC LEARNING METHOD	This study	
Laurillard, 2002, 2013			Blair, 2006	Lam, 2011		
Communication forms	Activities/ moves		Crit functions	Steps	Moves	
Discursive/ discussion	Tutor presents conceptual knowledge (1) Student articulates understanding of conceptual knowledge (13)	Tutor presents concepts Student presents conception	Explanation Presentation Clarification Sharing	Clarify	**CLARIFY/ discursive**	**Present**
	Student expresses partial understanding via question (2)	Student questioning				**Question** (add: prompt)
	Student expresses partial understanding via comment or answer (2) Tutor gives feedback on student's account (14)	Student comment (or answer) Tutor comments				**Comment** (answer)
Adaptive/ adaption	Tutor adapts experiential task to help student experience the concept / task sets goal for the student (3) Student adapts action in the light of conceptual knowledge (4)	Tutor adapts task goal Student adapts action		Test	**TEST/ adaptive**	**Adapt**
	Student further adapts action (8)					
Reflective/ reflection	Student reflects on interaction using conceptual knowledge (7) Student reflects on interaction to develop conceptual knowledge (11)	Student reflects on feedback Tutor reflects on learning	Feedback Reflection Critical analysis	Elicit	**ELICIT/ reflective**	**Reflect**
	Tutor reflects on student interaction to begin new dialogue (12)					
Interactive/ interaction	Student acts to undertake task (5) Student generates new action to undertake task (9)	Student action towards goal Tutor sets task goal Student revises action	Simulation	Decide	**DECIDE/ interactive**	**Present**
						add: **Question** (prompt)
	Tutor gives feedback on student's action (6) Tutor gives feedback on new action (10)	Tutor comments, hints				**Comment** (answer)

There is still limited empirical evidence to demonstrate how to support effective online discussion, regardless of the discipline (Laurillard 2013:259).

Learning through experience

Based on the design studio where learning happens primarily through solving problems of varying complexity (Steinø & Khalid, 2017) drawing on Kolb's Experiential Learning Cycle (see Figure 4) is appropriate. The architectural studio, through its origins in the beaux-arts tradition, has a focus on learning by doing (Dewey, 1938).
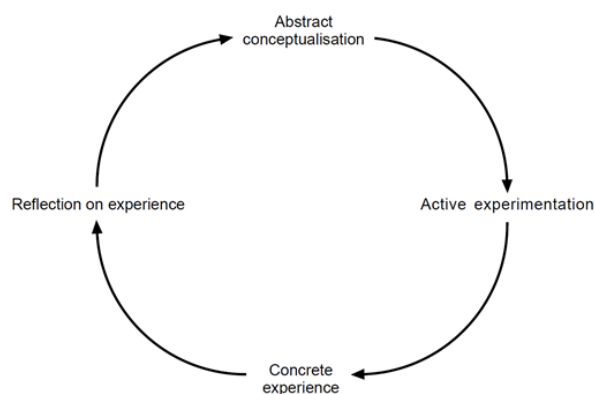
Figure 4: Kolb's Experiential Learning Cycle, 1984

The thought and act processes of designing are interconnected' as suggested by Belkis Uluoglu (2000:35), 'linking doing and thinking' (Maftei & Harty 2015:54) and bringing about 'discovery of new meanings' as suggested by Schön and Wiggins (1992:154). This research draws on literature on learning through experience (Kolb, 1984; Lewin, 1957; Dewey, 1938; Carey *et al.*, 1999; Blair, 2006; McLeod, 2013; Gunawardena, Lowe & Anderson, 1998).

Table 3 shows how the four modes of student-tutor interaction have been formulated for this study, based on Kolb's (1984) phases of experiential learning, Lewin's (1957) Lewinian Experiential Model, Dewey's (1938) Model of Learning, Blair's (2006) crit functions, McLeod's (2013) model, and Gunawardena, Lowe and Anderson's (1997) phases of online interaction. The column on the righthandside shows how the four moves, namely Negotiation, Exploration, Reflection, and Application have been conceptualised for the purpose of this research.

Table 3: Learning through experience: Literature

LEARNING THROUGH EXPERIENCE							
Kolb 1984	Lewin 1957	Dewey 1938	Carey et al. 1999	Blair 2006	McLeod 2013	Gunawardena et al 1997	This study
Phases of experiential learning	Lewinian Experiential Learning Model	Model of Learning		Crit functions		Phases of online interaction	Modes
Abstract Conceptualisation (AC)	Formation of abstract concept and generalisations	Knowledge	Operating on concepts (abstract/ theory)	Explanation Presentation Clarification Sharing Feedback	Conceptualise	Sharing/ comparing (I) Negotiation (III)	**Negotiation** Operating on concepts/ conceptualise (abstract/ theory)
Active Experimentation (AE)	Testing implications of concept in new situations	Judgement	Applying concepts	Critical analysis	Test	Exploration (II) Testing/ modification (IV)	**Exploration** Applying Concepts/ test
Reflective Observation (RO)	Observations and reflections	Observation	Building concepts	Reflection	Reflect	Discovery (II)	**Reflection** Building Concepts/ reflect
Concrete Experience (CE)	Concrete experience	Impulse	Operating on application (concrete/ practice)	Simulation (Explanation Presentation Clarification Feedback)	Experience	Agreement/ application (V)	**Application** Operating on application/ experience (concrete/ practice)

Considering the need for students to constantly move from the concrete to the abstract and back again, in order to learn (Laurillard, 2012; Bates, 2016; Gunawardena, Lowe & Anderson, 1998; Carey *et al.*, 1999; Percy, 2004; Blair, 2006; Stuart-Murray, 2010; McLeod, 2013), it can be assumed that these episodes provide the key learning interactions to 'modulate… concepts and practice' (Laurillard, 2013: 121). However, literature on design education is silent on 'how thinking and doing, or the thought and act processes of designing are interconnected' (Uluoglu, 2000:35).

Learning is the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience. (Kolb 1984:41)

According to Milovanovic and Gero (2018) 'a student-centered learning approach implies that the student must be active in order to enhance their learning outcome.'

Learning through cognitive apprenticeship

The third theme is based on learning through cognitive apprenticeship. It is a process by which learners learn from a more experienced person by way of cognitive and metacognitive skills and processes (Dennen & Burner, 2007).

This study draws from the Cognitive apprenticeship (CA) instructional design model, that originated from situated theory and was introduced in 1989 and developed by Allan Collins and John Seely Brown (Collins, Brown & Newman, 1989). The model presents learning occurring as experts and novices interact socially while focused on completing a task aimed at developing cognitive skills through participating in authentic learning experiences and tasks (Dennen, 2004; Wang & Bonk, 2001). Collins, Brown and Newman (1989:456) clearly define CA as 'learning-through-guided-experience on the cognitive and metacognitive, rather than physical skills and processes'. The concepts of situatedness and legitimate peripheral participation (Lave & Wenger, 1991) are key to CA as a method of learning. Situated learning occurs through participants' active participation in authentic contexts.

Table 4 sets out the link between Blair's (2006) crit functions, and Collins, Brown and Newman's (1989) methods of Cognitive Apprenticeship. The column on the righthandside contains the methods of student-tutor interaction used in this study, based on the literature, namely articulation, reflection, exploration, modelling, scaffolding, and coaching.

Table 4: Learning through cognitive apprenticeship: Literature

LEARNING THROUGH COGNITIVE APPRENTICESHIP		
Blair, 2006 **Crit functions**	**Collins et al., 1989** **Methods of Cognitive Apprenticeship**	**This study**
explanation, clarification, presentation, sharing, simulation	articulation (telling/ showing)	articulation (telling/ showing)
feedback, reflection, critical analysis	reflection, exploration	reflection, exploration
	modeling, scaffolding, coaching	modeling, scaffolding, coaching

Collins, Brown and Newman (1989, cited in Dennen, 2004: 814) succinctly define Cognitive Apprenticeship as 'learning-through-guided-experience on cognitive and metacognitive, rather than physical, skills and processes.' Core to cognitive

apprenticeship as a method of learning are the concepts of situatedness and legitimate peripheral participation, as described by Lave and Wenger (1991). Situated learning occurs through active participation in an authentic setting, founded on the belief that this engagement fosters relevant, transferable learning much more than traditional information-dissemination methods of learning. However, it is more than just learning by doing; situated learning requires a deeper embedding within an authentic context.

Articulation: The expert encourages students to verbalise their knowledge, thinking or problem-solving process through presentations of their projects and associated challenges (Collins, Brown & Holum, 1991). This offers students opportunities to learn from each other's solutions and to negotiate and defend their knowledge.

Reflection: In this strategy, the expert encourages students to compare their ways of problem solving and experiences with that of experts and other learners (Collins, Brown & Holum, 1991). Students can articulate the underlying thoughts behind their actions during the process of learning, demonstrate points at which they were learning from the tutor's strategies and integrate that knowledge to their learning as well as their past experiences.

Exploration: Students are encouraged to identify their own problems, form hypothesis, to test them, and to find new ideas, solutions and viewpoints (Collins, Brown & Holum, 1991; Enkenberg, 2001, cited in Dennen, 2004). Students are encouraged to pose and solve their own problems, with the aim of encouraging students to consider how skills and knowledge they have gained can be transferred to new situations in the practice setting.

Modeling: It refers to an expert demonstrating the process and strategies involved in performing a task and an apprentice observing the practical display of the performance and building a conceptual model of the processes that are required to accomplish the task (Collins, Brown & Holum, 1991).

Scaffolding: In the learning process, the tutor provides the skills, strategies and links that the students are unable to provide to complete a task. This support is then removed slowly by surely as the learner gains independence and no longer needs support to complete the desired task (Collins, Brown & Holum, 1991).

Coaching: It is sometimes considered the same as mentoring and sometimes different, Collins et al. (1989) describe coaching as the assistance from a master. The coach observes learners as they carry out a task and offers hints, scaffolding, feedback, modeling, reminders, and new tasks.

Within the Cognitive Apprenticeship model of learning (Collins, Brown, and Newman, 1989), Harrigan and Carey (1998) formulated an adaptation of Diana Laurillard's conversational model for mediated learning (1993), which was based on Pask's Conversational Theory (1976). The Mediated Conversations for Cognitive Apprenticeship (MCCA) diagram provides a vizualisation abstraction of a learning activity scenario. Figures 5 and 6 depict the interaction between the expert (in this case, the tutor) and learner (in this case, the student) and how their interaction operates on (building) concepts and application (applying concepts).
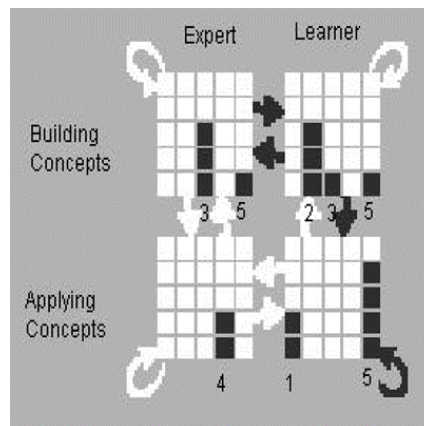
Figure 5: MCCA Diagram. Source: Carey, Harrigan & Holland, 1999
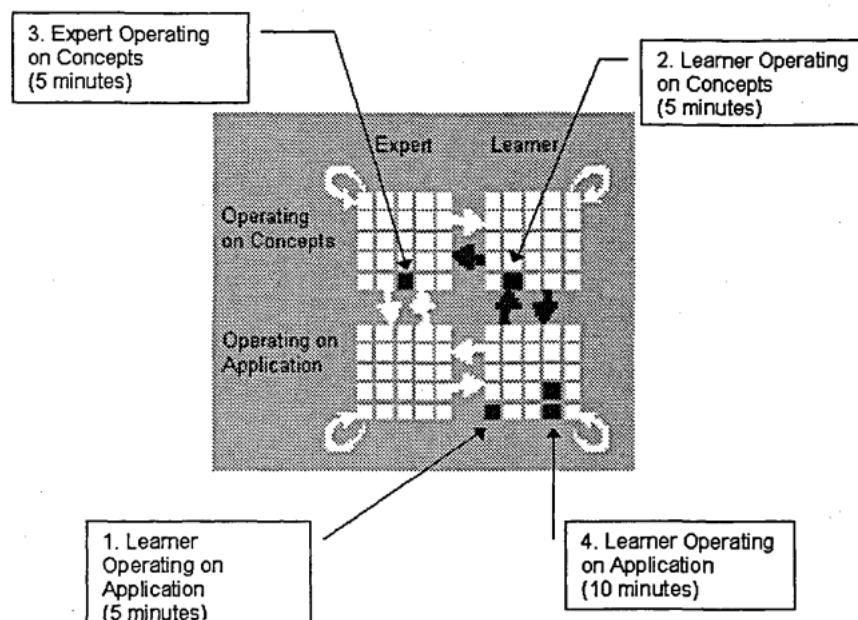
Figure 6: MCCA Diagram Implementation. Source: Carey et al., 1999

As a variant of the MCCA diagram, Holland (1999) developed the LID visualization, (Figure 7) presented collaboratively with Carey and Harrigan (Carey, Harrigan & Holland, 1999). The MCCA diagram and LID form part of a Toolkit to guide instructional design processes. These schemas intend to show the conversational moves and the

four modes of activity, without focusing on the content, but reflecting 'ordering, onset time, and duration information' (Holland, 1999). Due to capacity constraints, unfortunately, this work has not progressed beyond the 1990s (Carey, 2017).
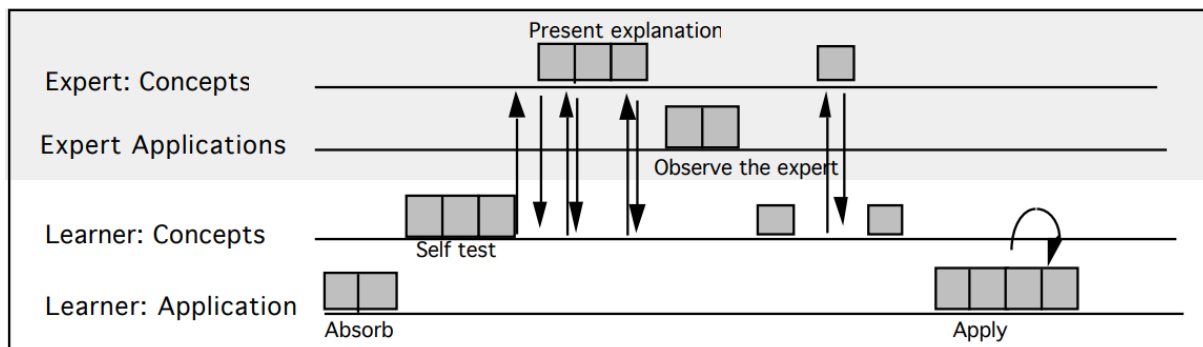
Figure 7: LID for a sample learning scenario. Source: Holland, 1998

This study responds to a call by Dennen (2004) for more research on cognitive apprenticeship 'that will lead to greater generalizability of results and the development of prescriptive knowledge to guide practitioners' (Dennen, 2004:825). It also addresses an interruption of the work by Carey, Holland and Harrigan (Carey, 2017), as well as a gap in the current literature on the architectural crit (Webster, 2004; Blair, 2006; Oh *et al.*, 2013; Olweny, 2015) and the live online crit specifically (Ng, 2007).

2.4 Conceptual framework

The conceptual framework for this study is constructed from the three most prominent kinds of student-tutor interaction and ways to learn, that emerged from the literature. The moves are drawn from Conversation Theory, the modes from Experiential Learning Theory and the methods from Cognitive Apprenticeship (see Figure 8). These three theories were chosen based on their prominent association with the practice of the design crit. Blair's (2006) crit functions were used for comparison, across the three models.

The study also references the work of Tom Carey (2017) and his fellow researchers, who were the first to draw a link between these theories and models (conversation theory, experiential learning theory and cognitive apprenticeship), for instructional design, although not in the context of architecture education.

Considering Laurillard's (1993) Conversational Framework, Kolb's (1984) experiential framework, and Collins, Brown & Holum's (1991) Cognitive Apprenticeship, the moves (learning through conversation), modes (learning through experience) and methods (learning through Cognitive Apprenticeship), were aligned to form the conceptual framework for this study. The moves are *present, question, comment,*

reflect and *adapt*. The modes are *negotiation, exploration, reflection* and *application,* and the methods *articulation, exploration, reflection, modelling, scaffolding,* and *coaching*. The relationships between the moves, modes and methods are reflected in the Conceptual framework (figure 8), which guides the exploration of the data collected for this research.

MOVES Learning through Conversation	MODES Learning through Experience	METHODS Learning through Cognitive Apprenticeship	
CLARIFY (discursive) **Present** **Question** / prompt **Comment** / answer	**NEGOTIATION** Operating on concepts/ conceptualisation (abstract/ theory)	**Articulation** telling	
TEST (adaptive) **Adapt**	**EXPLORATION** Applying concepts/ test	**Exploration**	**Modeling** **Scaffolding** **Coaching**
ELICIT (reflective) **Reflect**	**REFLECTION** Building concepts/ reflect	**Reflection**	
DECIDE (interactive) **Present** **Question** / prompt **Comment** / answer	**APPLICATION** Operating on application/ experience (concrete/ practice)	**Articulation** showing	

Figure 8: Conceptual framework

2.5 Summary

In chapter 2 I reviewed the literature in two parts, namely my experience and development as a design tutor, and secondly, I discussed the literature in terms of characteristics of the live online crit setting, the student-tutor relationships in the live online crit, and the student-tutor interaction in the live online crit. The chapter concluded with an overview of the conceptual framework constructed from and employed in the research, to explore the data. In the next section I discuss the methodology employed in the study.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In this Chapter I describe the methodology of the research, as the 'strategy of inquiry' (Lincoln & Guba, 2013:86). I present the research paradigm and setting of the research, followed by the research sample, data sources and data collection. The research methods that I employed, follow next. Finally, the authenticity and ethics, and the limitations and delimitations of the study are presented, concluding with a summary.

3.2 Research paradigm

The research paradigm as 'overarching philosophical system' (Lincoln, 2005:230) comprises my ontological, epistemological and methodological premise as a researcher (Denzin & Lincoln, 2005, cited in Lincoln & Guba, 2013).

In this research I take a social constructivist ontological position, adopting social constructivism as a theory about the 'development of knowledge through the interactions that individuals have with each other' (Taylor, 2018:218). This position is based on the premise that 'things and meanings don't exist independently, but that they are socially constructed' and that these 'socially constructed meanings are in a constant state of revision' (Taylor, 2018:218). As a researcher and educational practitioner my own account of the social world is a construction that is presented here as a version of reality.

The epistemological frame that motivated my research approach and actions, is Interpretivism. It considers that the nature of knowledge involves no single reality, but that it must be interpreted. Rather than objective and measurable facts, 'interpretivist epistemology seek out subjective beliefs that are co-created by the researcher and the researched...' (Lincoln & Guba, 2013:88).

These philosophical assumptions framed the research questions, methods, data analysis and the discussion of the findings.

3.3 Research setting

The research setting is the live online crit that is mediated via a webinar platform (see Figure 9). The online crit is a prominent studio learning activity that forms part of a blended learning design of a two-year blended undergraduate programme at a University of Technology in South Africa. In this context I explore the student-tutor interaction, as the unit of analysis.
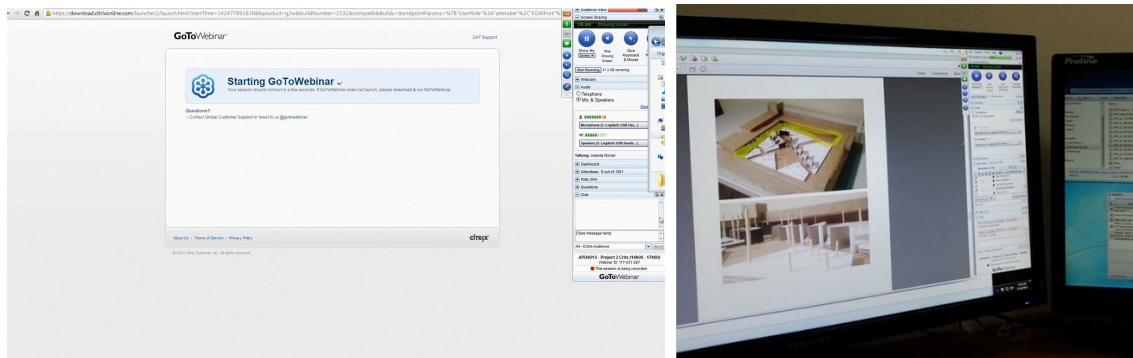
Figure 9: GoToWebinar Platform

This programme is offered through a university-industry collaboration and implemented to address demographic transformation in the architectural profession (Poulsen & Morkel, 2016). The programme is aimed at working individuals who have been unable to continue with or complete their studies, due to financial reasons or life commitments, and those who have been excluded from Higher Education in the past. The group of 40 working students are based in architectural workplaces, spread across South Africa, and including the neighbouring countries of Namibia and Zimbabwe.

The blended programme comprises quarterly on-campus blocks, office-based mentoring, and online leaning engagements. The online component is facilitated in formal and informal online leaning settings that occur both synchronously and asynchronously. Social and informal online spaces are set up in Facebook and Pinterest, and student only Whatsapp groups serve as a 'back channels' to formal and informal learning conversations. An asynchronous formal learning space is provided in the form of the Blackboard Learning Management System (LMS). It contains organisational information such as study guides, institutional rules and regulations, a calendar, and announcements. Learning content is provided in the form of interactive project briefs, recorded lectures, class notes, video, and text-based resources. The LMS also provides for the upload of student assignments, online written and graphic feedback by tutors, and the display of student grades. Linked Google documents are employed for ongoing individual student design journal updates and for feedback by tutors in written and graphic formats.

During the live online crit, a group of eight to ten students, at a time, meet online in a virtual GoToWebinar space, with one or two tutors present. Students upload their work to Blackboard on the Monday preceding the online crits that normally take place on Tuesday and Wednesday afternoons, in groups, to accommodate the full student cohort. A student is allocated a one-hour crit slot during which she is required to be online to present her work, and respond to prompts and questions, mainly by tutors, but also, on occasion, by her peers attending the session. A link to

the webinar space is sent by e mail to the student the day before, and when the session is about to start, she simply clicks on it to enter. Webinar sessions can be joined from a PC, laptop, tablet or smartphone, and preferably using a headset for audio. To save time, the tutor manages the screen, by sharing the respective student's work to all participants, and the student whose work is being reviewed, directs the tutor to which work to move. Students and tutors present in the online session are assigned pens of different colours to point, create on-screen markings and diagrams on the work displayed.

The text chat facility is used for social comments, written inputs and feedback by students and tutors, and to share links to support material, including blogs and websites. The online crits are automatically recorded and made available to students to view in mp4 format, soon after the crits have been concluded.

The student-tutor interactions observed in this research, are three live online crits, focusing on individual project work generated by three year 1 part-time students. The project that forms the object of these crits, is the design of a small-scale intervention in the urban landscape of the Heerengracht in the Cape Town central business district. The aim of this first design project for the year was to explore fundamental design principles and process by employing a conceptual design idea to generate a design proposal, and to communicate it appropriately.

The project counted towards 15% of the total grade for the design subject for the year, and the assessment criteria were:

1. Clarity of concept (own understanding and interpretation of group work)

2. Considered and engaged design process (precedent, key design moments and refer to Project 2 design journal)

3. Appropriate response to context (site analysis)

4. Convincing experiential idea (including scale, ergonomics)

5. Effective communication of the idea (presentation)

6. Appropriate design response (including design informants, precedent analysis)

7. On-time submission

The project was completed in two parts, to scaffold the learning. The first part was conducted as a vertical studio (group) project during the first on-campus block for the year, with one year 2 and two year 1 students per group. Each group was assigned a conceptual spatial idea generated through readings that the year 2 student in the group had previously engaged with, in preparation of the on-campus

block. The group was required to find a space in the city, near the campus, that they believe could be modified through an exploration of the conceptual spatial idea that was assigned to them. The intention was that space-defining elements would be employed, in accordance with the selected spatial concept. The single project outcome per group was communicated through diagrams, freehand sketches, and a conceptual model.

The second part of the project comprised individual work. Year 1 students were required to further develop the group project in the two weeks following the on-campus block. They were supported in the office by their workplace mentors and online by their peers and tutors. The students were required to continuously update their design process documentation in their online design journals and participate in two online crits. The crit session that forms the focus of this study, is the second and final crit before the project submission. The submission of individual work had to contain a clear representation of the allocated spatial design concept, details of and the reasons for the choice of the site, the student's personal response to the group proposal, the nature and qualities of the intended spatial experience and at least one appropriate conceptual precedent. This had to be presented in the form of a short motivation explaining the design strategy, diagrams, sketches and a 1:200 scale concept model.

The crits formed the final online interaction of the project, and the duration of each crit was between 20 and 30 minutes each. In section 3.5.3 follows an overview of the design intent of the three projects, and a summary of each respective crit.

3.4 Research sample and data sources

The data corpus employed in this research includes online surveys completed by graduates, students and tutors, a focus group interview with graduates, and three online crit protocols.

Students, graduates, and tutors were invited to complete the online surveys. The response rates of the graduates and tutors were 100% respectively, and 60% of the year 1 and 38.5% of the year 2 students completed the online surveys. Five graduates participated in the 90-minute focus group interview that was conducted on campus, and three online crit protocols were analysed (See Table 5).

Table 5: Data sources

Target population	Research instrument	Sample	Response rate	Participants
2015 graduates (2014 intake) Class of 13: 7B/6W;1F/12M	Focus group interview	n=5 1B/4W; 1F/4M	38.5 %	A - E
	Online survey	n=13 7B/6W;1F/12M	100%	G1 - G13
2016 year 1 students (2016 intake) Class of 30: 19B/11W/; 6F/24M	Online crit protocols	n=3 1B/2W; 0F/3M	100%	C1 - C3
	Online survey	n=18 9B/9W; 5F/13M	60%	S1 - S23
2016 year 2 students (2015 intake) Class of 13: 6B/7W; 1F/12M	Online survey	n=5 2B/3W; 0F/5M	38.5 %	
2015 & 2016 Tutors	Online survey	n=5 0B/5W; 2F/3M	100%	T/1 - T/5

Key: B: black/ W: white/ F: female/ M: male

3.4.1 Students

All 43 students who were registered at the time of data collection, were invited to participate in the research, namely 30 in year 1 and 13 in year 2.

A total of 23 (S1 – S23) students completed the online survey, that accounts for 53% of the total number of registered students. Of the year 1 cohort, 60% participated in the online survey, including 9 black and 9 white students (5 female and 13 male). Of the year 2 cohort, 38.5% completed the online survey, including 2 black and 3 white students (5 male).

The three year 1-crit protocols (C1 – C3) were selected through purposive sampling. The chosen crit protocols were produced by engaged students who employed a range of different design approaches. Student C1 (Architecture and human senses) explored sensory strategies, student C2 (Pathways and planes) was interested in design elements for space-making, and student C3 (Duality) wanted to translate an abstract idea into form.

3.4.2 Tutors

All five tutors (T/1 – T/5) who taught across the two years (2015 and 2016), completed the online survey. This group includes 2 white females and 3 white males. The three crit protocols that were analysed involved the same two tutors, T1 and T2.

3.4.3 Graduates

Of the 2015 graduates (G1 – G13), 13 participated in the study by completing the online survey. The graduate cohort of 13 is made up of 6 white (five males and one female) and 7 black (all male) students, which means that 38.5% of the graduates participated in the focus group interview, including 100% of the females, 14% of the black students and 66% of the white students who were registered for the programme.

Five graduates (A - E) participated in the focus group interview. This sample comprised one black and four white students, including one female. This sample was selected through convenience sampling. The location of the focus group interview on campus in Cape Town resulted in only Cape Town-based students participating. Although this represents a small sample (38.5%) of the total graduate cohort, the results of the focus group interview correlated with the online survey that was completed by the full cohort.

3.5 Data collection

The qualitative data collection took place over a period of six months, from January to June 2016 (see Figure 10). Three data collection methods were used, namely a focus group interview, online surveys, and online crit protocols. The focus group interview was conducted with five graduates and the online survey was completed by 13 graduates, 23 students (year 1 and year 2) and five tutors. Three year-1 online crit protocols were selected to form part of the data set.
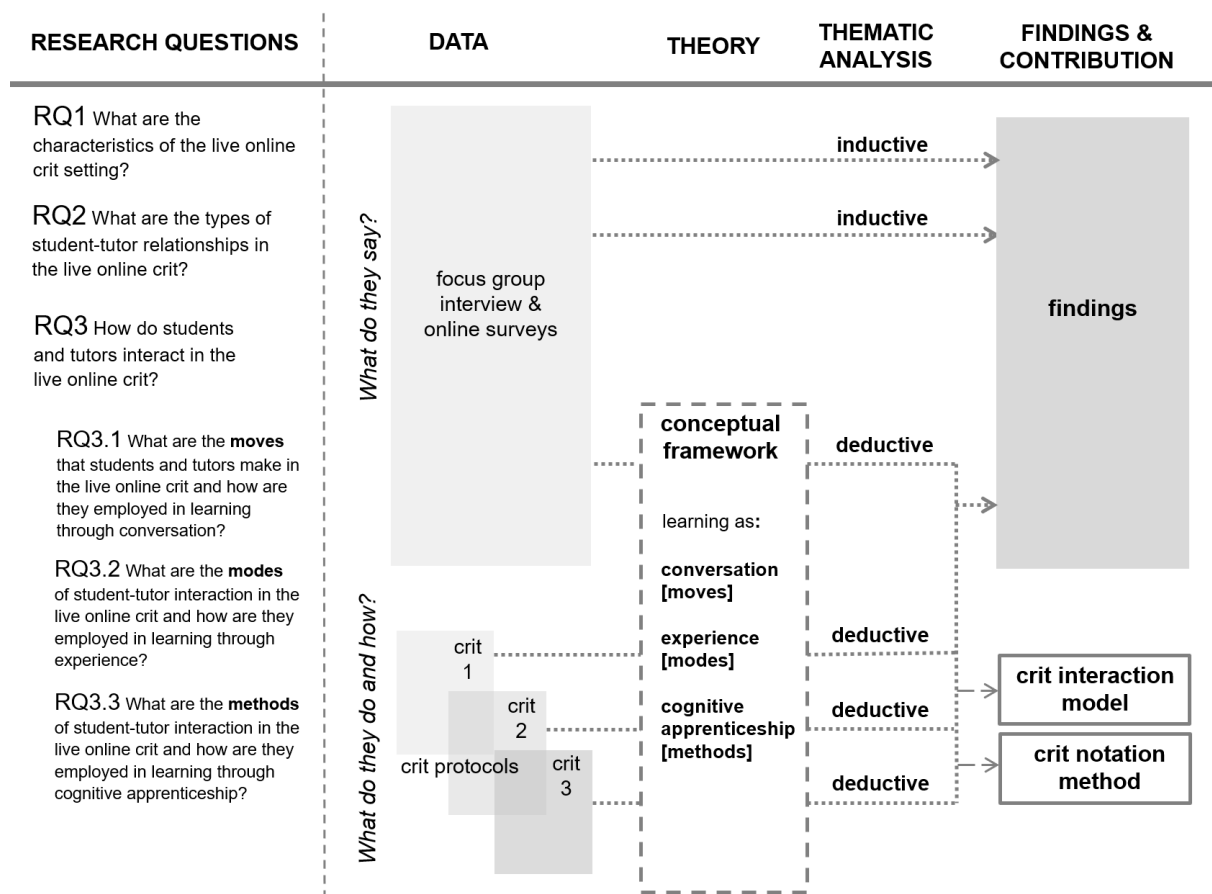
Figure 10: Research process

The focus group interview and the online survey data were collected to explore the students', graduates' and tutors' perceptions of the online learning setting, the student-tutor relationships, and the student-tutor interaction in the live online crit.

The online crit protocol data were collected to explore how the student and tutor interact in the live online crit.

3.5.1 Focus group interview

A 90-minute focus group interview was conducted with a group of five members of the 2015 graduate group (A – E). The semi–structured questions that guided the focus group interview were borrowed from Bernadette Blair's (2006) doctoral thesis on the formative critique. The decision to use Blair's (2006) questions was guided by the clear alignment between the crit functions that she describes, and the key literature on which the conceptual framework for this study is built. This literature includes Laurillard's communication forms and activities, and Lam's (2011) steps of the Socratic learning method. Refer to the conceptual framework presented in section 2.4.

The questions that were formulated for the focus group interview focused on the students' perception of the nature of the crit, its purpose, value, and challenges. Students were asked what makes a crit successful, how the crit helps or hinders learning, whether they found it stressful; and how the crit might be improved. Finally, students were prompted to elaborate on the student-tutor relationship and roles that play out in the crit. As expected, the focus group interview produced rich narrative data because as 'human instrument, I was able to ask, probe, and tailor' the interview (Lincoln & Guba 2013:98).

The focus group interview was audio recorded in a digital format and transcribed verbatim. The transcription was in a Microsoft Office Word file. On completion of the transcript, I checked the document for spelling errors, and added a heading, the date and numbered questions and the lines for easy reference. Finally, I changed the identifying information and anonymised the participants (A – E, and Interviewer).

The qualitative research methods, including coding and analysis, are described in section 3.6.

3.5.2 Online surveys

Tutors (T/1 – T/5), 2015 graduates (G1 – G13) and students from both 2016 year 1 and year 2 cohorts (S1 – S23) completed online surveys. The focus group interview questions were included, together with questions on the perceived characteristics of the different crit types, the most effective modes of communication used in the crit, how technology has impacted the crit and what students and tutors should expect from each other, to ensure effective learning interactions.

The online surveys were administered through Google forms. The qualitative research methods, including coding and analysis, are described in section 3.6.

3.5.3 Crit protocols

This data set is naturally occurring data (Potter, 2002) because it exists regardless of the research intervention. Because all online crit sessions are automatically recorded and made available to students as learning resources, students were aware that the online sessions were recorded.

The three crit protocols were selected through purposive sampling, from the repository of recorded crit interactions linked to the case. These recordings were selected based on the degree of student engagement (three highly engaged students were chosen) and the range of different design approaches adopted by the respective students. Student C1 (Architecture and human senses) explored different sensory strategies, student C2 (Pathways and planes), was interested in design elements for space-making, and student C3 (Duality) wanted to translate an abstract idea into form. The two tutors present (T1 and T2) were constant, with the researcher as participant observer (T2). Because the student peers who attended the webinar sessions did not actively participate in the webinar text chat, these interactions were not included in this exploration.

The transcriptions of the three crit protocol audio tracks were compiled in sequence with screenshots of the respective on-screen activity, located where they occurred in the audio track – see Figure 11 for Crit 2 example.
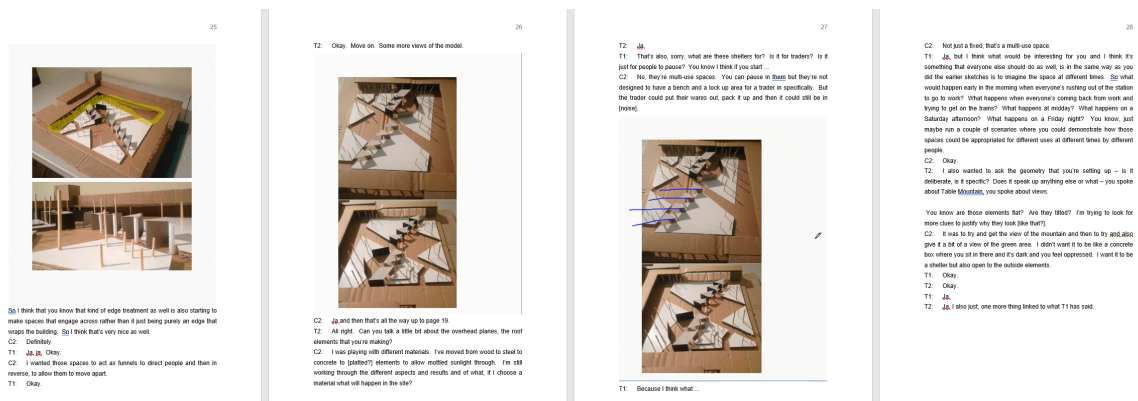
Figure 11: Crit 2 protocol

Next follows an overview of the three online crit protocols, including the duration, crit participants and the respective students' design approaches.

Crit 1: Architecture and human senses

The participants of this crit session were two tutors (T1 and T2), student C1 and a group of six peers who attended the online session. Tutor 1 fulfilled the webinar presenter role which meant that she advanced the slides that were submitted by student C1 whose work was the focus of this crit. The slides contained text and

images, including precedent research, sketches, and a photo of the conceptual model. The duration of the crit was 20 minutes and it contains 69 turns.

Student C1's chosen site was a small public square. His design intent was to provide a range of spatial and sensory experiences through guiding the users' movements. The crit material contains mainly freehand sketches with annotations, and a photo of the conceptual model (refer to Figure 12).

Student C1 explored the following spatial design concept in his design:

'Enhancing the human senses by moving through spaces. The ideas of using architectural and natural elements to enhance certain human senses by manipulating form and function.

The nature and qualities of intended experience: People will be drawn into the concrete structure through a[n] opening divided with a semi-translucent element [to] create the feel of curiosity, when inside the structure has a maze-like linear circulation route. The person will move from space to space experiencing different elements enhancing a certain sense. These spaces will have different wall and floor finishes with transition elements.

That indicates the nature of a different space, a play with different wall heights and punctures through the concrete structure will be determined by the nature of the sense it is intended to enhance.'
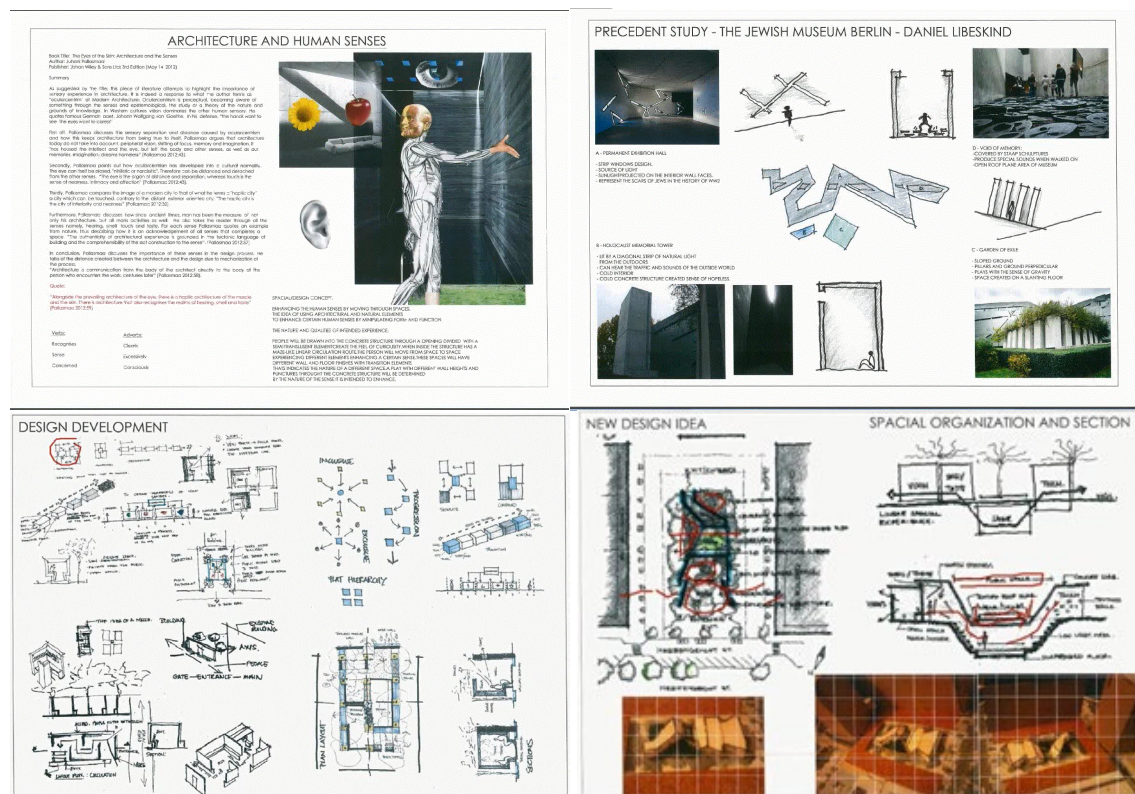
Figure 12: Crit 1 screenshots

Crit 2: Pathways and planes

The participants of this crit session were two tutors (T1 and T2), student C2 and a group of six peers who attended the online session. Tutor 1 fulfilled the presenter role which meant that she advanced the slides submitted by student b that the crit focused on. The slides contained text and images, including precedent research, sketches and several photos of models of conceptual alternatives. The largest part of the crit focused on the three-dimensional exploration through discussion of the models. The duration of the crit was 30 minutes and it contains 80 turns.

Student C2's project is located in the busy Cape Town railway station precinct. The design intent for this project was to employ pathways and planes to enhance the experience of movement and rest and for the gathering and dispersal of commuters. Overhead planes define informal market spaces that also frame Table Mountain views. The largest part of the crit focuses on the three-dimensional exploration through discussion of the physical models (see Figure 13).
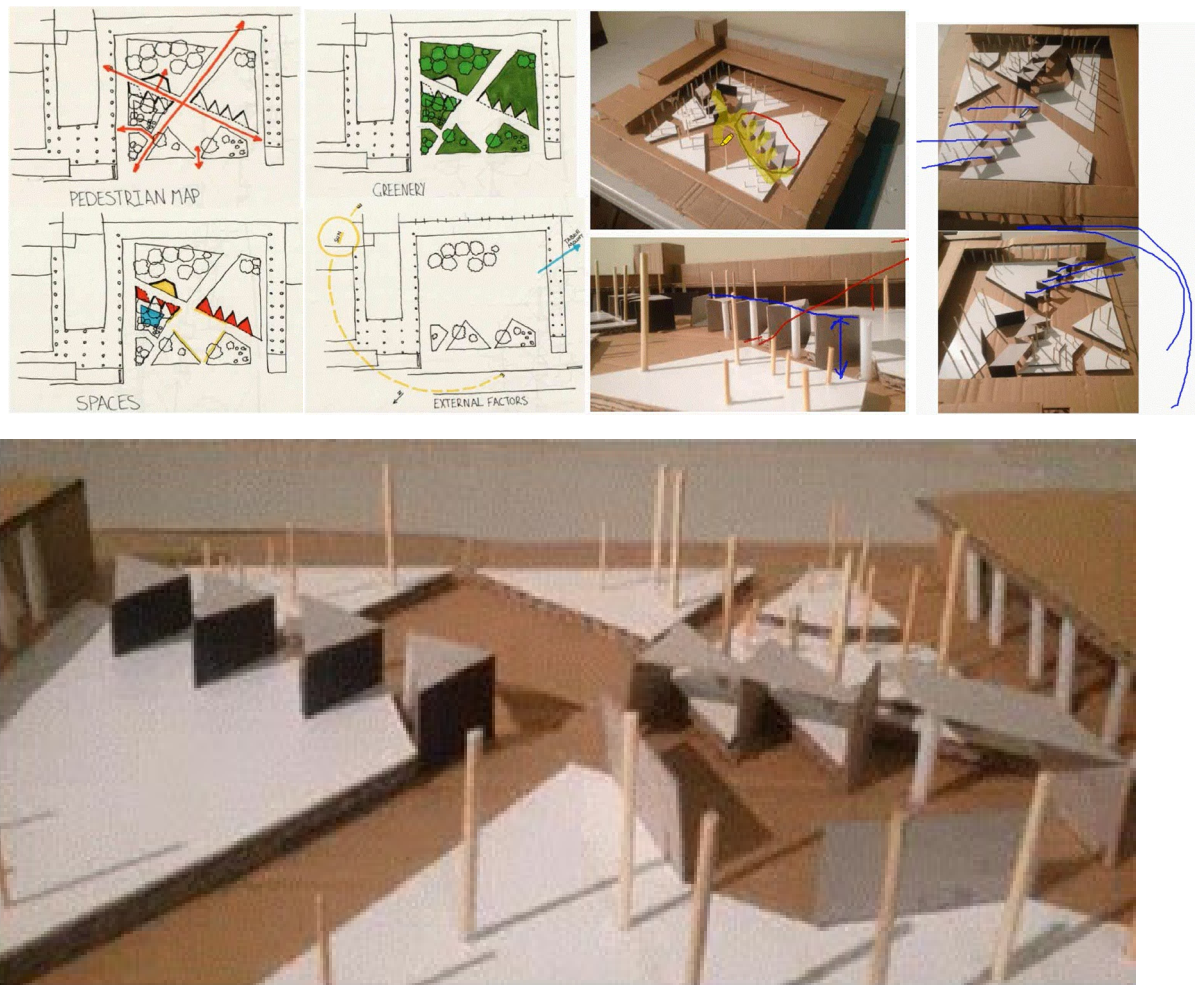
Figure 13: Crit 2 screenshots

Student C2's design intent for this project was:

My personal response to the group work project was to build on what was developed during the group work phase of the project and work on solutions that I felt were important.

The pathways relate back to the concept by funnelling people towards the station by narrowing the pathways. Subtly cr[e]ating a gathering and bringing people together while in reverse the pathways widen and allow the crowds to disperse into the intervention space and beyond into the city.

Horisontal planes were altered in the existing space to define the 'short cuts' there raised terraces on the east and west with the existing terraces on the south frame the site, while the green area to the south against the station exists is kept at ground level. A second terrace is added to the east terrace to provide an elevated view of Table Mountain to the South West over the space. The west terrace is also raised, but bare of a forest of trees unlike its counterparts, thus not infringing of the view from the site as a whole.

All existing trees on the site are kept as they are already well established, while all new trees are to be deciduous indigenous trees thus maximising shade in the summer months and sunlight in winter.

Stepping aside from the single use covered walkway of the group project, multi-use covered spaces are cut into the sides of the terraces for yearlong protection from the elements. They are intended as pause/ contemplation/ gathering spaces that feed right off of the walkways. They can also be used as informal market spaces, but are not intended to be permanent traders, when he packs up his wares and moves on, the space is then open for public seating once again.

Crit 3: Duality

The participants of this crit session were two tutors (T1 and T2), student C3, and a group of six peers who attended the online session. Tutor 1 fulfilled the webinar presenter role which meant that she advanced the slides submitted by student C3 that the crit focused on. The slides contain text and images, including precedent research, sketches and several photos of models of conceptual alternatives (refer to figure 14). The largest part of the crit focuses on the three-dimensional exploration through discussion of the physical models.

Student C3 employed the concept of duality to remodel an existing urban flower market space in a heritage area. His design intent was to introduce a sense of intimacy, bring nature back into the city and create opportunity for rest. He tried this by inserting a glass box between two historic buildings, visualising a quiet and intimate elevated sanctuary in a noisy urban space.
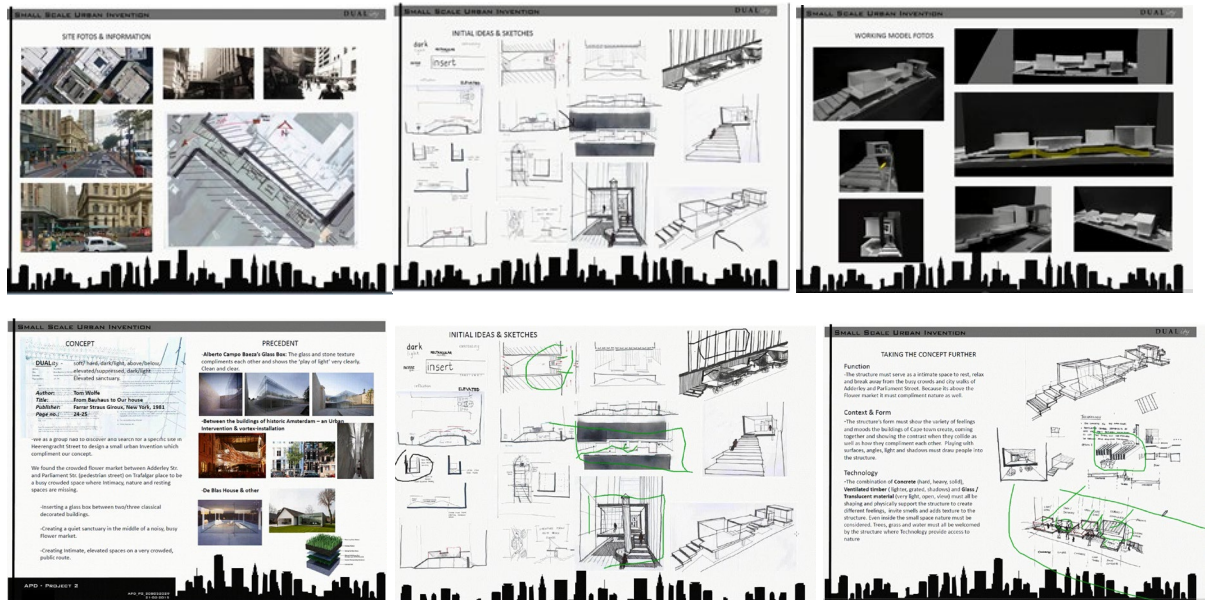
Figure 14: Crit 3 screenshots

Student C3 described his design intent as follows:

> *The concept is DUALity: soft/ hard, dark/ light, above/ below, elevated/ suppressed, dark/light, an elevated sanctuary. The concept was inspired by Tom Wolfe's 'From Bauhaus to Our house' (1991). We as a group had to discover and search for a specific site in Heerengracht Street to design a small urban Intervention which compliment[s] our concept. We found e crowded flower market between Adderley Street and Parliament Street (pedestrian street) on Trafalgar Place to be a busy crowded space where intimacy, nature and resting spaces are missing Flower market.*

> *Inserting a glass box between two/ three classical decorated buildings.*

> *Creating a quiet sanctuary in the middle of a noisy. Busy Flower market.*

> *Creating intimate, elevated spaces on a very crowded public route.*

3.6 Research methods

I employed qualitative exploratory or hypothesis-generating research methods in a single case (Yin, 2009), to discover patterns and relationships through analysis and interpretation (Auerbach & Silverstein, 2003; Braun & Clarke, 2006).

The objective of exploratory research is to gather preliminary information that will help define problems and suggest hypotheses. I adopted the two principles for qualitative hypothesis-generating research formulated by Auerbach and Silverstein (2003), namely 'questioning rather than measuring' and 'generating hypotheses using theoretical coding' (2003:17).

These qualitative research methods involved the use of 'research participants as expert informants (Auerbach & Silverstein, 2003:31), and 'reflexivity as the explicit use of the researcher's subjectivity and values', as sources of knowledge (2003:32). In this research I bring my own values, positioning, and disciplinary traditions to interpret the data.

I followed a reflexive thematic analysis (TA) approach as described by Braun and Clarke (2006). The purpose of TA is to identify patterns of meaning (Braun & Clarke, 2014) across a dataset in response to a research question. Through a rigorous process of 'data familiarisation, data coding, and theme development and revision', patterns are identified (Braun & Clarke, 2006: 79). Braun and Clarke (2006; 2014) posit that, rather than codes and themes emerging from the data, they are actively generated and constructed by the researcher, through various iterations.

Two categories of data were analysed; the first to establish what the students and tutors say about the student-tutor interaction in the live online crit, and second, what their practice shows, in other words, what they do (refer to Figure 10).

In the following section I describe how I employed inductive thematic analysis and deductive thematic analysis. For both I used the six-phased reflexive TA method formulated by Braun and Clarke (2006) as a guide. This method aims to achieve a rigorous process of data interrogation and engagement. Rather than a linear process, I approached it as an iterative and reflective method that develops over time and involves a constant moving back and forward between phases (Nowell *et al.*, 2017; Braun & Clarke, 2006; Clarke & Brown, 2014).

To find the answers to RQ1 and RQ2, I used inductive reasoning to thematically analyse the focus group interview and online survey data. To find the answers to RQ3 (RQ3.1 – RQ3.3), I applied deductive reasoning to thematically analyse the same focus group interview, online survey, and the online crit protocol data. These methods are discussed in the next section.

3.6.1 Inductive thematic analysis

I used inductive thematic analysis (TA) to explore the focus group interview and online survey data in response to RQ1 namely 'What are the characteristics of the live-online crit setting', and RQ2, 'What are the types of student-tutor relationships in the live online crit' (refer to Figure 10).

As suggested by Creswell (2007) I built patterns, themes and categories from the bottom-up and I organised the data into more abstract units. Inductive thematic analysis starts with the data but coding it without trying to fit it into a pre-existing coding format (Braun & Clarke, 2006). It further means that, although the data were collected specifically for the research, the themes that were identified do not mimic the questions that I asked the participants.

Familiarising with the data

The first TA phase was 'Familiarising with the data'. To achieve this, I listened and relistened to the audio recording of the focus group interview, prepared the transcription myself, and read and reread it several times on completion of the transcript. I read through the online surveys that were administered through Google Forms. I did so by reading through the automated report that contains the responses, organised according to the respective questions, and I read the responses individually. I listened and read actively, analytically and critically, making notes and reflecting on assumptions, for example what I am bringing to this from my experience, not only through my involvement in the discipline, but also as participant observer.

Generating the initial codes

The second phase was 'Generatiing the initial codes' that identify important features of the data, relevant to the research questions. I coded the entire data set, after which I collated the data relevant to each code (Braun & Clarke, 2006:87). The codes were rich and nuanced and allowed to evolve. The focus group interview data were coded using Atlas.ti v7, and the online surveys were printed and manually analysed, using colour coding.

Searching for themes

The third phase was 'Searching for themes'. As suggested by Braun and Clarke (2006, 2014) I constructed themes through clustering codes, and gathering all data relevant to each candidate theme, or broader pattern of meaning. Next I collated data relevant to each potential theme, to review the viability of each potential theme, and considering these in relation to central organising concepts.

Reviewing themes

The fourth phase was 'Reviewing themes'. During this phase I checked the candidate themes against the dataset, to make sure that they tell a convincing story of the data and answering the research questions (Braun & Clarke, 2006).

Defining and naming themes

The fifth phase of the process was 'Defining and naming themes'. During this phase I decided on a clear name for each theme, based on the focus of each, and in relation to the story of the data, and the central organising concept.

Producing the report

The sixth and final phase of the process was 'Producing the report'. This final phase requires the weaving together of the analytic narrative and the data extracts, contextualised in relation to existing literature. See chapter 4 for the research findings.

3.6.2 Deductive thematic analysis

To find the answers to RQ3, namely 'How do students and tutors interact in the live online crit', I used deductive thematic analysis to explore the focus group interview, online survey, and the online crit protocol data (refer to Figure 10).

I started from the theory, following a deductive 'top down' approach by using codes and themes generated from the conceptual framework that was formulated based on existing concepts and ideas. As suggested by Auerbach and Silverstein (2003:69) I used the data to 'elaborate, refine, and validate theories in the literature'. This is in alignment with an exploratory or hypothesis-generating approach.

Although the deductive thematic analysis phases that I followed, are presented in sequence, these were executed iteratively. Only in some respects do the phases align with Braun and Clarke's (2006) six-phased reflexive TA method, as presented below.

Familiarising with the data

The first phase was 'Familiarising with the data'. During this phase, I listened to the recorded focus group interview audio files, read and reread the focus group interview transcript and the online surveys. I viewed the online crit screencast recordings (see Figure 15) and I read and reread the transcripts, noting down initial ideas.
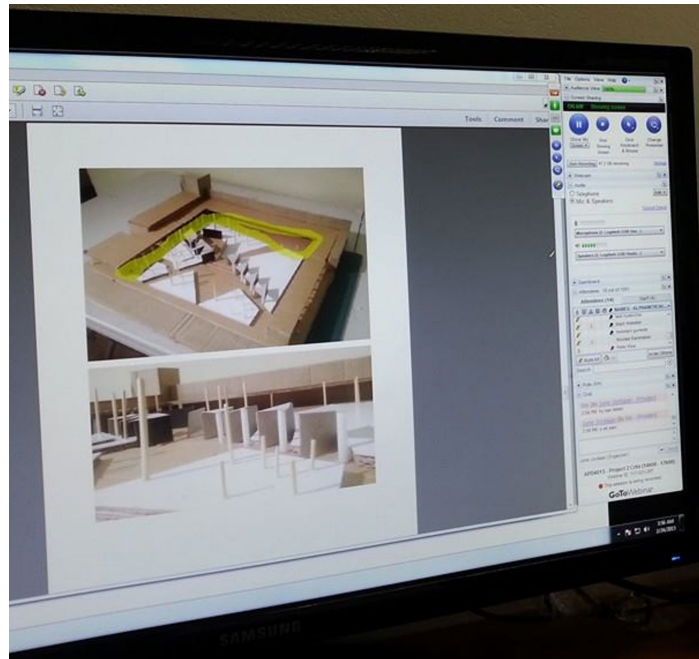
Figure 15: Viewing screencast recordings

Next, in Microsoft Word, I formatted the transcripts with screenshots of the key graphic instances interspersed with the text as they occurred during the crit interactions. This provided a text and still image account of the crit protocol recordings, that originally comprised audio and video (screencast). The students (C1 – C3) and tutors (T1 and T2) were anonymised and labelled (see Figure 16), to identify separate turns. A turn is not related to a unit of time, but, instead, corresponds with Goldschmidt *et al.*'s (2014) definition of a unit, namely that 'a unit comprises the spoken output, or verbalisation, of each of the participants (tutor and student), until the other party takes a turn in speaking (Goldschmidt, Hochman & Dafni 2010:287)'.
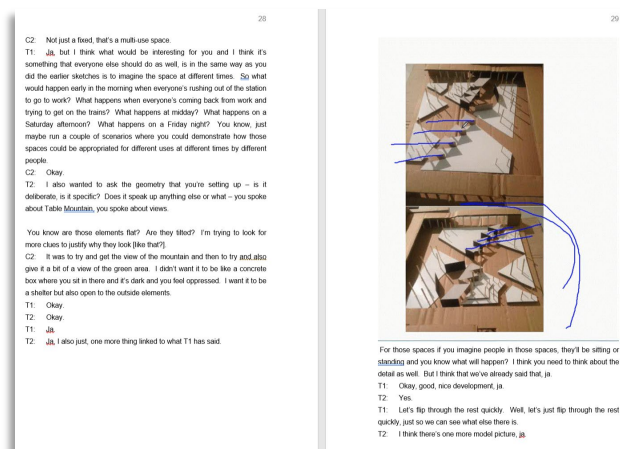
Figure 16: Formatting transcripts

Generating the initial codes

Phase two was 'Generating the initial codes'. Candidate codes and themes were derived from the Conceptual Framework (see Figure 8). I systematically marked up the entire data set of formatted transcripts with these codes and themes (Figure 17), collating data relevant to each code. The graphics were not coded but provided the context for the analysis of the student-tutor interactions as evident in the verbal exchanges.

Figure 17: Marking up transcripts

I numbered the turns and I made notes to record the initial codes assigned to data units, and to document the rules and rationale as I worked my way through the data set. In addition, I kept a record of key examples of such rules and decisions and the series of choices that I made (see Table 6).

ac >< : abstract conceptualisation/ ce >< : concrete experience/ ae ˅ : active experimentation/ ro ^ : reflective observation

articulate or demonstrate/ on action/ in action

		Kolb experiential cycle		Conversational framework				
			Notes	T	Example	S	Example
ac	><	**Abstract conceptualisation/** Process of making sense of what has happened Generalisations, formulate definitions, draw conclusions, WHAT Explains, presents and demonstrated conceptual idea: in-action ad on-action	**Tutor** presents conceptual knowledge *Tutor explains something, introduces a concept* **Student** expresses partial understanding via comment, question or answer, Student: analysis, understanding Student articulates understanding of conceptual knowledge *Student explains understanding*	TUTOR'S CONCEPTION Presents concepts/ conceptual knowledge, hints and comments	*Good, nice but it's a very nice presentation for us to respond to. I just think for everybody on one page, we've got a model, a plan, diagram, section. I mean this is a really useful single page to cross-reference. I think it's been very valuable in this discussion. (Tutor 2, Jayden: 51)*	STUDENT'S CONCEPTION Questions, presents conception as product	*So, it was that idea of moving to one space congregating and then dispersing once again, once experiencing a specific event.* (Student, Paul: 3)
ce	><	**Concrete experience/** *Doing something* Action in a particular context WHAT Explains, presents and demonstrates action to achieve the goal: in-action ad on-action	**Tutor** gives feedback on student's action/ *(acknowledgement of student's articulation)* *Tutor makes a statement/ demonstrates alternatives)* **Student**: Action to achieve goal *Student shows what she did, revises action (reflection on action)*	TUTOR'S CONSTRUCTED ENVIRONMENT Sets task goal, feedback on action/ Tutor's constructed environment	*… So I think then you need to be really careful about you know – make sure that that element you know, floats. (Tutor 2, Ken: 39)* That's also, sorry, what are these shelters for? Is it for traders? Is it just for people to pause? *(Tutor 1, Paul: 48)*	STUDENT'S ACTIONS Action to achieve goal, revises/ modified action/ Learner's actions Shows what he did	*In action So maybe this space over here can just be like an open space in the ground where you can like – there's an open – no roof – roof structure over and you can just hang like …* (Student, Jayden: 46) *On action* Reference to the two photographs of the

Searching for themes

In phase three, 'Searching for themes', I collated codes into potential themes, grouping all data relevant to each potential theme. I prepared a theoretical narrative (see Figure 18) as suggested by Auerbach and Silverstein (2013), by 'retelling the participant's story in terms of theoretical constructs (Auerbach & Silverstein, 2013:74). Using the formatted transcripts, I grouped the numbered 'turns' into episodes that represent the key themes in the narrative.

This phase involved recording my observations to identify groups of turns as episodes and translating the crit interactions into the language of the literature and the conceptual framework, for example:

Crit 1 comprises of episodes a to l, as follows:

Episode a: turns 1 to 12

Turns 1 to 12 comprise of greetings, social conversation and orientation.

Episode b: turns 13 to 18

The student describes the spatial design concept of the group project, that provided the starting point for his project development. He explains the design intent and shares information about the site and chosen precedent

study. On-screen images are advanced, but no on-screen drawing takes place during this stage. The interaction focuses on the conceptual aspects of the work, with the student presenting conceptions as products and the tutors giving minimal hinting and commenting input, to allow the student to continue to explain his design reasoning process.

So basically, like I said there, the spatial design and the concept is enhancing the human senses by moving through spaces. The idea of using architectural and natural elements to enhance certain human senses by manipulating form and function. So that's the spatial design concept. (a)

Turns 42 to 43 (episode h continued)

T2 adapts the task by moving the conversation 'down' to the experiential, by demonstrating the testing of different alternatives - modeling exploration. T1 provides learning scaffolding to support the student's learning experience and the student confirms his understanding.

Turns 44 to 45 (episode h continued)

T2 models reflection by moving the conversation back to the discursive level through reference to design theory, whilst pointing to the on-screen graphics. T1 takes it down to the experiential level, modeling exploration through showing relevant examples.

> *Both [on plan and section] you've got the opportunity here to have a really, really interesting on plan section, Righini talks about the plan section relationship. There's some kind of language so rather than kind of tightly wrapping – [tutor pen moving] it's more a flying and movement. It's not moving enough, I think at this stage. This is now just a – off the cuff, personal response. (T2)*

Turn 46 (episode h continued)

The student confirms his understanding and revises action. There's no movement of on-screen images or markings.

> *Ja, and build a better model to explain the space. (a)*

Turns 47 to 49 (episode h continued)

During this episode, T1 models exploration by demonstrating how the student might use the model to test alternative design solutions. The student mimics exploration followed by another exploration move modelled by T1. Tutor markings are visible in yellow; red and blue markings from previous tutor (blue) and student (red) turns.

> *Well, I think the model you need to, ja, you need to use the model to explore what's closed, what's open, what floats, what's solid. You know again, as part of your concept. Here, all the planes are pretty much the same you know whereas the floor could fold up and become the wall and the roof or the roof could be something completely different you know, ja. (T1)*

Figure 18: Theoretical narrative

Crit protocol visualisation

To visualise the crit protocol results, I developed the Crit Notation Method (CNM), a graphic method of notation (see Figures 19 and 20), drawing on the main codes and themes embedded in the conceptual framework (Figure 10).

This visualisation of the crit protocols, using a graphic representation of the codes and themes, helped me to observe patterns in the data. As suggested by John Tukey it 'force(d)' me 'to note the unexpected' (1977, cited in Bezerra, Jalloh, & Stevenson (1998:335). To visualise the student-tutor interaction in the crit protocols in terms of the moves that they make, the modes that they use to make them, and the methods that they use, I developed the Crit Notation Method (CNM) as a graphic language or

syntax. The crit notation represents the student-tutor interaction in the live online crit, in a linear configuration, read from left to right, much like a music score; employing a visual representation like architects use diagrams to capture the essence of a project (Tschumi & Bierig, 2014).

I considered existing models that describe learning through conversation, learning through experience, and learning through Cognitive Apprenticeship. These are illustrated in Figure 19, namely Laurillard's Conversational Framework, Kolb's Experiential Learning Cycle, and the Learning Interaction Diagram (LID) conceptualised by Tom Carey, Kevin Harrigan and Simon Holland. The LID, in turn, is an adaptation of Harrigan and Carey's (1998) MCCA diagrams which draws on Laurillard's Conversational Framework or model for mediated learing designs, which, in turn, is based on Pask's Conversational Theory.

Learning through Conversation. Laurillard's Conversational Framework. (Carey, Harrigan & Holland, 1999)	**Learning through Experience:** Experiential Learning Cycle (ELC) (Kolb, 1984)
Learning through Cognitive Apprenticeship: Mediated Conversations for Cognitive Apprenticeship (MCCA) Diagram (Carey, Harrigan & Holland, 1999)	**Learning through Cognitive Apprenticeship:** Learning Interaction Diagram (LID). (Holland, 1999)

Figure 19: Crit Notation Method: Informants

Figure 20 shows the numbered turns grouped in alphabetically labelled episodes, relating to the modes of interaction of the student (black symbols) and the tutor (grey symbol), respectively. Participant (titled 'person') roles are marked with 'S' (Student), 'T1' (Tutor 1) and 'T2' (Tutor 2). A turn is not linked to any measure of time. Instead, it follows Goldschmidt's definition of a unit that '…comprises the spoken output, or verbalisation, of each of the participants (tutor and student), until the

other party takes a turn in speaking (Goldschmidt, Hochman & Dafni 2010:287).' It also follows the definition of 'a turn' by Kneser, Pilkington and Treasure-Jones (2001:67) as 'a contribution by a particular participant (and is) delimited by them starting and stopping speaking.' To every turn, the most prominent thematic code was assigned. An episode is a series of turns that display similar characteristics. Refer to Addendum 3 for a full-scale representation.
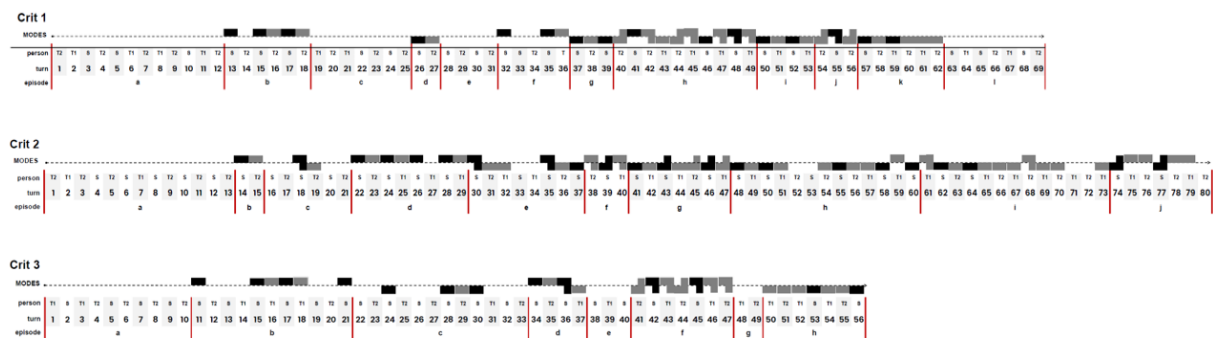
Figure 20: Crit Notations

Each notation comprises the Moves (Theme 1), Modes (Theme 2) and Methods (Theme 3) as set out in the thematic map (Table 8).

Theme 1 focuses on learning through conversation, drawing on Laurrillard's conversational framework. The codes, Present (P), Question (Q), Comment (C), Explore (E) and Reflect (R), represent the Moves that the student and tutor make.

Theme 2 centres on learning through experience, based on Kolb's Experiential Learning Theory. The codes, Negotiation (N), Exploration (E), Application (A,) and Reflection (R), represent the Methods that the student and tutor use.

Theme 3 targets learning through Cognitive Apprenticeship, drawing on the work of Collins, Brown and Newman (1989). The codes, Articulation (Ar) for telling and showing, Exploration (Ex), Reflection (Re), Modeling (Mo), Scaffolding (Sc) and Coaching (Co), represent the Modes in which the student and tutor interact.

On the notation a dotted line separates the experiential mode from the discursive mode of the online student-tutor interaction (refer to Figure 21). The discursive is shown above the line because it denotes theory and abstract concepts and the experiential below the line, associated with the concrete, implementation, and praxis.

Negotiation (operating on concepts and on the discursive level) appears as a rectangle above the line and Application (on the concrete level) is shown as a

rectangle below the line. The symbols appear in grey (tutor) or black (student), depending on whose turn it is. Movement between the discursive and the experiential is shown with an L-form turning up for Reflection (moving from the concrete to the abstract) and down for Exploration (moving from the abstract to the concrete).

Although it was possible to assign one of the four modes to each turn, in some cases more than one mode could apply and the boundaries between different modes were not definitive. The modes were therefore assigned according to the most prominent for each turn.

Figure 21: Crit Notation Method: Example

'Gibbons and Brewer (2005: 121, cited in Conole, 2010) argue that once a notational system is established it can become i) a tool for remembering designs, ii) a structured problem-solving workspace in which designs can take form and be shared, and iii) a kind of laboratory tool for sharpening and multiplying abstract design language categories.

Reviewing themes

In phase four, 'Reviewing themes', I checked if the themes work in relation to the coded extracts and the entire data set, generating a thematic map (see Table 7). The Thematic map illustrates how, drawing on the conceptual framework (A), the crit interaction model (C) is developed through representing the data in the form of notations (B).

Table 7: Themes and codes

	A. From conceptual framework Used in first iteration: Word	B. Refined for notation Findings Used in notation	C. Further refined for crit interaction model
Theme 1	Moves: learning through conversation		
	Activities (Laurillard 2002, 2013)		
Codes	Tutor presents conceptual knowledge (1) Student articulates understanding of conceptual knowledge (13)	**Present**: Tutor presents concepts Student presents conception	Clarify: - present

	Student expresses partial understanding via question (2)	**Question**: Student questioning	- question
	Student expresses partial understanding via comment or answer (2) Tutor gives feedback on student's account (14)	**Comment**: Student comment (or answer) Tutor comments	- comment
	Tutor adapts experiential task to help student experience the concept/ task sets goal for the student (3) Student adapts action in the light of conceptual knowledge (4) Student further adapts action (8)	**Explore**: Tutor adapts task goal Student adapts action	Test - adapt
	Student reflects on interaction using conceptual knowledge (7) Student reflects on interaction to develop conceptual knowledge (11) Tutor reflects on student interaction to begin new dialogue	**Reflect**: Student reflects on feedback Tutor reflects on learning	Elicit - reflect
	Student acts to undertake task (5) Student generates new action to undertake task (9)	**Present**: Student action towards goal Tutor sets task goal Student revises action	Decide - present
		Question:	- **question**
	Tutor gives feedback on student's action (6) Tutor gives feedback on new action (10)	**Present**: Tutor commens, hints	- comment
Theme 2	Modes: learning through experience		
	ELT (Kolb, 1984)		
Codes	Abstract conceptualisation AC	**Negotiation**/ abstract Operating on concepts	Negotiation
	Active experimentation AE	**Exploration** Applying concepts	Exploration
	Reflective observation RO	**Reflection** Building concepts	Reflection
	Concrete experience CE	**Application**/ concrete Operating on application	Application
Theme 3	Methods: learning through cognitive apprenticeship		
Codes	Articulation	Articulation: telling	Articulation

Exploration Reflection Modeling Coaching Scaffoloding	Exploration Reflection Articulation: showing Modeling Coaching Scaffolding	Exploration Reflection Modeling Coaching Scaffolding **Navigation** **Socialisation**

Defining and naming themes

In phase five, 'Defining and naming themes', I refined the specifics of each theme and the overall story that the analysis tells, generating clear definitions and refining the names for each theme.

The crit notations enabled me to expand the conceptual framework (Figure 8) by noting the occurrence of the different themes in the respective crit protocols (see Table 8). Using the coding scheme set out in the map of themes (Table 8), I documented the Moves, Modes and Methods, for each of the three crit protocols.

Although I noted the frequency of different categories and themes, these were not measured. If there was a single occurrecnce of a particular Move, Mode or Method in the crit, a black dot was used to signify it. Through this process, links and relationships between the different codes and themes were confirmed, which lead to the Crit Interaction Model (CIM) as a development of the conceptual framework (refer to section 4.5).

Table 8: Map of themes

	MOVES RQ 3.1	CRIT 1	CRIT 2	CRIT 3	MODES RQ 3.2	CRIT 1	CRIT 2	CRIT 3	METHODS RQ 3.3	CRIT 1	CRIT 2	CRIT 3
									Navigation (+)	●	●	●
									Socialisation (+)	●	●	●
student — Discursive/ CLARIFY	**present**	●	●	●	**NEGOTIATION** Operating on concepts (abstract/ theory)	●	●	●	Articulation (telling)	●	●	●
	question	-	-	-								
	comment	●	●	-								
tutor — Discursive/ CLARIFY	**present**	-	●	-					Articulation (telling)	●	●	●
	question (+)	-	-	-					Modeling Articulation	-	-	-
	comment	●	●	●					Scaffolding Articulation	-	●	●
									Coaching Articulation	-	●	-
student — Adaptive/ TEST	**adapt** (adapts practice)	●	●	●	**EXPLORATION** Applying concepts	●	●	●	Exploration	●	●	●
tutor — Adaptive/ TEST	**adapt** (adapts task goal)	●	●	●					Exploration	●	●	●
									Modeling Exploration	●	●	●
									Scaffolding Exploration	●	●	-
									Coaching Exploration	-	-	-
student — Reflective/ ELICIT	**reflect** on feedback	-	●	-	**REFLECTION** Building concepts	●	●	●	Reflection	-	●	-
	reflect on practice (+)	-	●	-								
tutor — Reflective/ ELICIT	**reflect** on learning practice	●	●	●					Reflection	●	●	●
									Modeling Reflection	●	●	●
									Scaffolding Reflection	●	●	●
									Coaching Reflection	●	-	-
student — Interactive/ DECIDE	**present** (action)	●	●	●	**APPLICATION** Operating on application (concrete/ practice)	●	●	●	Articulation (showing)	●	●	●
	present (revises action)	●	●	-								
	question (+)	-	-	-								
	comment (+)	●	●	●								
tutor — Interactive/ DECIDE	**present**	-	-	-					Articulation (showing)	●	●	●
	question (+)	-	●	-					Modeling Articulation	-	●	-
	comment	●	●	●					Scaffolding Articulation	●	-	●
									Coaching Articulation	●	●	●

Producing the report

'The sixth and final phase is 'Producing the report' (Braun & Clarke, 2006). This involves the final analysis of selected extracts, relating back to the research question and literature. Refer to Chapter 4 for Findings.

3.7 Authenticity and ethics

As a social constructivist researcher, I am aware of how my own personal, cultural and historical background informs how I interpret the data. Therefore, I position myself, my experiences, and my personal background in the research, to interpret the meanings that others have about the world (Creswell, 2007; Auerbach & Silverstein, 2003). Moreover, the research says as much about me as it says about the terrain that it maps (Clarke, 2017). My bias is the belief that knowledge is socially

constructed and that there should be trust in a student-tutor relationship for learning.

In my role as the University coordinator of the part-time programme, I acted as participant observer in this study. This means that a degree of subjectivity was inevitable. However, it equipped me with valuable perspectives and insights (Creswell & Poth, 2017). I employed verification strategies, including triangulation using multiple data sources, namely a focus group interview, online surveys and crit protocol analyses; and peer review by a colleague not involved in the programme, who checked the research process and coding samples. Furthermore, to balance my input as a tutor in the crits, another colleague performed the role of tutor 1.

To conduct a trustworthy thematic analysis for 'acceptability and usefulness' of the research, I made 'pragmatic choices' as suggested by Nowell *et al.* (2017:3). These are in line with the methodological criteria required to achieving rigour in qualitative research, formulated by Lincoln and Guba (1985) as credibility, dependability, transferability, and confirmability, as set out below.

3.7.1 Credibility

Credibility can be operationalized through the process of member checking to test the findings and interpretations with the participants (Lincoln & Guba, 1985).

Lincoln and Guba (1985) suggested several techniques to address credibility. These include activities for example prolonged engagement, persistent observation, data collection triangulation, and researcher triangulation. They also recommended peer debriefing to provide an external check of the research process, to increase credibility, as well as examining referential adequacy to check the preliminary findings and interpretations against the raw data.

In this study I carried out triangulation of methods to ensure authenticity and trustworthiness (Lincoln & Guba, 1985). The multiple data sources include a focus group interview, online surveys, and protocol analyses. Peer review was provided through checking of the research process and coding samples, by a colleague who was not involved in teaching on the programme.

To ensure rigour and integrity, I took certain measures during the entire research process, in respect of procedures described in the literature (Braun & Clarke, 2006; Polit & Beck, 2008). For instance, multiple triangulations, including person, time, method, and space triangulation were used during data collection, for example, online surveys and a focus group interview.

3.7.2 Dependability

Through conducting all the data collection and transcribing the focus group interview verbatim I could get a balanced and accurate picture of the research field. I made sure that the research process is logical, traceable, and clearly documented (Tobin & Begley, 2004, cited in Nowell *et al.*, 2017), for the reader to judge the dependability of the research (Lincoln & Guba, 1985).

3.7.3 Transferability

Although I do not know the sites that may wish to transfer the findings, I aimed for thick descriptions as suggested by Lincoln and Guba (1985), so that the findings can be transferred to other contexts as well.

3.7.4 Confirmability

According to Guba and Lincoln (1989) confirmability is established through achieving credibility, dependability, and transferability. As recommended by Koch (1994) I noted the reasons for theoretical, methodological, and analytical choices throughout the study, so that others can understand why and how decisions were made. Finally, these strategies are in line with Auerbach and Silverstein's (2013:77) qualitative approach to employ the concept of 'justifiability of interpretations' rather than 'reliability and validity' which are commonly associated with quatitative research.

3.7.5 Ethics

Ethical clearance was obtained from the Research Ethics Committee of the institution. Informed consent was obtained from every participating student, graduate, and tutor. Participants were also assured of anonymity.

3.8 Limitations and delimitations

The limitations of the study are mainly related to the size of the study group, and the specifics of the context. The findings are based on a single case and therefore these cannot be generalised to all cases and situations. The size of the student group was limited (40 in total) and although the online surveys were completed by a good representation of the total group, the protocol analyses focused on three students only, and the face-to-face focus group interview, because of the location, was limited to students residing in Cape Town.

A larger and more varied study group would have allowed more variation and depth in the findings. For example, compared to this study that is focused on mature part-time students, future research could focus on a younger and perhaps also full-time student population.

In view of the subsequent sudden pivot to remote and online learning and teaching in 2020, that amplified problems with student inequalities in the architecture studio globally (Morkel *et al.*, 2021), the research results should be even more widely transferrable.

In this research I did not attempt to compare online learning with the traditional onground alternative, and I did not evaluate its success. Through the qualitative exploratory approach, I sought to provide a deep understanding of the student-interaction in the live online crit, that was the most prominent synchronous learning interaction component of the blended learning design. Therefore, although I noted the instances when certain behaviours were observed, I did not measure the frequency of these occurrences.

Furthermore, although I used the crit graphics to support the audio data, in my analysis I focused on the concepts and meaning expressed and communicated via the audio that was recorded and transcribed, and I did not analyse the graphic content that was exchanged between the student and the tutor.

In a future study, rather than Thematic Analysis, Content Analysis might be employed as a methodology to reveal a broader range of textual matter, symbols, messages, information, mass-media content, and technology supported social interactions (Krippendorff, 2004; Hsieh & Shannon, 2005), that were mediated between the student and the tutor. Finally, Discourse Analysis through which detail like gestures and pauses would be recorded, can also be considered.

3.9 Summary

In this chapter I discussed the methodology, starting with an overview of the research paradigm and setting. On these sections followed an explanation of the research sample and data sources, namely the students, tutors, and graduates. Next, I discussed the data collection process, including the focus group interview, the online surveys, and the crit protocols. The chapter concludes with the research methods, including inductive and deductive thematic analyses, authenticity and ethics, and limitations and delimitations. In the next chapter I present the findings of the research.

CHAPTER 4: FINDINGS

In this chapter, I will discuss the findings, starting with the characteristics of the live online crit setting (RQ1) in section 4.1, followed by the types of student-tutor relationships in the live online crit (RQ2) in section 4.2. Next, I discuss how the students and tutors interact in the live online crit (RQ3) in section 4.3, in terms of learning through conversation (RQ3.1) in section 4.3.1, learning through experience (RQ3.2) in section 4.3.2, and learning through cognitive apprenticeship (RQ3.3) in section 4.3.3. A discussion of the findings follows each section, and the chapter concludes with a summary.

4.1 Characteristics of the live online crit setting

The first question was 'What are the characteristics of the live online crit setting?' (RQ1). The reason for asking this question was to determine the nature of the setting in which the live online student-tutor interaction takes place. The instruments that were used to get the answer were online surveys conducted with students (S1 – S23), tutors (T/1 – T/5) and graduates (G1 – G13), and a focus group interview conducted with a group of graduates (A - E).

These instruments showed me what characteristics the participants experienced in the live online crit and were reflected in their views on the live online crit setting. Although the online surveys provided a broad perspective of graduates', students' and tutor's views, the rich narrative data was found in the focus group interview with the graduates.

The thematic analysis of the data produced ten characteristics of the live online crit. Although these may not all be unique to the live online crit, together they present a picture of the nature of this learning setting. These characteristics were grouped in three clusters, namely stress (the stress experienced by students), sources (the sources of engagement) and socialisation (socialisation and interaction).

Next follows a discussion of the ten characteristics of the live online crit:

4.1.1 Stress experienced by students

In 'Redesigning the Design Crit', McCarthy (2011:5) identifies student anxiety as one of the main criticisms against the traditional crit, together with the 'student inability to learn from the feedback given due to the heightened atmosphere of the crit'.

In this study, students reported opposing views on the degree of stress experienced in the live online crit.

> *I think that the crit was just a serious part of our work that one needed to prepare for, but not necessarily stressful. (G5)*

> *Me being naturally an anxious/ stressing person, I found the online*
> *crit quite stressful... (G6)*

Characteristics found in this study, that impact on the experience of the individual, perceived to either increase or reduce stress, are *internet-reliance, participant-invisibility,* and *ubiquity.*

Internet-reliance

The live online crit relies on power and internet connectivity. Students and graduates identified the risk of losing internet connectivity in some locations and during certain times, for example because of load shedding:

> *The only disadvantage [of the live online crit] is the reliance on*
> *technology, because if there is load shedding, then crits are*
> *impossible, where as a face to face [it] may have still been possible*
> *provided the work was printed out in time. (G6)*

This supports the literature that suggest that technical difficulty, slow network transmission and speed, poor audio and loss of internet connection, negatively impact synchronous online sessions (Ng, 2007; Wang & Hsu, 2008). Wang and Hsu (2008) suggest that these obstacles can be overcome if the presenters familiarise themselves with the webinar tool in advance and are prepared for any technical glitches, for example by rescheduling sessions if needed.

Participant-invisibility

The data revealed that the live online crit lets participants be heard rather than seen. In this case, the webcam is not used. Instead, students and tutors use audio and digital pen markings to explore the work submitted for review.

Only one student (S8) identified communication 'directly over a microphone', as a challenge:

> *I find online/webinar crits somewhat stressful since I find it difficult*
> *to communicate directly over a microphone instead of addressing*
> *directly in person. The flow of conversational discussion is*
> *somewhat disjointed in comparison to regular in person discussion.*
> *(S8)*

The prominence of audio as a means of communication (listening) causes some students to feel more exposed. The conversation, when turned to the presenting student, seems to be highly focused, with all attention directed at her, as explained by G6:

> *…I think what made me anxious about the online crit was the fact that everyone was listening in. It was like you were under the spot light and your work was now under scrutiny by a panel of judges [tutors] and students listening in. (G6)*

Others feel more at ease and less stressed in the absence of personal visual interaction (looking), both from the perspective of looking,

> *You would not be looking [at] anyone who would otherwise make you feel nervous in a face-to-face crit. (G5)*

and being looked at (by tutors and peers):

> *The good thing about online crits is that you don't feel pressured from the eyes of our [sic] peers. (S4)*

> *The main benefit of technology is that the lecturers and students do not have to be in the same room when critting. Therefore, the student can be in a more comforting space when talking online and when not facing the lecturers, it is not that intimidating. (G9)*

Because participants can't see each other, one would expect multi-tasking to occur in the online crit setting. Yet, the results show that the online crit it is not subjected to the usual distractions associated with the physical face to face studio setting, as suggested by B:

> *…You know the other people are listening more, more closely, and like student A said, you don't want to make a fool of yourself. [Face to face] you can talk amongst each other … [while] someone else is presenting… Well, I think it's a thing of you log on alone, but you're part of this group, so you [you] listen more intently, and if you're in a [physical] group like this you can sit and chat while they're critting, so I think it's better if you're alone in a group, than in an actual group. (B)*

This supports the literature, for example Ng (2007) found that the absence of physical presence online seems to relax students. In his research on the online tutorial, students reported, not only on the ease of answering questions 'behind the veils', but that they were able to better formulate the questions as well.

This resonates with Hassanpour, Utaberta and Zaharim's (2010:282) findings that, in traditional crit sessions, students fear to perform 'in front of looking eyes.' They claim

that, because of students' fear of eye contact, they often fail to hear the tutor feedback.

Ubiquity

The live online crit is 'everywhere'. This learning setting provides a virtual space for students and tutors to meet, regardless of the location of their homes and workplaces. Students, tutors and visiting experts can join the crit from different locations and even across different time zones.

> *Technology has made it possible to have crits wherever you are, provided you have a decent internet access and a computer/[or] smart phone. (G6)*

Some students reported that the freedom to choose and 'own' the physical space from which they participate in the live online crit, makes them feel more 'at ease', as explained by G5:

> *Technology in my view has positively impacted the crit in that... One gets to cho[o]se and own their space in which they would do the crit, which makes one more at ease during the crit. The fact that you would be alone in you[r] own chosen environment was relaxing in itself... I could do the crit from anywhere convenient for me. (G5)*

There's no clear evidence from the student and graduate responses that the live online crit setting significantly adds to the stress experienced in the traditional crit. Views on this issue differ. Some students argue that stress and pressure are increased because 'everybody is listening', and others say it is reduced because they 'can't see each other'. Students' personal choice of physical learning space, coupled with physical distance, appears to reduce the stress experienced in the crit.

This finding supports the literature that suggests that the online environment enables students to learn in their home environment where they are 'more relaxed' (Percy, 2004:151).

4.1.2 Sources of engagement

Media-intensity, multi-communicability and resource-efficiency emerged from the data as characteristics related to the sources of engagement.

Media- intensity

In their feedback, students, graduates, and tutors mention the presence of multiple media for different forms of communication in the live online crit. T/4 explains how technology expands the forms of communication face to face and online:

> *Technology has increased the ability to use many forms of communication whether f2f or online. (T/4)*

The live online crit accommodates a range of media for interaction, as emphasised by G6:

> *I found the most effective means of communicating one's ideas are clear annotated sketches/ diagrams, clear drawings (plans, sections elevations, 3ds etc) and models (ample photos for the online crits). The on-screen sketching was very useful in helping to explain an idea or highlight an area of a drawing under discussion. Most importantly in communicating ideas is clear and understandable speech. It helps to think through even if it is just in your mind what you are going to speak about and how you will be speaking about your drawings. (G6)*

In this virtual studio setting, all material, whether in two or three dimensions, that students and tutors engage with online, is presented in digital format (Morkel, 2017; Poulsen & Morkel, 2016) for discussion, regardless of the media through which these were generated e.g., physical models, hand drawn sketches, computer generated graphics, photos or graphic and text references and research. It also doesn't matter in which of the other blended learning settings the artefacts were produced i.e., in the workplace, online design journal or on-campus block. As explained by G6, in the online crit, all the work is in one place – students don't need to carry the drawings with them:

> *With the online crits you don't have to carry large amounts of drawings with you as all your work is uploaded. (G6)*

Graduate B refutes the common belief that the digital medium excludes engagement with analog and physical media, deemed necessary for developing design expertise:

> *...I don't think that people should be scared just because you're doing online crits, you're gonna lose process models because process models is like the way you've been taught to figure things out. So, if you've been taught to do it, you will know it makes your life easier, and you know... (B)*

The graphic material that forms the focus of the crit is uploaded prior to the crit, displayed on-screen during the crit and available through the recording, after the

crit (Poulsen & Morkel, 2016). Students value the importance of the graphic content of their crit submission, as suggested by graduate C:

> *You have to explain yourself better graphically... through your online presentation. (C)*

Although on-screen pointing and sketching may be less spontaneous and drawing with a mouse is not ideal, on-screen markings play an important role in online crit communication.

> *The drawing with a mouse is not ideal... (S20)*

> *...the ability to doodle on screen helps a lot in not losing too much with regards [compared] to actual face to face interactions. (S12)*

T/5 argues that the live online crit helps the student to communicate her argument and design premise both verbally and graphically:

> *...Argument and design premise is absolutely paramount for the student to get his/her point across clearly both verbally and graphically. No other [online] interference [sic] focusses all attention on this. (T/5)*

These findings support the literature (Bailey 2005; Maftei & Harty 2015; Oh et al. 2013; Schön 1983) claiming that a range of communication media should be present and combined for best crit results; with sketching used as an important component (Goldschmidt *et al.*, 2014). However, it contradicts the literature (Oh et al., 2013) that propose synchronous online learning lends itself best to text communication.

Wamg and Hsu (2008) suggest the webinar works well for real-time multimedia demonstrations. Although some of the graduates claim the hands-on experience, for example through model-building, does not get lost in the live online crit, Wang and Hui-Yin (2008, cited in Zoumenou *et al.*, 2015) posit that hands-on demonstrations were less effective in the online environment.

Multi-communicability

The live online crit setting accommodates multiple communication channels and tools, including live audio and the digital representation of two and three-dimensional graphics submitted online by the students, that are visible through screen-sharing. It also allows for multiple tools on the webinar platform, including text chat and co-browsing, used simultaneous. The latter was highlighted by B, D and G4, in their feedback:

> *And that's another thing: in an online crit, Tutor 3 used to do that a lot, he posted links… And I think most people then went on to that link, checked it out quickly, where, on a normal [traditional] crit you won't be able to… (B)… yes, you won't get that information… (D)*

> *[It is] … easy to reference to online precedents [shared] by [the] Lecturer. (G4)*

The webinar software used for the live online crit, GoToWebinar, does not allow participants to engage in text chat with each other. They're also no able to see who else is present in the online crit. Through the webinar text chat, participants can only interact with tutors who have organiser status. The student WhatsApp group that was used mostly for asynchronous conversation, was also used as a student back channel during the live online crit sessions, as explained by graduate A in the focus group interview:

> *Well, [we used WhatsApp] all the time… Normally we would be talking to each other on the WhatsApp group while we were being critted or whatever… (A)*

Through it, they provided peer to peer support by offering hints and information during the live online crit.

> *Yes, we'll say 'have a look at this building' or 'why don't you try this?' It's actually very good feedback that you get from your peers. (E)*

Even though the webinar platform is best suited for one on one personal interaction as stated by T/4,

> *The one on one personal interaction around a design issue is what makes this mode of learning different to other modes (T/4)*

parallel conversations can be conducted by accommodating multiple tools like WhatsApp.

These findings support Wang and Hsu's (2008) identification of multilevel interaction as one of the five advantages of webinar tools. It adds to the research by Anderson *et al.*, (2006), who found that the live online learning environment provides multiple tools for communication and presentation. Their research, however, was focused on the internal webinar tools and didn't include external tools such as the WhatsApp chat. These findings further support Ng's (2007) view that the webinar platform is a teacher-led learning environment that works best for one-on-one communication.

However, in this case, through its accommodation of multiple tools, active peer to peer interaction can exist parallel to the main online crit interaction.

Resource-efficiency

Graduates and students experience the live online crit as saving time and money; saving time through focused engagement and saving money through limiting paper (G4), printing (G6) and traveling (G5):

> *Technology allows the crit to be straight to the point through the use of Webinar. No wasting of time pinning up paper or waste of paper. (G4)*

> *Most of the work is in a digital format already and then creating a pdf and uploading is much easier than making costly prints for a crit. (G6)*

> *It saves a lot of time which would have otherwise be spent moving and getting to venues. (G5)*

The crit remains a time-consuming, labour-intensive and costly educational model (Hitge, 2016; McCarthy, 2011), and therefore efficiency is paramount. Although the literature does not specifically speak to the cost benefits of online learning for students, affordability was identified by Wang and Hsu (2008) as one of five advantages of this medium.

4.1.3 Socialisation and interaction

The final four characteristics of the live online crit, found in the data, are linked to socialisation and the nature of the interaction of participants. These include *formality, accessibility, work-orientation,* and *inclusivity.*

Formality

A strong theme that emerged from the graduate focus group interview and online surveys completed by graduates, students and tutors, is the formal character of the live online crit, as suggested by graduate B:

> *I think the online webinar will be more formal again. Standing at my drawing board with a lot of bumph, discussing whatever I did, is a lot less formal than presenting your work on a webinar. (B)*

Students and tutors compare it to a formal presentation, for which preparation is essential, to elicit tutor feedback. The formal and focused nature of the live online crit and rigorous scheduling, requires students to clearly present their thinking, as explained by graduate A and T/4:

Online was definitely more like a presentation, also due to the time constraints… You really had to present it to… (A)

The online crit tends to be more focussed than f2f as time is limited, students have to prepare adequately beforehand and the discussion is more measured. (T/4)

Given the time constraints, as graduate E explains, students must come prepared, be organised, properly articulate their ideas graphically, systematically compile them and carefully plan how they will be verbally presented.

It's like when online you have to be a bit more clear, or more complete so that it… because if you come to a [traditional] crit, you can come with your scrap papers and you can still draw on that, to show your ideas, but with the online [crit] you sort of need something that's a bit more neater and a bit more resolved… you think about like 'I'm gonna start with speaking this' and you think about systematically how you will like layout your work in which order, but with the face to face crit you can just come with your pile of drawings and throw it out on the table and just work your way through it. But it needs to be much more organised with the online crit. (E)

T/5 suggests that the live online crit may be more effective if the students came even more prepared and focus on where the problems are, avoiding repeat information:

Online crits can be improved if students are more prepared and if they can be assisted more to focus on the key aspects of what they need help with. Quite a bit of time goes into repeat information rather than focusing on where the problems are. (T/5)

Students appreciate the value of the formal aspect of the live online crit to contribute to learning as confirmed by A:

Yes, I think so definitely [it helps with the learning] (A)

and it helps them learn about the importance of presentation to sell ideas:

they learn (without knowing) that presentation is key to 'sell' architectural ideas. (T/5)

Graduate B suggests that this learning setting ensures that students properly articulate their ideas rather than waiting for the tutor or a peer to step in.

Yes, I've learnt that if you keep quiet long enough [in a traditional crit], if you get asked a question, someone will lead you into the answer, so if you do that f2f the lecturer, or not necessarily the lecturer, but someone will… I don't wanna [sic] say be be uncomfortable in the silence and then start talking, and lead you to what they were thinking, where online it's different, that you… (B)

Yet, the formal and organised nature of the live online crit, although efficient and focused, seems to limit opportunity for informal and serendipitous learning as emphasised by T/1:

Face to face… conversations have the convenience of the actual pen to paper communication and they sometimes show some hidden thought process that the student deems irrelevant but that the lecturer [tutor] picks up. The idea of, ' o[h] what is this little sketch here'. (T/1)

These findings support the literature by Anderson *et al.* (2006), that the synchronous online crit, through its formality, promotes focused interaction, in contrast to the informality of the asynchronous online crit asserted by Percy (2004).

Accessibility

The data suggests that the live online crit provides equal learning opportunity to all students to participate in and attend all scheduled sessions, through access to the same shared screen in the synchronous session, as well as access to all the recordings afterwards.

The strength in online crits is the ability for students to participate in each and every crit session given and benefit equally, rather than just getting your own crit, watching 2 other people's crits, and going home… I personally look at (almost) everyone's work wholistically [sic] and try [t]o build a general idea of what is correct and what isn't. This would never be possible through conventional crits. Conventional crits were a nightmare. (S20)

Not only do crit recordings help students to revisit their own crit interactions, to make sure they understand, and in case they missed important feedback,

[The] online crit via webinar for me worked very well. First the fact that the crit was recorded meant that I could revisit at any time, those comments made about my work and listen to them word for word. (G5)

but students can also relate the feedback that others received, back to their own projects, using the crit recording as a learning resource and thereby reducing the need for unnecessary repetition by tutors:

> *I could listen in to other crits and apply some advice given to other students instead of the lecturers repeating things to each student. (G5)*

Graduate A reflects on the value of observing someone else's crit

> *I found that most of my lightbulb moments was when I was looking at someone else's stuff. (A)*

and revisiting one's own crit as a 'third person':

> *… by listening to other student crits, you learn as well. Being able to re-listen to previous cirt [sic] sessions at own time has been beneficial because you view your feedback as a 3rd person. (S6)*

Finally, G6 suggests that the value of the recorded crit as a resource can be more widely used for learning, teaching, quality assurance and research:

> *[Crits] can now be recorded and replayed fro [sic] clarity… These can then be used to educate others who join architectural schools and curriculum researchers to further refine the experience of the crit. (G6)*

Another aspect of the live online crit that relates to equal learning opportunity, is how online turn-taking helps to ensure that every student is given a turn to present her work and elicit conversation and feedback. As graduates A and D jokingly remark, it's not so easy to avoid an online crit:

> *Yes, and you can't avoid the crit. Like you know, haha… like sometimes if it's a crit in person, you get to a class where there's lots of students, you can hide. (A)*

> *…like behind the wall (D)*

> *… whereas you know, online, like we all realized, you know, you are definitely going to be critted… (A)*

Students say that the live online crit works well with many observers (S8 refers to 'spectators') because everyone can see the work shared on-screen, on their own devices. The size of the crit group is not limited by proximity to and visibility of the crit material:

> *Face to face [there is an] efficient flow of communication, [but] somewhat restrictive for spectators [whereas] online [it is] logistically very convenient, easy for large numbers or viewers to be involved. (S8)*

These findings support the literature that suggest that 'students hear all critiques of all projects and benefit from feedback to their peers' (Bender & Vredevoogd, 2006: 119), and whenever they want it (Oh *et al.*, 2013). It further supports literature that suggest that students get access to the same tutor feedback 'unlike the front row advantage' in conventional settings (Romiszowski, 1988, cited in Bender & Vredevoogd, 2006:119). The findings further support Wang and Hsu (2008:177) reported advantage of the webinar through 'archiving of seminar content for personal review or for people who missed the real-time session'. In this respect the study responds to Olweny's (2015) observation that students often miss the benefit of the tutor feedback because it is not properly recorded through note-keeping by the student or her peers.

Work-orientation

The student, graduate and tutor respondents agree that the live online crit is focused on the work. One of the main contributing factors is the screen-sharing of online submitted student work, that appears on all participants' device screens so that everybody is looking at the same image:

> *You deal with the images on the screen. It's more direct. (C)*

> *Both parties are more focused on the discussed issue or what is displayed on the screen. (G12)*

The webcam is not used (Poulsen & Morkel, 2016) and therefore, instead of focusing on the participants, the emphasis is on the images and on-screen drawing activity and accompanying verbal conversation. Students and graduates report that the absence of gesture and facial expression in the crit avoids misunderstanding due to the misreading of facial cues. They also suggest that it helps to hold the attention of both students and tutors in the crit and limit distractions.

> *Presenting your work with use of webnair [sic] software with help of audio and video helps in distance learning as well as avoiding misjudging by facial presentation but focus on work done. (S14)*

> *It also helps you to stay focused. F2f sometimes someone gets distracted, where online … everybody is focusing on the work. No distractions. (D)*

Although the literature submits the importance of non-verbal cues in the crit (Anthony, 1991) none of the respondents report the absence thereof to negatively impact on the crit. On the contrary, students and graduates indicate that these can be confusing and distracting. Anthony (1991) posits that the effective use of nonverbal expression can enrich the student-tutor interaction in the traditional crit, but also admits that facial expression and tone of voice can confuse students, if great care is not taken by tutors to be consistent and positive in their non-verbal communication. This view is supported by these findings.

Inclusivity

The final characteristic of the live online crit that emerged from the graduates', students' and tutors' responses, is that it widens access and expands the range of participants. The online medium can reach more students and provide access to a broad range of experts with diverse backgrounds and skills.

> *Online has the advantage of reaching more students and also an easy way to 'dial in' an expert on an ad hoc basis, thus access to a wide range of opinions. (T/1)*

> *It can now involve a lot more people from different locations and one can get a wider diversity of views about their work. (G5)*

As explained under the points 'media-intensivity' and 'accessibility' above, the crit recordings, through their availability to all students, provide access to all the learning conversations so that no one is excluded. These findings support the literature that indicate the online setting widens access and enhances convenience (Lowenthal, Dunlap & Snelson, 2017) and provides access to learning to those who have been unable to do so in the past (Poulsen & Morkel, 2016).

4.1.4 Discussion

In response to Research Question 1, '**what are the characteristics of the live online crit**', ten characteristics were identified. These were grouped in three clusters namely *stress experienced by students*, *sources of engagement* and *socialisation and interaction*.

This research provides empirical evidence that contradicts the general perception that students and tutors are sceptical of the use of technology for design education (Fleischmann, 2018), and that design studio cannot be easily transferred into an online environment (Fleischmann, 2018; Kwan, 2010). It shows that, despite some obvious limitations, the live online crit offers a setting for engaging and constructive interactive learning.

Characteristics that impact on the experience of the individual, perceived to either promote or reduce stress, *are internet-reliance*, *participant-invisibility* and *ubiquity*. Although the risk of losing internet connectivity can add to the stress experienced by students, this disadvantage can be easily accommodated by advanced planning and clear rules of engagement. The focus on audio in favour of the physical visibility of participants, is preferred by some, but not all students. However, the absence of a physical online presence appears to remove some of the stress barriers, reduce the imbalance in power relations between student and tutor and contribute to the attentiveness of students. Online interaction that is available anytime and anywhere provides choice and savings and supports non-traditional students towards lifelong learning.

Media-intensity, *multi-communicability* and *resource-efficiency* are characteristics associated with the sources of engagement cluster. The online use of a range of communication and interaction media and tools promote rich and multiple crit conversations. Since hands-on demonstrations are less effective in the online environment, it should be accommodated elsewhere in the blend, or, for example, through recorded video demonstrations. The fact that all design artefacts are uploaded online, provides for good record-keeping of students' design processes. Communication on multiple platforms concurrently, adds to the richness of interaction with a range of tutors and peers, that contributes to the learning experience. It also helps students to develop verbal and written articulation skills. Access to workplace internet and a reduction in travel and printing expenses, lead to resource-efficiency, together with the financial advantages associated with working whilst studying.

The final four characteristics are linked to *socialisation* and the nature of the *interaction* of participants, namely *formality*, *accessibility*, *work-orientation*, and *inclusivity*. The formal and organised nature of the online crit inhibits informal and serendipitous learning. Care should be taken to create opportunity for these learning experiences elsewhere, as part of a blended learning approach. There is no limit to the number of crit participants online at any given time. The online medium seems to limit distractions through its focus on the work shared on-screen. Also, students have access to all the learning conversations which means that no one is excluded.

It is hereby not suggested that the live online setting as a learning environment should replace face to face crits entirely. Instead, I argue that, based on the characteristics identified in this study, the live online crit may expand the current crit setting beyond the physical studio. An understanding of the value that the live online

crit setting can add, and its limitations, can help educators and tutors design learning interventions suitable to specific learning contexts, towards addressing challenges related to student diversity, limited resources and a rapidly changing higher education context. As a result, not only will learning be more easily accessible to working students wishing to study part-time, but graduates will be better equipped to navigate multiple physical and online modes of interaction necessary to practice architecture in the 21st Century.

In the next section, Research Question 2, '**What is the nature of the student-tutor relationship in the live online crit**' will be adressed.

4.2 Student-tutor relationships in the live online crit

The second question was '*What are the types of student-tutor relationships in the live online crit?*' (RQ2). The reason for asking this question was to determine the relational context in which the live online student-tutor interaction takes place. The instruments that were used to get the answer were online surveys conducted with students (S1 – S23), tutors (T/1 – T/5) and graduates (G1 – G13), and a focus group interview conducted with recent graduates (A - E). These instruments showed me what types of student-tutor relationships are experienced in the live online crit. Although the online surveys provided a broad perspective of graduates', students' and tutors' views, rich narrative data was found in the focus group interview with graduates.

Students value the interaction with the tutor for individualised feedback to develop design expertise:

> *One on one interaction with the lecturer (tutor) is one of the key points in developing my design. This is where I can discuss what my ideas are and how I would like to move forward in my design, with an opportunity for positive or negative feedback from the lecture[r]s, possible precedents to study and alternative ideas to explore. (S10)*

> *[Tutors] help me to realise strength and weakness in my thoughts and processes and I get to know of expert contributions. (S15)*

The analysis of the data produced four types of student-tutor relationships. These are the novice-expert, architect-client, mentee-mentor and child-parent relationships.

Since the live online student-tutor interaction exists as part of a blended program, it follows that, in addition to these, more types of student-tutor relationships may exist

in the other learning settings, and with other parties. For example, graduate D explains how the student's relationship with the online tutor differs from that with the workplace mentor. The latter helps the student prepare for the online crit, during which the online tutor responds with feedback.

> *I think your [workplace] mentor critting your work is more like establishing answers and online crits is (sic) more like from the lecturers (tutors) answering your answers. Confirm that you're on the right track. (D)*

It is furthermore suggested that the same tutors may take on different roles and therefore maintain different kinds of relationships in different learning settings:

> *That's almost the different hats that you're wearing, where like you're not on the whatsapp group, but on facebook you're like a 'friend' and then on the portal you're the teacher or the and (sic) then somewhere else you'll be the client... (B)*

> *I'd say it does not change, but maybe it becomes more familiar. The 'role' of the lecturer might change in terms of 'what hat' they are wearing - client, developer etc. (G1)*

Although these roles remain largely constant, respondents indicate that, over time, the student-tutor relationship becomes easier, more familiar and comfortable:

> *I don't think the relationship changes, but I do feel the student and lecturer get to understand and know each other better, making it easier to communicate. Students also feel more comfortable with the lecturers. (G6)*

> *[Over time] The relationship matures in a way to make both parties more comfortable with each other and understand the tone of voice and personalities better. (G13)*

In the next section the four types of student-tutor relationships found in the live online crit, are discussed in terms of the degree to which the student's work is subject to judgement and criticism by the tutor, the hierarchy and power relations between student and tutor and the nature of their behaviour and attitudes towards each other. The four types of student-tutor relationships identified in this study, are the novice-expert, architect-client, mentee-mentor, and child-parent relationships.

4.2.1 Novice-expert

The *novice-expert* relationship where the tutor performs the role of an expert, is reported to be the most prominent student-tutor relationship in the live online crit. This relationship is discussed below, in terms of the degree to which the student's work is subject to judgement and criticism by the tutor, the hierarchy and power relations between student and tutor and the nature of their behaviour and attitudes towards the other.

Approval and evaluation

The student seeks approval from the tutor as expert, and confirmation of her progress:

> *Crits give one an indication as to whether they are on the right track with their design and offers a perspective either [sic] than your own which may inspire you and result in an improved end product. (S11)*

Although the crit is not a formal assessment it is often perceived as a kind of evaluation of the student's work by the tutor, who also acts as examiner in another learning setting.

> *… It's like when I had my last crit with my [workplace] mentor it was like I got stuck and I said ok, how can you help me out here, and then we sort of designed through the building and then I presented that to the lecturers to see what their…(E)… feedback is (D)*

It is this seeking of approval from the tutor by the student, and the tutor pointing out deficiencies in the work, that present the crit in a negative light,

> *A crit i.e. a 'criticism' or critique per se has a negative connotation to many. A review is perhaps a better word.* (T/3)

and it leaves the student potentially vulnerable, with the tutor in a position of power in relation to the student. Tutor 1 recalls an experience from her days as a student, when she felt vulnerable and exposed in the crit situation:

> *When i [sic] was a student it felt like a vulnerability of laying bare your ideas, waiting for the wolves to tear in to a carcass. But as a tutor its more of a sharing experience? Maybe my perception was flawed as a student. (T/1)*

Although it is understood that it is the work that is criticised and not the author of the work,

> *[You have] to take negative feedback about a design without becoming defensive, you as a student are not been (sic) criticized, it is your work.*

> *lecturers arnt their [sic] to hold your hand, they are there to push you, to make sure that you learn and understand what you need to become successful. (S10)*

students and tutors agree that tutor authority should never be used to humiliate a student:

> *Students should never feel personally threatened. Students should never be interrupted and belittled. (T/2)*

> *You can criticize someone but don't be like nasty or shout at them in front of everyone, I mean, that makes students never wanting to bring anything ever again. (A)*

Instead of focusing on the shortcomings of the student's work, the tutor (as critic) should offer constructive feedback:

> *The aim of a review is to give positive direction to students to assist them in the development of their designs and solutions. A critic is by definition a person who offers reasoned judgment or analysis, value judgment, interpretation or observation, and as such a 'crit' should offer the opportunity for students to engage with such a person related to their work or efforts. (T/3)*

In this study, students felt this was the case in the live online crits:

> *Yes, your [the tutor's] criticism... I felt was always constructive. It was like that is wrong, try this. Not this is wrong, why didn't you do this, that's how negative... (A)*

These findings support the literature that shows that the tutor's role as a more knowledgeable other (Vygotsky, 1978) is to judge the students' progress (Higgins *et al.*, cited in Blair, 2006; Lotz, Holden & Jones, 2015), measuring their work against the standards set, and making the gap visible through the crit (Marie & Grindle, 2014). It is aligned with Durling's observation that students need to 'check they are on the right track and 'do the right things' (Ashton & Durling, 2000:3). It supports Blair's (2006) assertion that such feedback should always be constructive. Furthermore, the data confirms Christine Percy's (2004) view that, in the crit, the tutor's roles as assessor and facilitator are often blurred. Yet, from the data, it transpired that the tutor is not meant to 'correct' the work of the student, but rather to prompt the student to think about alternative solutions, and to model design expertise. It aligns with Webster's (2008) critique of Schön's work in this respect.

In their aspiration to master design expertise, students constantly seek tutor approval; and to establish the 'distance' (Lave & Wenger, 1991; Blair, 2006) that remains, for the novice student to become an expert, 'judgement' is made by the tutor. This is also true for the live online crit, but such judgement and criticism are seen to be supportive and constructive as suggested by Abdullah (2012). Yet, to shift the focus from 'keeping the student on the right path (closing the gap) to a focus on student-centred learning' (Blair, 2006:14) where the student takes charge of her own learning, requires a different approach to feedback and assessment.

Master and apprentice

Some tutors maintain there should be hierarchy in the student-tutor relationship, with emphasis on the tutor's role as expert,

> *...Whilst healthy debate is encouraged there should still be hierarchy. Often students disagree just for the sake of trying to make a point when it is clearly not 'right'. It's difficult to point out 'right' and 'wrong' in architecture! Two lecturers who compliment [sic] each other will either agree or disagree on a particular point. If they agree the chances are that the point they're making is valid, should they disagree it leaves more room for debate... (T/5)*

> *The lecturer must give positive direction to students to assist them in the development of their designs and solutions. The lecturer is not just a facilitator, he is a conductor and controls the learning method and pace and must achieve the objective. (T/3)*

and the students concur:

> *...the relationship should be an open relationship whereby both parties provide their thoughts, but their [sic] should be an understanding that the student should obey and respect the lecturer with regards to their opinion as the lecturer is the more qualified and more senior of the two. (G9)*

However, the students don't think that tutors see themselves as superior to them:

> *...students see lecturers as more superior/senior, but lecturers do not necessarily see themselves in that way. (S2)*

These findings support Percy's (2004:149) observation that 'Implicit in the students' acceptance of the crit was the silent affirmation of the superiority of their tutors and legitimation of social difference.' The problem with the tutor as expert or 'master' is that students may blindly follow the tutor's direction without proper understanding of the feedback (Oh *et al.*, 2013; Dutton, 1991) or they may feel intimidated by it (McCarthy, 2011; Odgers, 2001, cited in Oh *et al.*, 2013). This phenomenon seems to be

particularly pertinent in education in sub-Saharan Africa as suggested by Mark Olweny (2015; 2017) where students aspire to mimic the work of their tutor whose approval they seek as a confirmation of their competence.

However, in this study, it was found that, in the live online crit, students are less likely to feel intimidated by a tutor and their critical thinking and learning is not generally inhibited by overpowering tutor feedback. This is encouraging, since a more balanced and equal relationship between student and tutor (Willenbrock, 1991), as well as a student-centred approach is believed to '…facilitate(s) more advanced levels of learning than traditional tutor centred approaches.' (Stuart-Murray, 2010:16).

T/2 suggests that, rather than being subordinate, students should be viewed as individuals who simply happen to be less experienced than their tutors.

> The student should not be seen as a subordinate. Lecturers and mentors should be seen as individuals who are to varying degrees more experienced. (T/2)

Moreover, since these students are working individuals and because they come with varied practice experience, they may, in some respects, be more knowledgeable than their tutors.

> I think that's probably a possible problem of this course since that everybody had to have worked a couple of years and now they're in the industry, and they think they know a lot and they might even think that they know better than the lecturers [tutors] so obviously people do get frustrated because they think well I know, I've been doing this for four years. So, I think, we didn't really have that [tutors breaking students down] because you guys really helped us to better ourselves, and not tried to break us down… (B)

This response supports Percy's (2004:152) observation that, in the online environment, sometimes the student becomes the expert through demonstrating 'a more advanced technical knowledge than their tutors, giving them 'a sense of superiority and confidence.'

Although some students acknowledge and accept a degree of control by the tutor,

> Tutor and student relationship, one learns, and the other directs. (S6)

asymmetrical power relations through race, gender, age, and role or position were not identified in this studio:

> Not at all. I think we respected you guys because you were our teachers and it didn't matter which gender or race you are… whatever, you are our lecturers,

and we respect you because you are trying to teach us something and we are trying to learn something. (B)

Some students suggest that they should be given full presenter rights in the webinar, enabling them (rather than the tutor) to control the visuals on the screen.

I think the online crits could be improved more if the presenter (student) has full control over the online session by moving through pages/ slides etc. (G6)

These findings support the literature that highlights tutor control and an imbalance of student-tutor interaction (Kneser, Pilkington & Treasure-Jones, 2001; Oh *et al.*, 2013; Goldschmidt *et al.*, 2014), where the student and tutor interact in a student-tutor relationship. However, they don't support the literature highlighting power exerted through gender, that refers to 'men as masters' (Willenbrock, 1991). Reasons for this might be the maturity of the students and the balanced distribution of gender among the tutoring staff.

The request by the students to take control of the screen, resonates with Helena Webster's (2008) reference to an example of tutor control of student learning (in her criticism of Donald Schön's work) where the tutor takes control by physically moving the student's workbook. From the literature it is evident that the most successful crits are those where power relations are dissolved (Hassanpour, Utaberta & Zaharim, 2010; Willenbrock, 1991).

Respect and familiarity

From the data it transpired that potential asymmetrical power relations are mitigated by mutual respect, a sense of responsibility and a commitment towards the shared goal of learning:

I think the relationship between a lecturer and student (tutor) is still respectful. There is a certain goal in mind by both parties and there is a responsibility by both parties to reach this goal. The student must achieve this goal and the Lecturer is there to guide/explain/teach the student to achieve this. (G8)

I've been taught the same: you don't argue with your elders, you respect them. But if you're certain about your stand point, you can. (B)

The tutor's role in the student-tutor relationship in the live online crit is not perceived as authoritarian:

I find that the lecturers are quiet [sic] casual and don't come across as authoritarians, which is great because it makes one more relaxed. (S11)

The perception of students, graduates and tutors is that although the relationship between students and tutors is formal, it is also close and personal:

> *A close, formal relationship which is in actual fact a long conversation/debate to resolve a design/problem (G1)*

> *The one on one personal interaction around a design issue is what makes this mode of learning different to other modes. (T/4)*

The student-tutor relationship as novice-expert in this study, supports the literature on the master-apprentice relationship (Oh, 2010; Oh *et al.*, 2013), with the tutor as instructor (Cronjé *et al.*, 2006), and authority (Goldschmidt *et al.*, 2014; Goldschmidt, Hochman & Dafni, 2010). In sub-Saharan Africa where elders are seldom questioned, and authority celebrated, power relations are often skewed, and learning hindered as a result (Olweny, 2015, 2017). It is especially detrimental to design learning that relies on open and critical dialogue. It may be different for online learning environments, however, where the student and tutor are seen to be in a more familiar relationship (Percy, 2004). Christine Percy (2004) ascribes the possible reasons for such familiarity and 'a reduction in inhibitions and awareness of difference in status between the tutors and students' to 'the use of the written 'voice' as opposed to the verbal 'voice' in the asynchronous text-based online crit setting that she studied (2004:152). These findings suggest that it might be similar in a synchronous online environment, although further research is needed to explore this assumption.

4.2.2 Architect-client

The second type of relationship that emerged from the data, is the architect-client relationship, sometimes also referred to in the literature as the architect-developer or designer-user relationship. In this relationship, the student takes on the professional role of the architect, and the tutor, in turn, performs the role of the client, developer or user.

Next follows a discussion of the degree to which, in this relationship, the student's work is subject to judgement and criticism by the tutor, the hierarchy and power relations between student and tutor and the nature of their behaviour and attitudes towards each other.

Feedback for improvement
Graduates and students suggest that the tutor, acting as client, provides feedback on student's work like a client would respond to an architect. Such feedback is not directed at the author of the work, but seen to add value to the project:

...architect - client type relationship or student - teacher. Someone that reviews your work and might change it to suit them better. (G7)

And also, clients want, in an office, the client is not always gonna to be happy with what you present, and they will give you feedback and you need to learn to respond to that and not take it necessarily personally (yes others), but see it as part of the journey, part of the design. (B)

Partners in practice

I found that the student-tutor relationship acknowledges the different student and tutor roles and hierarchy in accordance with the real-life practice situation:

As it should be, a lecturer a[n]d a student. Once those lines are blurred, the standard of work is compromised. Eventually, all we do during our studies is to prepare us for real-life work which we would experience as architect & client. (S3)

Therefore, the power relations between student and tutor are more symmetrical or balanced as they work 'like partners',

Lecturer (tutor) and Students end up working like partners in the design process, with the Lecturer unlocking ideas for the Student. (G4)

than what would be expected in the student-expert relationship discussed above.

Preparation for the profession

The architect-client student-tutor relationship prepares students for a real-life workplace situation:

... Eventually, all we do during our studies is to prepare us for real-life work which we would experience as architect & client. (S3)

... that's how it works in an office. You don't just work alone... you're always bouncing off ideas, so you need to get used to being criticized... Ja, my friend has this new student working for them, just a student intern, and he gets so offended when they just tell him, you know, what needs to be done, and actually it's just like a crit, you know, so ja, a learning process. (A)

In this relationship, the student takes one a more professional role (architect) but is still required to respond to the feedback given by the tutor, who simulates the role

of client or developer. In this study, the working students have shown to be familiar with these roles.

> *...the relationship between us is great, very professional. They gave us a different perspective of what architecture was about. (G2)*

The reference to the tutor as client, developer or user as suggested by students in this study, supports the literature that presents the tutor as client surrogate (Goldschmidt *et al.*, 2014), consultant (Mewburn, 2012) or user (Goldschmidt *et al.*, 2010; Oh *et al.*, 2013; Dutton, 1991). Although Davies and Reid (2000, cited in Blair, 2006) question the tutor's ability to roleplay as client, Dutton (1991) maintains that, in this role, the tutor refrains from judging student work, and instead, acts to represent a user or a group of users, to test, prompt and model their reactions. Although the tutor is still the expert, this relationship provides for a more constructive, less intimidating learning experience.

4.2.3 Mentee-mentor

The third type of relationship in the live online crit, reported by students and tutors in this study, is the mentee-mentor relationship. The student takes on the role as mentee and the tutor acts as mentor, guide, coach and facilitator.

Below follows a discussion of this relationship in terms of the degree to which the student's work is subject to judgement and criticism by the tutor, the hierarchy and power relations between student and tutor and the nature of their behaviour and attitudes towards each other.

Guidance and advice

Although reference is made to the evaluation of student work by the tutor,

> *The lecturer (tutor) is there to guide the student through helpful evaluation of the design process. (S22)*

the focus is on suggestions and encouragement, rather than judgement:

> *I see it as a mentor / mentee where ideas are shared, and comments are given about the mentees work done. The Lecturer (tutor) is there to guide the student through their design, their word is not gospel, it is the suggestion of alternate ideas or encouragement. (S10)*

The tutor provides guidance, rather than instruction

> *The tutor/ lecturer assumes the role of a guide, guiding the student but not forcing or instructing the student what steps to take. The lecturer suggests ideas/ steps to take in order to design his/ her building or what research to look at etc. (G6)*

> *...there [sic] are more of guider than lecturers. they guide you to your full potential... The student presents ideas about their approach to the design issue and the lecturer tries to understand their intentions and to then guide the student in an appropriate direction to best resolve the design. (T/4)*

and challenges and prompts the student to expand her thinking:

> *The lecture(r) is the facilitator, guide(r) and adviser engages and challenges the student to think deeper and more carefully about their work . (G)*

These findings are in line with the literature that presents the tutor as a guide (Cronjé *et al.*, 2006) or facilitator (Goldschmidt *et al.*, 2014), prompting students to think critically on their own (Attoe & Mugerauer, 1991).

Coaching to full potential

According to the student responses they feel that they are in charge of the learning process, supported by the mentor or coach who provides advice and encouragement,

> *One could say that a tutor/ lecturer is much like a coach in a sport, the coach can offer guidance and advise [sic] to the sportsman, but it is completely up to the sportsman to implement that advis[c]e while training and playing. (G6)*

but the student decides how she wants to employ it.

> *The tutor guides and encourages the student to reach her full potential and acts as a sounding board when needed. (S16)*

> *I feel that relationship is that of a sounding board where ideas and theorems tested and questioned and where a moment of realisation can be attained that would not be reached on your own. (S16)*

The respondents' reporting on the tutor's role as a coach or mentor, contradicts Attoe and Mugerauer's (1991) description of the coach (mentor) as an authoritative figure. Instead, they refer to the coach as guide (Cronjé *et al.*, 2006), and supportive

facilitator (Goldschmidt *et al.*, 2010; 2014; Ligorio, Talamo & Simons, 2002; Burnett, 2003.)

Trust and openness

Mention is made of the student-tutor relationship as friendly and, over time, able to support easy interaction:

> *Given that you are given the platform to defend yourself i find it friendly as if you are interacting with your peers. (G3)*

> *…[over time the relationship] changes in the way that you can easily open up to your lecturers. (G3)*

These findings support the literature that presents the tutor role as counsellor for example Attoe and Mugerauer's (1991) counsellor role. Students, graduates, and tutors reported that the tutor as mentor provides guidance (Cronjé *et al.*, 2006; Oh et al., 2013), encouragement and acts as a sounding board to students. This resonates with Lam's (2011:40) emphasis on the tutor's role as dialogue facilitator, rather than direct instructor, through the Socratic learning method and reciprocal learning principles. Other literature that these findings support, in respect of the role of the tutor as coach, are Schön (1987), Uluoğlu (2000) and Goldschmidt *et al*. (2014) who suggest that this tutor role is less authoritative than the expert role. This signifies a shifting tutor role from expert to facilitator, in a democratised studio.

4.2.4 Child-parent

The fourth and final type of student-tutor relationship that emerged from the data, is the child-parent relationship, where the tutor takes on the role of a carer.

One student (S5) identified a child-parent student-tutor relationship in the live online crit. It matches Attoe and Mugerauer's (1991) parental tutor role, identified through one-hour interviews with twenty award-winning tutors to establish what excellent studio tutors do. In their study, a significant number of tutors likened good tutor practice to parenting. This meant helping students, nurturing, and showing an interest in the student's life and work. They identified two more roles as caring helper, namely coach and counsellor, but of the three the parent role did most to shift the focus from the tutor to the student. This finding supports the literature that define the tutor role as social supporter (Cronjé *et al.*, 2006).

However, as suggested by Anthony (1991) the child-parent relationship in the paternalistic atmosphere of the studio when tutors 'behave like surrogate parents' (p. 8), may intimidate students and hamper learning.

4.2.5 Discussion

In response to Research Question 2, 'what are the types of student-tutor relationships in the live online crit', four types were identified, namely novice-expert, architect-client, mentee-mentor, and the child-parent relationship.

This research adds to the limited body of knowledge on the student-tutor relationship in online learning settings generally (Wallace, 2003), in synchronous online learning settings (Burnett, 2003; Cronjé *et al.*, 2006; Ng, 2007), and in studio type synchronous online learning settings specifically (Oh *et al.*, 2013).

In their framework for critiquing practice: conditions and methods, Oh *et al.* (2013) include the student-tutor relationship as a component of critiquing methods. This inclusion demonstrates the importance of consciously considering student-tutor relationships in crit practices.

Table 9: Student-tutor relationships: Literature

student-tutor relationships found in this study	Attoe & Mugerauer, 1991	Cronjé *et al.*, 2006	Oh, 2010; Oh *et al.*, 2013	Goldschmidt *et al.*, 2014, after Quayle, 1985
novice-expert		student-instructor	apprentice-master	student-expert student-authority
architect-client			designer-user	
mentee-mentor/coach	student-counsellor student-coach	student-guide student-mediator		student-coach student-facilitator
child-parent/ carer	child-parent	student-social supporter		

Four types of student-tutor relationships emerged from the data, supporting Wallace's (2003) view that tutors take on multiple roles in learning relationships. The student-expert relationship emerged as the most prominent, followed by the architect-client relationship. The mentee-mentor, and child-parent relationships were also identified. The latter was not a notable relationship associated with the student-tutor interaction in the live online crit.

These findings support the literature that refers to the student-expert (Cronjé *et al.*, 2006; Oh *et al.*, 2013; Goldschmidt *et al.*, 2014), architect-client (Oh *et al.*, 2013), mentee-mentor (Attoe & Mugerauer, 1991; Cronjé *et al.*, 2006; Oh *et al.*, 2013), and child-parent (Attoe & Mugerauer, 1991; Cronjé *et al.*, 2006) relationships.

The third relationship identified in the work of Goldschmidt *et al.* (2014) where the tutor performs the role of a buddy, was not found in the live online crit. It's worth considering here Percy's (2004:149) view that the studio tutor is more able to act as

the student's critical friend (buddy) in the 'adversarial setting of the crit', in cases where the tutors were also present in the studio, where the student prepared work for the crit. She found that there was a difference in the student-tutor relationships in cases where students and tutors shared the same (physical) workspace, as opposed to where they didn't. Percy posits that studio-based staff bring the history of the 'casual, open-ended, and serendipitous moments of intervention and informal dialogue that took place with the students in the design studios prior to the crit' (ibid. 2004: 1149). This provides some explanation why the tutor role of buddy is not associated with the live online crit, that forms part of a blended learning model where students and tutors are physically separated for most of the time.

The degree to which judgement and criticism are associated with the live online crit, varies across the different types of student-tutor relationships, and are most pronounced in the student-expert relationship. However, criticism was reported to be constructive, focusing on suggestions for improvement of student work, rather than directed at the person. The findings do not support the literature on the abuse of authority by the tutor (Percy, 2004; Webster, 2008). Although not specifically named in their responses, the descriptions provided by students, graduates and tutors in this study, of the tutor's role as providing feedback, positive direction, and expertise, match the student-tutor relationship of master and apprentice (Oh, 2010; Oh *et al.*, 2013; Kvan, 2001; Schön 1987; Ellmers, 2014) or novice and expert (Marie & Grindle, 2014; Goldschmidt *et al.*, 2014) found in the literature. Various authors suggest that the apprenticeship model is associated with asymmetric power relations (Stuart-Murray, 2010; Goldschmidt *et al.*, 2014), but what is significant, is that it's not so much the presence of the asymmetrical power relations, but its abuse that inhibits learning (Blair, 2006; Dutton, 1987). In this regard we should turn to literature on Cognitive Apprenticeship (Collins, Brown & Holum, 1991) that encourages a focus on the student as the expert, thereby shifting the expert role to a facilitator role, which is appropriate for a democratised studio.

Hierarchy and asymmetrical power relations are present in the live online crit. In the architect-client relationship, the parties were reported to be more equal, like partners in architectural practice; and in the mentee-mentor and child-parent types of student-tutor relationships, the power shifts more towards the student. The student-tutor relationship where asymmetrical power relations are most pronounced, is the novice-expert type of relationship. However, although the superiority of the tutor is acknowledged, the students did not perceive the tutor's role as authoritarian.

Other than one student's reference to the need to hand over control of the screen from the tutor to the student, no further indication was given of dissatisfaction of one-way communication and tutor-control, as reported in Ng's (2007) study on the asynchronous Interwise online tutoring system.

Graduates, students. and tutors in this study did not report on asymmetrical power relations with tutors in positions of power (Stuart-Murray, 2010; McCarthy, 2011; Oh *et al.*, 2013) through a difference in race, gender or age. Instead, graduates suggested the inverse, namely that some students are believed to be more experienced than the tutors, in some respects. These findings support Percy's (2004) discovery that conducting crits online reduced the power relations between tutor and student. Although her study focused on a text-based asynchronous online setting, it is relevant to note her observation that students became empowered through having to 'act as narrator and translator of their design process', because the digital interface did not expose it. Through this, 'knowledge and ownership were returned to the student' (Percy, 2004:151). She found that the computer acted as a mediator in the student-tutor interaction, thereby further reducing the power relations between them.

The behaviour of the student and tutor and their attitudes towards another in the live online crit, were reported as formal, respectful, and professional, yet, at the same time, casual, easy, familiar, friendly, close and personal, and characterised by trust and openness. Online, students are less likely to feel intimidated by a tutor and their learning is not inhibited by overpowering tutor feedback. Instead, potential asymmetrical power relations are mitigated by mutual respect and a sense of responsibility and commitment towards the shared goal of learning.

In the next section the student-tutor interaction in the live online crit will be explored, in terms of learning through conversation (moves), learning through experience (modes) and learning through cognitive apprenticeship (methods).

4.3 Student-tutor interaction in the live online crit

The third question was '*How do students and tutors interact in the live online crit?*' (RQ3). The reason for asking the question was to explore how learning is mediated through conversation, experience, and cognitive apprenticeship, in the live online crit, as represented in the conceptual framework – see Figure 8.

RQ3 was explored through three sub-questions:

RQ3.1: What are the moves that students and tutors make in the live online crit and how are they employed in learning through conversation?

RQ3.2: What are the modes of student-tutor interaction in the live online crit and how are they employed in learning through experience?

RQ3.3: What are the methods of student tutor interaction in the live online crit and how are they employed in learning through cognitive apprenticeship?

The instruments that were used to get the answer to this question, were online surveys conducted with students (S1 – S23), tutors (T/1 – T/5) and graduates (G1 – G13), and a focus group interview conducted with a group of graduates (A - E). These instruments revealed the perceptions of students, tutors and graduates of how they interact in the live online crit. In addition, three live online crit protocols were analysed, guided by the conceptual framework. The protocols showed me how the students and tutors interact through the moves that they make, the modes through which they make them and the methods that they use.

The next three sections contain the results of the moves (section 4.3.1), modes (section 4.3.2) and methods (section 4.3.3) reported by the students, tutors and graduates, and how they are employed in learning through conversation (moves), experience (modes) and cognitive apprenticeship (methods), respectively. A discussion of the findings for the main research question (RQ3) follows in section 4.3.4.

4.3.1 Learning through conversation: moves

I used the *moves* identified in the conceptual framework (see Figure 22) as a guide to explore the data. The *moves* are grouped as *clarify* (*present, question, comment* as discursive moves), *test* (*adapt*), *elicit* (*reflect*) and *decide* (*present, question, comment* as interactive moves). In the conceptual framework they are recorded to operate as discursive (clarify), interactive (decide), adaptive (test) and reflective (elicit) communication forms (Laurillard, 2002, 2013; Lam, 2011).

MOVES Learning through Conversation	MODES Learning through Experience	METHODS Learning through Cognitive Apprenticeship	
CLARIFY (discursive) **Present** **Question** / prompt **Comment** / answer	**NEGOTIATION** Operating on concepts/ conceptualisation (abstract/ theory)	**Articulation** telling	**Modeling** **Scaffolding** **Coaching**
TEST (adaptive) **Adapt**	**EXPLORATION** Applying concepts/ test	**Exploration**	
ELICIT (reflective) **Reflect**	**REFLECTION** Building concepts/ reflect	**Reflection**	
DECIDE (interactive) **Present** **Question** / prompt **Comment** / answer	**APPLICATION** Operating on application/ experience (concrete/ practice)	**Articulation** showing	

Figure 22: Conceptual framework: Moves

Below follows an account of the moves that the students, tutors and graduates identified, supported with examples, and followed by a discussion on how these were observed in the crit protocols. Table 10 illustrates the findings. A black dot signifies at least one instance of the relevant *move* observed in a crit protocol. 'Plus' symbols (+) indicate those *moves* not contained in the conceptual framework, that were either tested against or discovered in the data.

The moves that the students and tutors make in the live online crit, are presented below (see Table 10), followed by a discussion of the key findings.

Present

A significant number of students, tutors and graduates referred to *presentation* as a prominent activity associated with the live online crit. They used words like 'present', 'explain', 'share' (Blair, 2006, Smith, 2011), 'discuss' (Smith, 2011), and 'clarify' (Blair, 2006; Lam, 2011).

The participants reported that the student and tutor take turns to convey their respective knowledge and understanding to the other, as explained by tutor 4:

> *The student presents ideas about their approach to the design issue and the lecturer tries to understand their intentions and to then guide the student in an appropriate direction to best resolve the design (T/4).*

Different media are employed to convey ideas in the live online crit, including audio and on-screen sketching over graphics (sketching, diagramming, computer-generated two- and three-dimensional drawings, and photos of models), and text prepared for the crit, as explained by C and G6:

> *You have to explain yourself better graphically ... through your online presentation (C)*

> *I found the most effective means of communicating ones [sic] ideas are clear annotated sketches/ diagrams, clear drawings (plans, sections elevations, 3ds etc) and models (ample photos for the online crits). The on screen [sic] sketching was very useful in helping to explain an idea or highlight an area of a drawing under discussion. Most importantly in communicating ideas is clear and understandable speech. (G6)*

To *present* an understanding, whether to clarify (discursive) or decide (interactive), not only helps facilitate the negotiation of meaning between student and tutor, but it also helps them to make sense of such understanding,

> *...Sometimes you understand something, you worked it out, a million times in your head, and you understand it but the next person doesn't understand it as well as you do and you sometimes think the person will understand it easily but you need to, when you present your work you sort of need to take a step back, and think how will another person look this and read it so that they can understand, because you understand it well already so you just need to be clear on your explanations... (E)*

and to invite feedback from others:

> *I think when one is given the importunity [sic] to explain their idea to other people, it gives one the feeling of how your thoughts are received. You get to measure the coherence or order of not only the way you design will function but also how other people see it. (G5)*

An example of *present* as a move to clarify (discursive move) occurs in crit 1 where the student describes the spatial design concept of the group project, as the starting point for his project development. He clarifies the design intent and shares information about the site and chosen precedent study. The interaction focuses on the conceptual aspects of the work, presented by the student, but with minimal tutor input, to allow the student to explain his design reasoning process.

So basically, like I said there, the spatial design and the concept is enhancing the human senses by moving through spaces. The idea of using architectural and natural elements to enhance certain human senses by manipulating form and function. So that's the spatial design concept. (Crit 1: 13)

Another example of the student using *present* as a move to clarify a concept, follows below. The student explains the abstract idea on which his design decision is based:

It was the – a quote from the – From Our House to Bauhaus book. It was more about how American students were travelling to Europe, post World War II and then back to the States just before the war. So, it was that idea of moving to one space congregating and then dispersing once again, once experiencing a specific event. So that's what we tried to convey in our group work, so and then I tried conveying that back through my individual work. (Crit 2:14)

The only instance of the tutor using *present* as a move, occurs in crit 2, and it is a discursive (clarify) move. No interactive (decide) *present* moves by the tutor were identified in the crits. This is understandable, considering that the tutor is not the author of the work. The tutor makes a move to clarify a theoretical idea by explaining the role of the model as a design tool:

But I think – and the thing is that the model is just conceptual. It's exploring but it's using, you know, very simple elements to explore different options, you know. So, one reads the model in different ways, but I also think that the little sketches, the analytical sketches that you did are something that will be useful for everyone to do in the space that they're working in. Just to think through how people move and how you change that movement and the use of the space through your intervention, okay. (Crit 2:79)

Further along in the same crit, *present* as an interactive move is observed. The student demonstrates how his group decided to create the spaces. T2 responds with an acknowledgement of the student's action, but she does not offer feedback. During this episode the interaction focuses on the student's actions and the implementation of design ideas, accompanied by active on-screen drawing by the student:

…. So, we came up with the idea of making this – creating this kind – some kind of maze element [student markings in red] but I chose to move away from that because for me it didn't – it worked for creating these human senses but it's too – how can I say it [student

markings in red] – like next to each other. So – but we had – we created these transition spaces over here by treating each space differently because [unclear] more enhance these senses. We can go on. (Crit 1: 26)

Table 10 illustrates that all three crits contained *present* moves by students, both to clarify (discursive moves) and decide (interactive moves). Only in crits 1 and 2 does the student revise action; there is no occurrence of this move in crit 3. This means that in all three crits the students present their design activity in preparation of the crit. Two of the three students 'revise' their actions during the crit which imply that they demonstrate new ideas or actions during the crit.

The only crit that contains instances of the tutor presenting concepts to clarify them, is crit 2. In none of the three crits the tutor used *present* as an interactive move. This means that the tutor did not demonstrate the application of a concept in any of the three crits.

These findings suggest that the student dominates this move, rather than the tutor. This observation is supported by student A's remark that the 'online [crit] was definitely more like a presentation…'

The live online crit is dominated by *present* moves made by the student, both on the discursive (to clarify understanding) and interactive levels (to demonstrate decisions). The data shows that the tutor does not dominate this move. The live online crit can therefore not be likened to a lecture (Hassanpour, Utaberta & Zaharim, 2010) that is associated with the transmission of content by the lecturer or tutor, but rather, as McKeachie and Svinicki (2006, cited in Bates, 2016: 12) suggest, for 'modeling expert thinking'. The findings don't support the idea of the 'tutor monologue' (Blair 2006:33) or the 'virtuoso performance of… tutors' (Percy, 2004:150, cited by Blair 2006:33) that is often associated with the crit. However, the findings support Christine Percy's discovery that in the online crit, students 'were obliged to act as narrator and translator of their design process' and that the 'tutor's role was subordinated in the dependence on the student's reading and interpretation' (Percy, 2004:151). Furthermore, although the live online crit in this case, fulfils the role of a formative crit in the blended programme, it takes on the character of an assessment in respect of the focus on the student's role to *present* his work (Lymer, 2010).

Question
The students, tutors and graduates referred to *questioning* as an important activity - not only for clarification of meaning by the student,

> *You know if you're lost and you know if you're not and it's up to you to ask questions that's another thing like you, ja, it's your responsibility to say when you're confused or whatever, so...(A)*

but also, for the tutor to prompt the student to think and further explore her ideas:

> *It was something that Tutor 1 or Tutor 3 said. They just said but why not do whatever and at that moment when they said that I thought well flip! ... Why didn't I think about that.... No, they definitely didn't tell me what to do. It was a question. Like most of the input in the crits will be questions... (B),*

> *Pointing out good aspect [sic] and advising me on how some aspects of project may be carried out, but most [sic] asking me why, where and when question is essential... (S14)*

These questions are intended, not only to invite elaboration or clarification, but also to prompt students to expand their thinking, as explained by S15 as what he expects from a tutor:

> *Objective opinions and questioning that would lead to self realisation. That 'Ahaaa!' moment.*

In crit 2 the tutor responds with a question, partly to invite clarification by the student, of decisions about scale, but also to model self-reflective behaviour. This question is accompanied by the tutor's pen moving up and down the columns, and markings in blue:

> *Ja, I'm just asking what – what – in terms of scale you know, what height and why that height? (Crit 2:36)*

Later in the same crit the tutor again responds with a question, this time prompting the student's thinking about the geometry and the form-making implemented in his design proposal:

> *I also wanted to ask, the geometry that you're setting up – is it deliberate, is it specific? Does it speak [sic] up anything else or what – you spoke about Table Mountain, you spoke about views. You know, are those elements flat? Are they tilted? I'm trying to look for more clues to justify why they look like that. (Crit 2:63)*

As illustrated in Table 10, there were no instances of the student questioning; not as a discursive move to clarify understanding, nor as an interactive move to

demonstrate a decision. Following on the finding that the live online crit is dominated by the student presenting, it appears that *question* is a move used by the tutor to invite a student response rather than the student directing questions of clarification at the tutor. All the tutor *question* moves in this study were observed in crit 2. These *question* moves occurred as interactive moves and not as discursive moves. This finding suggests that these tutor questions are focused on the student's application of knowledge, rather than her explanation of concepts. It can therefore be inferred that, in this live online crit, the tutor's questions act as prompts to invite further action from the student, but they don't invite clarification or elaboration on the student's presentation of a concept.

Since the student-tutor interaction in the live online crit is not characterised by the tutor presenting knowledge, it is not surprising that there are no instances of student *question* moves, seeking clarification from the tutor, in the three crit protocols. Instead, *question* moves were employed by the tutor to prompt the student's thinking about their practice.

Although students, tutors and graduates mentioned the tutor *question* or prompt as an important component of the student-tutor interaction in the live online crit, only one crit (crit 2) contains *question* moves made by the tutor. Laurillard's conversational framework (2002, 2013), includes the student *question* move only on the discursive level and not on the interactive level. Neither does it include tutor *question moves* on either the discursive or the interactive levels.

Yet, the respondents identified *question* as an important move in the crit in general.

These findings support the literature that emphasise *question* as an important tutor move (Atto and Mugerauer, 1991, Hitge, 2016) as 'dialogue facilitator', performing the role of 'questioner that students should take up after they become comfortable with the method' (Lam, 2011: 40).

> *Questioning allows for the rigorous disclosure and criticism of a design as distinct from its author, which is important, for the Socratic method seeks to reveal, not to judge. Ultimately the goal is to teach the student how to question his own work by knowing how to ask questions, and how to answer them usefully. (Lam, 2011:40)*

The analysis of the crit interactions revealed that, although the participants value *question* as an important crit move, it was absent from two of the three crits. Further research is needed to explore how this move is employed in the live online crit, responding to Christine Percy's (2004) assertion that questions remain about the potential of online learning to achieve deep engagement in debate.

Comment

The data produced reference to *comment* as a move performed in response to *present* and *question* moves made by the other party. This move includes student and tutor responses in the form of feedback, judgement, criticism, approval, hints, suggestions and answers to questions, as illustrated below.

Clear feedback helps a student understand her design and guide further work,

> *...Work uploaded had to be designed to a point by the student and presented to get feedback and approval from the lecturers so as to continue designing. (G)*
>
> *In general, the student are [sic] seeking advice and direction, and the lecturer should try to give this. (G13)*
>
> *...To give feedback and suggestions to further develop my work. (G6)*
>
> *To advise the student of where the student can improve, to advise the student in the design and the skills involved. (G9)*

and prepare the student for architectural practice:

> *...You don't just work alone... you're always bouncing off ideas, so you need to get used to being criticized. (A)*

In crit 1 the tutor responds with a comment on the student's conceptual clarification,

> *No, it's a good example. (Crit 1:16)*

and later in the same crit, she provides feedback on the student's action:

> *Good, nice but it's a very nice presentation for us to respond to. I just think for everybody on one page, we've got a model, a plan, diagram section. I mean this is a really useful single page to cross-reference. I think it's been very valuable in this discussion. (Crit 1:60)*

In crit 3 the tutor performs a *comment* move in response to the student' s action by suggesting a different presentation technique:

> *Or perhaps make it a line, just a line and not a tone. (Crit 3:51)*

As illustrated in Table 10, two of the three crits, namely crit 1 and crit 2, contain student *comment* moves to clarify concepts. Although this move is not contained in Laurillard's (2002, 2013) Conversational Framework, all three crits contain student *comment* moves on actions. Instances of tutor *comment* moves, both discursive and interactive, were found in all three crits.

It can therefore be concluded that both the student and the tutor make extensive use of *comment* moves, reinforcing the conversational nature of the crit as mechanism for formative feedback. Such feedback helps the student consider the results of their design acts and reasoning (Goldshmidt et al., 2014). These findings support the literature that suggests that, for formative feedback to help improve learning, both student and tutor should take an active part in it (Blair, 2006; Ellmers, 2014).

Adapt

Students and graduates expressed the need for the tutor to help them to test and try out different design possibilities or solutions:

> *… let the student think of different solutions and come up with his/hers own original thought. (G13)*

> *… I am looking for alternative ideas to open my mind up to different possibilities. (S10)*

> *I see it as a sort of supervision from the lecturer/tutor to the student where the lecturer assists students to break what ever [sic] boundaries they might have put for themselves and explore more avenues when executing their work. (G10)*

Although none of the students, tutors or graduates specifically referred to the tutor performing *adapt* moves (adapting the task goal), the crit protocol analyses produced instances of these, in all three crits, as well as instances of students using *adapt* moves in their practice.

In crit 1, the tutor employs the *adapt* move by suggesting how the student might test different design possibilities, employing 'what if' questions, but not necessarily expecting answers from the student:

> *Although it's real, we really want you to explore [unclear]. Ja, no, what if it gets wet, it drains. I see you've already raised that floor. You know there's this very kind of safe space on the side so now everything is pushed in. You can – it can perhaps encroach a little bit – expand into that space. You know be a little bit more – you know like when somebody is doing a dance, and you know, use a space. If you're going to dance in the space make use of ja, just grab the space. (Crit 1:42)*

In the next example the tutor uses *adapt* as a move to change the task goal, in response to her observation of the student's thinking. Not only does she model the testing of ideas, but she also suggests a strategy to imagine different scenarios.

Ja, but I think what would be interesting for you and I think it's something that everyone else should do as well, is in the same way as you did the earlier sketches is to imagine the space at different times. So, what would happen early in the morning when everyone's rushing out of the station to go to work? What happens when everyone's coming back from work and trying to get on the trains? What happens at midday? What happens on a Saturday afternoon? What happens on a Friday night? You know, just maybe run a couple of scenarios where you could demonstrate how those spaces could be appropriated for different uses at different times by different people. (Crit 2:61)

In crit 3 a student uses *adapt* as a move to test different alternatives based on the tutor feedback:

Ja, no, that's actually good advice. I think that you see a lot of flowers hanging from those flower hanging walls and types of stuff where they can maybe mount the buckets with the flowers and stuff and because they have plenty of flowers on the underneath, I'm not even sure if they have enough space, just like that. So if we make layers and they can add it, like maybe it high and let's say higher, or how can I say it? Ja, like just higher levels of flowers and people can look actually at more flowers than just the ones on the ground. So, ja, that's actually nice advice. (Crit 3:42)

Later in the same crit, the student adapts his action in response to tutor feedback, by deciding to 'build a better model':

Ja, and build a better model to explain the space. (Crit 1:46)

As illustrated in Table 10, *adapt* moves were employed by both the student and the tutor, in all three crits. Although questions are often used by the tutor in *adapt* moves, they are not meant to invite a response (refer to section on *question* moves above). Instead, they model behaviour of exploration and testing of ideas. These findings support the literature that foregrounds the importance of design reasoning and exploratory thinking in design (Cross, 1990; Blair, 2006; Oh *et al.*, 2013; Ellmers, 2014).

The literature is silent on the extent to which online learning, and specifically synchronous online learning, promotes exploratory thinking and design reasoning. From these findings it can be concluded that the live online crit promotes this move, employed by both student and tutor.

Reflect
In their responses, few students, tutors, and graduates described *reflect* moves in relation to the live online crit. Perhaps it is because this type of crit is perceived to be

dominated by student presentation that invites tutor feedback (refer to RQ1 discussion), rather than the act of design itself.

Graduate D equates *reflection* to thinking, in response to the tutor's feedback, during the crit and thereafter, as well as in response to tutor feedback on another student's work:

> *I think the portal answered the questions, gave answers to the questions where, while you were critting there weren't necessarily answers yet to the questions... and then you can actually go think about it, okay I'll try this and you can reflect again about it and then maybe... and sometimes maybe the student was going this way and maybe I was pushing that way, understand where he goes and perhaps he still goes this way, always reflecting between the lecturer and the student, just keeps everyone on the same par of thinking... (D)*

Reflect moves occur in response to the student's work or the student's learning,

> *Crits also give rise to reflection of the problem and ones [sic] self in the process.* (S16)

and are not limited to the crit duration, but may continue between crits, by viewing the recordings:

> *I always find it beneficial to take a day or two after the crit to reflect on the feedback to my presentation, watch the recordings, review my notes and then write up a post-crit report for myself stating my goals for the next crit, what I need to correct in my presentation and what I need to work on to reach those goals. (S11)*

In crit 2 the student makes *reflect* moves, explaining how she thought about the implications of her actions after she had built the model in preparation of the crit:

> *After I finished building the model and looked at it, I thought it would have been an interesting idea to vary those heights because I am playing with the horizontal elements of the ground level itself, but I hadn't thought about that further in the sheltered areas. (Crit 2:39)*

In crit 1 the tutor *reflects* on the student's work, and explains the eliciting of a theorical rationale:

> *... I enjoyed the way in which you refer to the senses and, you know, it's evident that you've thought about that experience and how it will impact on the*

senses. I just, I'm not sure why it seems as if the, you've almost created an artificial boundary. So, you've taken a line and, to me, at the moment, this is just the very first observation, it looks quite restrained. So, it's almost as if it's been pushed into a form, it's quite tight and I think perhaps the design can loosen up a little bit. You know it also looks on the model quite solid and quite closed-in if you know what I'm saying. You know, also quite tight and perhaps there's not enough contrast between the tight spaces and perhaps the taller spaces. So, I think you, it's a little bit in the safe space at the moment, and you need to let go a little bit. I mean it doesn't have to be symmetrical, that element can fly up (Crit 1:44)

Similarly, in crits 2 and 3, the tutor *reflects* on the student interaction and draws design principles from it:

I think just – if I can chip in here … What's an interesting development from the earlier model was that now, although there is a linear route, it's not as confined. It's broken, so there are kind of – it's permeable. There's – it flows into other spaces as well… (Crit 2:45)

I wonder, just before we end off can we just look at the model? I think that's also in the way that you show the supports because you already, you want it to float, you know you don't almost want those columns to be visible. (Crit 3:44)

As illustrated in Table 10, all three crits contain *reflect* moves by the tutor, but only crit 2 contains instances of *reflect* moves by the student. The student *reflects* on tutor feedback as well as on her own practice. The latter move was not included in the conceptual framework, based on Laurillard's Conversational Framework (2002, 2013), but emerged from the data. The tutor, who dominates this move, reflects on the student's learning practice whilst demonstrating *reflection*.

The data found for student moves to *reflect* on practice, include instances of student reflection-on-action, and reflection-on-interaction. Tutor *reflect* moves on learning practice, include tutor reflection-on-action. The focus of the crit on the student and tutor engaging with student work produced before the live online crit rather than designing during the crit, explains why no instances of student reflection-in-action were observed in the crits. In this respect it is important to note that, within the scope of this thesis, it was not possibble to show what students were doing outside of the session. In other words, that which was not expressed or recorded, for example the parallel communication channels e.g., via WhatsApp referred to elsewhere.

The data shows that reflection-on-action by the student occurs in three forms. The first form is when, in the crit, the student reflects on the work prepared for the crit. The second form is when she refers to the reflection-in-action that happened prior to the crit, whilst preparing work for the crit. The third form of reflection-on-action by the student during the crit is when she refers to the reflection-on-action that happened prior to the crit, after preparing the work for the crit. The data confirms Schön's (1992, cited in Maftei & Harty, 2015:54) definition of reflection-on-action as 'a form of thinking back to action previously accomplished outside of the situation'. It is a 'deliberate process of pausing to think back over what they have done and considering how they might approach a similar problem in the future' as argued by Reymen (2003, cited in Ellmers, 2014:37).

Reflection-on-action occurs during the crit when the student reflects on the tutor feedback. This research builds on Schön's (1987) work by adding reflection-on-interaction that is reflection on the crit, after the crit, assisted by viewing of the crit recording.

The tutor reflection-on-action refers to the tutor reflecting on the student's learning actions by extracting design principles and concepts, to demonstrate the sense-making process to the student, and to help make the student's thinking visible.

The data supports the literature that reflection happens during the crit. However, it does not support both forms of reflection identified by Schön (1983), namely it does not include reflection-in-action. This research supports Wang and Bonk's (2001) assertion that reflection in an online cognitive apprenticeship environment also happens after the interaction because the session is recorded. This study adds another form of reflection, namely reflection-on-interaction. Furthermore, it supports the literature that 'reflection leads to abstraction' (Collins 1988:9) as it helps to link thinking and doing (Maftei & Harty 2015: 54), bringing about 'discovery of new meanings which will inform the further process' (Schön & Wiggins, 1992: 154).

Table 10: Moves observed in the crit protocols

		MOVES RQ 3.1	CRIT 1	CRIT 2	CRIT 3
student	Discursive / CLARIFY	present	●	●	●
		question	-	-	-
		comment	●	●	-
tutor		present	-	●	-
		question (+)	-	-	-
		comment	●	●	●
student	Adaptive/ TEST	adapt adapts practice	●	●	●
tutor		Adapt adapts task goal	●	●	●
student	Reflective/ ELICIT	reflect on feedback	-	●	-
		reflect on practice (+)	-	●	-
tutor		reflect on learning practice	●	●	●
student	Interactive/ DECIDE	present action	●	●	●
		present revises action	●	●	-
		question (+)	-	-	-
		comment (+)	●	●	●
tutor		present	-	-	-
		question (+)	-	●	-
		comment	●	●	●

Synthesis

In response to Research Question 3.1, 'What are the moves that students and tutors make in the live online crit and how are they employed in learning through conversation?', five moves were found, namely *present, question, comment, adapt* and *reflect.*

This research draws on literature on learning through conversation (Laurillard, 2002, 2013; Blair, 2006; Lam, 2011) to explore how the student and tutor interact in the live online crit. The five moves contained in the conceptual framework were found in the student, tutor and graduate responses and observed in the live online crit protocols.

As predicted, the first three moves, namely *present, question* and *comment* operate on both the discursive level (to clarify meaning), and on the interactive level (to demonstrate decisions). *Adapt* moves enable the testing of alternatives and through *reflect* moves meaning is elicited.

The frequency of *present* moves employed by the student compared to the tutor, in the live online crits, suggests that the student-tutor interaction in the live online crit is dominated by the student presenting her work to clarify understanding and demonstrate her design decisions. This kind of crit does not resemble a lecture, nor a 'tutor monologue', that is often associated with the traditional crit (Blair 2006:33). Instead, through its focus on the student's performance 'judged' by the tutor, the interaction resembles an assessment.

Since the student-tutor interaction in the live online crit is not associated with the tutor lecturing, it is not surprising that no instances of student *question* moves, seeking clarification from the tutor, were observed in the three crit protocols. Instead, *question* moves were mostly employed by the tutor, acting as 'dialogue facilitator' (Lam, 2011:40), to prompt the student's thinking about her practice. This finding supports Attoe and Mugerauer's (1991) understanding of the Socratic method, that it is 'teaching through questioning rather than through exposition and lecturing' (1991:46). Based on these findings, *question* as a tutor move to clarify and decide was added to the conceptual framework, towards formulating a model for the student-tutor interaction.

I found that the student-tutor interaction in the live online crit contains extensive use of *comment* moves by both the student and the tutor, in response to *present* and *question* moves performed by the other. This confirms the conversational nature of the crit interaction as mechanism for formative feedback. *Comments* include responses in the form of feedback, judgement, criticism, approval, hints, and suggestions. Based on these findings, student *comment* moves on actions to clarify and decide, was added to the conceptual framework.

Adapt moves were employed extensively by both the student and the tutor to test and explore ideas (student), and model exploration (tutor). These findings support the literature that emphasises the importance of design reasoning and exploratory thinking in design (Cross, 1990; Blair, 2006; Oh *et al.*, 2013; Ellmers, 2014). The literature is silent on the extent to which online learning, and specifically synchronous online learning, promotes exploratory thinking and design reasoning. From these findings it can be concluded that the live online crit accommodates *adapt* moves, employed by both the student and the tutor.

On the other hand, *reflect* moves were dominated by the tutor (modeling reflection) and not by the student. Although the students, tutors and graduates reported on three different forms of reflection associated with the crit, the crit protocols did not contain all of them. I did not observe reflection-in-action (Schön, 1983) in the live online crit protocols, which suggests design practice is absent from this kind of crit.

I added reflection-on-interaction to correspond with Wang and Bonk's (2001) assertion that reflection in an online cognitive apprenticeship environment also happens after the interaction of the online session, available to all participants afterwards. Furthermore, the findings support the literature that 'reflection leads to abstraction' (Collins 1988:9) as it helps to link thinking and doing (Maftei & Harty 2015: 54), bringing about 'discovery of new meanings which will inform the further process' (Schön & Wiggins, 1992: 154).

4.3.2 Learning through experience: modes

The data produced evidence of all four modes of interaction, contained in the conceptual framework (Figure 23), that are linked to learning through experience. The conversational framework describes *negotiation* as operating on concepts and *application* operating on practice; *exploration* involves applying concepts and *reflection* building them.

I found references to *negotiation, application, exploration* and *reflection* modes in the student, tutor and graduate responses and I observed all four modes in the three live online crit protocols.

MOVES Learning through Conversation	MODES Learning through Experience	METHODS Learning through Cognitive Apprenticeship	
CLARIFY (discursive) Present Question / prompt Comment / answer	NEGOTIATION Operating on concepts/ conceptualisation (abstract/ theory)	Articulation telling	
TEST (adaptive) Adapt	EXPLORATION Applying concepts/ test	Exploration	Modeling Scaffolding Coaching
ELICIT (reflective) Reflect	REFLECTION Building concepts/ reflect	Reflection	
DECIDE (interactive) Present Question / prompt Comment / answer	APPLICATION Operating on application/ experience (concrete/ practice)	Articulation showing	

Figure 23: Conceptual framework: Modes

Below follows an account of the modes in which they make the moves, that were identified in the participants' responses, supported by examples. A discussion

follows on how these were observed in the crit protocols. The findings are summarised in Table 11, with black dots indicating at least one instance of the relevant mode observed in a crit protocol. The symbols represent the student (shown in black) and tutor (shown in grey) roles in the respective modes of interaction.

The three crit notations in Figure 24 (see Addendum 3 for full-scale representations) represent the sequence of the modes of interaction performed by the student (symbol in black) and tutor (symbol in grey), respectively. These are mapped, from left to right, in relation to the turns taken and grouped in episodes. A turn associated with *negotiation* is illustrated with a horisontal rectangular symbol placed above the dotted line that separates the abstract (theory) from the concrete (practice) domain. *Application* is shown with a rectangle too but placed below the line. *Exploration* is represented with an L-shape turned downwards from left to right, and *reflection,* the same, but turning upwards. The gaps occur where turns are not linked to any of the four modes of interaction.

Figure 24: Crit notations

Negotiation and Application

Negotiation as described in the conceptual framework, operates on theory (Carey *et al.,* 1999). This mode of interaction draws on Kolb's (1984) abstract conceptualisation phase of experiential learning. *Negotiation* is associated with the abstract and conceptual domain of learning (Lewin 1957; McLeod 2013), that takes place through the negotiation of meaning between the student and the tutor (Gunawardena, Lowe & Anderson 1998):

> *...how information is exchange[d] between student and lecturer/ mentor that the main design/concept is understood by both parties and that the next level of the design/concept could be identified for the student to further the design/concept. (G8)*

It is an important requirement for learning

> *Crit events... conveying your design/concept to the lecturer/ mentor so that they can understand your design/concept and give you prompts to further you design/concept. (G8)*

that relies on the alignment of the conceptual understanding of the student and tutor:

> *I think for me sometimes the difficult part was combining what I had in mind for the design and what the lecture[r] understood from my design and concept. (G2)*

Below follows an example of such an instance in crit 1: 13 (episode b), where the crit starts with the student explaining her conceptual understanding:

> *So basically, like I said there, the spatial design and the concept is enhancing the human senses by moving through spaces. The idea of using architectural and natural elements to enhance certain human senses by manipulating form and function. So that's the spatial design concept. (Crit 1: 13)*

In this mode, the tutor's responses are brief and mainly involve confirmation, acknowledgement of the student's presentation, hints and comments:

> *Nice sketches. (Crit 2: 25)*

As demonstrated by the crit notations (Figure 24), this mode of interaction was recorded in all three crit protocols. In crit 1, episodes b (5 turns) and f (3 turns); in crit 2, episodes b (2 turns), d (7 turns) and j (4 turns, but interrupted); and in crit 3, episodes b (6 turns) and d (7 turns) are modes of *negotiation*. These moves are dominated by the student, and mostly concentrated in the first half of the three crits, except for crit 2 that follows a different pattern, and ends on this mode.

On the other hand, the *application* mode of interaction operates on practice (Carey *et al.*, 1999). It is associated with the concrete domain of learning (Kolb, 1984; Lewin, 1957), through the demonstration of experience by the student and tutor (McLeod, 2013).

The response by graduate D below refers to the online crit interaction, that is 'more (like) a demonstration' than working together on a design problem:

> *Yes, more a demonstration, than trying to figure out what it should be... (D)*

She explains how, online, the tutor demonstrates design behavior to the student, but face to face they seek a design solution together:

> *I think when you're drawing face to face, it's more like you figure out stuff, whereas online it's more like the lecturer [tutor] showing you something. When Tutor 1 used to draw something, and you draw, it's like your idea, it's not necessary how to figure it out like we'll sit there and work it out, it's more like this is how you think it's supposed to be and then afterwards you will work from there backwards and stuff. It's not like we have to resolve this, let's start drawing, it's more like maybe you should have done this… let's start drawing…it's more like getting to a point and moving on again. (D)*

In these crit protocols, *application* involves interaction about the implementation of design decisions.

In response to the tutor's question,

> *All right. Can you talk a little bit about the overhead planes, the roof elements that you're making? (T2, Crit 2, turn 54)*

student 2 explains her design practice in preparation of the crit:

> *I was playing with different materials. I've moved from wood to steel to concrete to platted elements to allow mottled sunlight through. I'm still working through the different aspects and results and of what, if I choose a material what will happen in the site? (C2, Crit 2, turn 55)*

Application occurred in the second half of crits 1 and 3, following the first two *negotiation* episodes and concluding each crit. Crit 2 is an exception, that ends on a *negotiation* episode. In crit 1, episode d (2 turns), episode g (3 turns), episode i (4 turns) and episode k (6 turns); in crit 2 episode e (5 turns, interrupted), episode h (10 turns, interrupted) and episode i (9 turns, interrupted), and in crit 3 episodes c (4 turns) and h (7 turns) represent the *application* mode of interaction *(see Table 11).*

Like *negotiation, application* involves brief tutor responses, mainly confirmation, acknowledgement of the student's demonstration and feedback in the form of hints and occasional questions and compliments. From this finding I can reasonably conclude that these modes of interaction are associated with a prominent student role in the live online crit. It suggests that this learning setting provides a degree of student control and autonomy, in contrast to the general understanding that the crit is tutor-dominated (Blair, 2006; Stuart-Murray, 2010; Ellmers, 2014).

The presence of *negotiation* and *application* modes of interaction performed by the student and tutor support the literature that claims professional education requires complex iterative transactions between the student and tutor, to 'modulate… concepts and practice' (Laurillard, 2013; Gunawardena, Lowe & Anderson, 1998; Carey *et al.*, 1999; Percy, 2004; Blair, 2006; Stuart-Murray, 2010; Laurillard, 2012; McLeod, 2013).

By suggesting how learning plays out through *negotiation* and *application,* in the student-tutor interaction in this learning setting, a current gap in the literature is addressed (Blair, 2006; Stuart-Murray, 2010; Oh *et al.*, 2013). These findings provide some clues that may lead to a better understanding of the crit strategies needed, not only in the live online crit specifically, but in crit practices more generally. Such strategies should facilitate activities associated with higher levels of cognition to achieve deep learning in the live online crit (Stuart-Murray, 2010).

Exploration and Reflection

Exploration as described in the conceptual framework (Figure 23), is linked to the application of concepts (Carey *et al.*, 1999). It involves the student testing the implications of a concept in new situations (Lewin, 1957; McLeod, 2013). *Exploration* moves the discourse (downwards on the notation) towards the concrete or practice mode, through judgement (Dewey 1938), critical analysis (Blair, 2006) and discovery (Gunawardena, Lowe & Anderson, 1998):

> *One can fall in love with a concept as a whole, whether it is right or wrong within the context of the brief. I would say that being advised to relook your concept can be difficult at first but obviously in the long run, it proves to be beneficial by making you test your own theories and concepts. (S22)*

The tutor models the testing of design alternatives or prompts the student to do so, as suggested by graduate B:

> *It was something that Tutor 1 or Tutor 3 said. They just said: 'but why not do…' whatever and at that moment when they said that I thought well flip!… Why didn't I think about that…. No, they definitely didn't tell me what to do. It was a question. Like most of the input in the crits will be questions. (B)*

Exploration is illustrated here with C3 considering alternative flower display arrangements:

… I think that you see a lot of flowers hanging from those flower-hanging walls and types of stuff where they can maybe mount the buckets with the flowers and stuff and because they have plenty of flowers [on the] underneath, I'm not even sure if they have enough space, just like that. So, if we make layers and they can add it, like maybe it high and let's say higher, or how can I say it? Ja, like just higher levels of flowers and people can look actually at more flowers than just the ones on the ground… (Crit 3: 42)

and T1, in turn, models *exploration* to C2 by suggesting different scenarios:

… So, what would happen early in the morning when everyone's rushing out of the station to go to work? What happens when everyone's coming back from work and trying to get on the trains? What happens at midday? What happens on a Saturday afternoon? What happens on a Friday night? You know, just maybe run a couple of scenarios where you could demonstrate how those spaces could be appropriated for different uses at different times by different people. (Crit 2: 61)

I observed *exploration* in all three crits, performed by both tutors and students (see Table 11). In two of the three crits (crits 1 and 3) it only occurs in the second half, and it's concentrated in two episodes. In crit 1 the *exploration* mode of interaction occurs in episodes h and j, and in crit 3 in episodes e and f. In crit 2 *exploration* instances are spread more evenly through the crit, in episodes c, e and f.

On the other hand, the *reflection* mode of interaction identified in the conceptual framework, builds concepts (Carey *et al.*, 1999). It does so by moving the interaction from the concrete to the abstract (upwards on the notation). *Reflection* involves student observations and reflections (Lewin, 1957; McLeod, 2013; Blair, 2006), and draws on Kolb's Reflective Observation phase of experiential learning (Kolb, 1984).

Below follows one example of only four instances of student reflection, that were found in the data - all four occurring in crit 2:

Those sheltered areas are open at the back, so you can actually stand here and look up at the mountain like that. [student's markings in red] So you look through the sheltered area at the mountain as well. So, it almost frames the view for you. (Crit 2: 43)

In the same crit, two turns later, the tutor adds to the student's reflection, elaborating on the sense-making ideas that the student initiated:
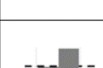
… What's an interesting development from the earlier model was that now although there is a linear route, it's not as confined. It's broken, so there are kind of – it's permeable… (Crit 2: 45)

In section 4.3.1 which deals with *reflect* as a conversational move, I explained that few students, graduates, and tutors directly referred to *reflection* in their responses. Yet I observed instances of *reflection* in all three crits. In crit 1, *reflection* occurred in episodes h and j, in crit 2, I found the *reflection* mode in episodes f, g, and j, and in crit 3, this mode was only evident in episode f. Tutor *reflection* occurred in all three crits, but *reflection* as a mode of interaction performed by a student, was only noted in crit 2.

These findings support the literature that claim reflection plays an important role in promoting learning from experience through meaning-making (Ellmers, 2014). However, the findings also confirm Christine Percy's (2004) concern that the crit lacks opportunities of sensemaking, although her research does not specifically focus on the live online crit. She found that '[I]n participaring in a critique of their work, students were able to demonstrate a learning of complex processes, through their descriptions of methods and procedures, but failed to demonstrate how that learning had enabled them to engage with the most abstract conceptions of their subject' (Percy, 2004:152). In her work on the asynchronous online crit, she found that 'students privileged description and explanation of process and technique over a demonstration of their command of critical exposition and an ability to conceptualise' (Percy 2004:147). She ascribed it to the fact that students were not taught the skills of critical reflection and argument. Further research is needed to explore this further.

Modes of *exploration* and *reflection* often occur grouped together in alternating episodes, for example episodes h and j in crit 1, episode f in crits 2 and 3. This finding supports Tony Bates' (2016) assertion that 'academic knowledge requires students to move constantly from the concrete to the abstract and back again, and to build or construct knowledge 'based on academic criteria such as logic, evidence and argument' (Bates, 2016: 95). However, literature on design education is silent on the construction of knowledge 'about how thinking and doing, or the thought and act processes of designing are interconnected' (Uluoglu, 2000:35). With this research I attempt to address this gap.

Table 11: Modes observed in the crit protocols

	MODES RQ 3.2		CRIT 1	CRIT 2	CRIT 3
student	**NEGOTIATION** Operating on concepts (abstract/ theory)		•	•	•
tutor			•	•	•
student	**EXPLORATION** Applying concepts		•	•	•
tutor			•	•	•
student	**REFLECTION** Building concepts		–	•	–
tutor			•	•	•
student	**APPLICATION** Operating on application (concrete/ practice)		•	•	•
tutor			•	•	•

Synthesis

In response to Research Question 3.2, '**What are the modes of student-tutor interaction in the live online crit and how are they employed in learning through experience?**', four modes of interaction were found, namely *negotiation, application, exploration* and *reflection.*

This research draws on literature on learning through experience (Kolb, 1984; Lewin, 1957; Dewey, 1938; Carey *et al.*, 1999; Blair, 2006; McLeod, 2013; Gunawardena, Lowe & Anderson, 1998) to explore how the student and tutor interact in the live online crit. All four modes of interaction contained in the conceptual framework were found in the student, tutor and graduate responses and observed in the live online crit protocols.

In both *negotiation* and *application* modes, the student dominated the interaction. In the three crit protocols the tutor's contribution was limited to brief inputs,

prompting for clarification and explanation, hinting, questioning and occasionally complimenting. *Negotiation* was concentrated in the first half and *application* in the second half of the respective crits. These findings demonstrate the general pattern of the crit interaction as starting with abstract and theoretical and ending with concrete and practical episodes.

The tutor's role features more prominently in the *exploration* and *reflection* modes. As premised, *exploration* is associated with the testing of ideas and *reflection* with the building of concepts. Based on who initiated the change in the experiential learning level (from abstract to concrete and *vice versa*), in other words who initiates *exploration* and *reflection*, it appears that the tutor lead crit 1 and the student lead crit 2. Crit 3 shows a more equal distribution of initiation of 'up' and 'down' interactions. This finding contests the literature on the common understanding that the crit is tutor-dominated (Blair, 2006; Stuart-Murray, 2010; Ellmers, 2014).

Various factors may be ascribed to the difference in the pattern of interaction of crit 2 compared to crits 1 and 3 and this question requires further research. However, since the dominance of the use of physical models by C2 is the only obvious difference, this might be a reason for the different pattern of crit interaction. Not only did the prominence of physical models appear to have assisted the student to continuously reflect on his own practice, but it seems to have helped navigate the conversation more equally between the concrete and the abstract; the practical and theoretical.

Modes of *exploration* and *reflection* occur together in alternating episodes; for example episodes h and j in crit 1, and episode f in crits 2 and 3. Considering the need for students to constantly move from the concrete to the abstract and back again, in order to learn (Laurillard, 2012; Bates, 2016; Gunawardena, Lowe & Anderson, 1998; Carey *et al.*, 1999; Percy, 2004; Blair, 2006; Stuart-Murray, 2010; McLeod, 2013), it can be assumed that these episodes provide the key learning interactions to 'modulate... concepts and practice' (Laurillard, 2013: 121). However, literature on design education is silent on 'how thinking and doing, or the thought and act processes of designing are interconnected' (Belkis Uluoglu, 2000:35). With this research I attempt to address this gap.

Considering the importance of reflection to promote learning from experience through meaning-making (Ellmers, 2014), it is important to consider Christine Percy's (2004) concern that the crit lacks opportunities of sensemaking through reflection. Although her research does not focus on the live online crit, she found that '[I]n participating in a critique of their work, students were able to demonstrate a learning

of complex processes, through their descriptions of methods and procedures, but failed to demonstrate how that learning had enabled them to engage with the most abstract conceptions of their subject' (Percy, 2004:152). In her work on the asynchronous online crit she found that 'students privileged description and explanation of process and technique over a demonstration of their command of critical exposition and an ability to conceptualise' (Percy 2004: 147). She ascribed this observation to the fact that students were not taught the skills of critical reflection and argument. Further research is needed to explore how student *reflection* can be promoted in the live online crit.

4.3.3 Learning through cognitive apprenticeship: methods

The data produced clear instances of the six cognitive apprenticeship methods. The methods of interaction identified in the conceptual framework (Figure 25), include *articulation, exploration, reflection, modeling, scaffolding* and *coaching.* The first three were employed by students and tutors and the latter three by the tutors only, but in conjunction with the first three methods. The crit protocol data revealed evidence of two additional methods that are not focused either on the content or the cognitive but serve to mediate the learning interaction between the student and the tutor. I named these *navigation* and *socialisation*.

MOVES Learning through Conversation	MODES Learning through Experience	METHODS Learning through Cognitive Apprenticeship	
CLARIFY (discursive) **Present** **Question** / prompt **Comment** / answer	NEGOTIATION Operating on concepts/ conceptualisation (abstract/ theory)	Articulation telling	
TEST (adaptive) **Adapt**	EXPLORATION Applying concepts/ test	Exploration	**Modeling Scaffolding Coaching**
ELICIT (reflective) **Reflect**	REFLECTION Building concepts/ reflect	Reflection	
DECIDE (interactive) **Present** **Question** / prompt **Comment** / answer	APPLICATION Operating on application/ experience (concrete/ practice)	Articulation showing	

Figure 25: Conceptual framework: Methods

The findings are summarised in Table 12, with black dots indicating at least one instance of the relevant method observed in a crit protocol. The plus (+) symbol signifies additional methods that emerged from the data and were therefore added.

Next follows a discussion of the six methods of cogitive apprenticeship that I found in the data, followed by a discussion.

The first three methods, *articulation, exploration* and *reflection,* are employed by the student and the tutor as part of the learning interaction. The following three, *modeling, scaffolding* and *coaching,* are employed by the tutor only, to mediate the learning interaction. I added the final two methods that emerged from the data, *navigation* and *socialisation*. These methods are employed by both student and tutor and do not relate to the learning content. Instead, they help mediate the learning interaction through timing, technology and informal chat.

Articulation

In their responses, the students, tutors and graduates noted the importance of *articulation* as a method of crit interaction, using multiple media,

> *A clearly articulated response to the design issue expressed as ideas through words, drawings and models. (T/4)*

to communicate their design reasoning,

> *Explaining your idea, to explain where the idea comes from and trying to explain what you want your endresult must be or where you are intending to go with the design. (G12)*

and to master the language of the profession:

> *...talking like an architect, explaining your ideas. (A)*

These findings support Allan Collins' assertion that *articulation* is a method of cognitive apprenticeship, through which students 'explicitly state their knowledge, reasoning- and problem-solving process in a domain' (Collins, Brown & Holum, 1991: 41; Oriol *et al.*, 2010). Lave and Wenger's (1991) observation that the ability to use the vocabulary and to practice within the context of a discipline, is fundamental to learning, is underscored.

However, the literature does not specifically address the types of media through which *articulation* of understanding and practices in learning interactions is achieved. From these results it is suggested that *articulation* takes on multiple media, including verbalisation as well as two- and three-dimensional representations.

Table 12 illustrates that, in this study, both students and tutors actively employed *articulation* in their interactions. This method was observed in all three crits, both to communicate students' and tutors' thinking, and their respective practices. This finding supports the literature that articulation makes thinking and doing visible, through telling and showing (Collins, 1988).

As maintained by Allan Collins (1988), *articulation* conveys students' knowledge and thinking, to make their tacit knowledge explicit, through 'telling' (Collins, 1988: 17). In this case it is achieved through on-screen markings and verbalisation:

> *And then for me, the site had a big influence on enhancing these human senses. So, I had to understand the site and the context better move across the site [student markings in red] and where the key areas are to create smell or where the strong smell will occur from... (Crit 1: 32)*

Through questions and prompts, students are also invited to consider, explain and show their practices (Collins, 1988):

> *Ja, I'm just asking what – what – in terms of scale you know [tutor's marking in blue - pen moving up and down along the column line on the lower image] What height and why that height? (T2, Crit 2:36)*

These findings support the literature that suggest that *articulation* is the method through which an expert helps a novice to gain expertise through demonstration, support, and providing examples' (Dennen & Burner, 2007):

> *Good, nice but it's a very nice presentation for us to respond to. I just think for everybody on one page, we've got a model, a plan, diagram section. I mean this is a really useful single page to cross-reference. I think it's been very valuable in this discussion. (T2, Crit 1: 60)*

Through *articulation*, tutors provide feedback in the form of hints and comments (Murphy, Ivarsson, Lymer, 2012),

> *Ja, I don't want you to lose you know that idea of the focusing on particular senses, but I think that it can be done in a much looser way without constructing huge buildings in that space. (T1, Crit 1:51)*

and *explanations* to clarify design practices (Dennen, 2004),

> *...Okay, around that building you can see we have a very hard edge on that side [student markings in black] and then because that side*

*of the building is actually very hard there, on the right-hand top, this
side, [student black markings on top RH side] there you can see it
as well. (Crit 3: 28)*

Exploration as a cognitive apprenticeship method will be discussed in the next
section.

Exploration

In their responses, the students, tutors and graduates noted *exploration* as a
method through which alternative design solutions are considered:

> The crit is a learning experience, where there is no concrete, 'yes or
> no' but an exploration of questions, ideas and possible solutions to
> design problems. (S16)

Participants agree that part of the role of the tutor is to prompt the student to
generate original ideas through exploring alternative solutions:

> *[It] [d]epends on the crit, but generally to give the student a[n] idea
> of how to move forward, let the student think of different solutions
> and come up with his/hers [sic] own original thought. (G13)*

These findings support the literature suggesting that, through *exploration,* students
are encouraged to form hypotheses, to test them to see their effects, and to
generate new ideas and viewpoints (Enkenberg, 2001, cited in Dennen, 2004; Dennen
and Burner, 2007:426). Students are encouraged to 'break' with the norm, as
suggested by G10:

> *I see it [the crit] as a sort of supervision from the lecturer/tutor to
> the student where the lecturer assists students to break what ever
> [sic] boundaries they might have put for themselves and explore
> more avenues when executing their work. (G10)*

Although not always easy to master, productive exploration skills are necessary to
put students in control of problem solving (Collins, 1988; Enkenberg, 2001, cited in
Dennen, 2004):

> *One can fall in love with a concept as a whole, whether it is right or
> wrong within the context of the brief. I would say that being advised
> to relook your concept can be difficult at first but obviously in the
> long run, it proves to be beneficial by making you test your own
> theories and concepts. (S22)*

From the crit protocols I observed that both students and tutors actively employed the method of *exploration* and these were found in all three crits (see Table 12).

In crit 3 the student employs exploration to imagine different ways (Oriol, Tumulty & Snyder, 2010) to address the design problem:

> *So I have to go explore that but there you can see it's actually open in between, let's say 40mm in between and that – if you walk past the flower garden, you can smell the flowers… on this one [student's markings in green] you maybe add a pergola or something to break the light. On this one you have – this is open [student's markings in green], this is maybe glass as well and then this is glass… and maybe that is the type of grass patch that's on that concrete…* (Crit 3:36)

Exploration to 'pushing students into a mode of problem solving on their own' (Collins et al., 2011: 14), and encouraging them to ask meaningful questions, is evident in T1's response in Crit 1 below:

> *Yes, but that's one experience, you know, there's another sense of when you walk under trees when they're full of leaves, when you walk under trees when they've lost their leaves. You know, so when you walk under a space where there's dappled light coming through where there's just openness to the sky, you know… So, what I'm saying is that, you know, the kind of very confined and I know you wanted to do some spaces where you completely deprive people of certain senses, but I think that can be done probably in more sort of subtle ways, you know.* (Crit 1:49)

As Collins *et al.* (2011:14) assert, '[f]orcing [students] to do *exploration* is critical, if they are to learn how to frame questions or problems that are interesting and that they can solve.' *Exploration* is closely linked to *reflection*, which is the method discussed next.

Reflection

In their responses, students, tutors and graduates refer to *reflection* as making sense of the learning interaction while it is happening in the crit, as well as after the crit:

> *[W]hile you were critting there weren't necessarily answers yet to the questions… and then you can actually go think about it, okay I'll try this and you can reflect again about it and then maybe… and sometimes maybe the student was going this way and maybe I was pushing that way, understand where he goes and perhaps he still*

> *goes this way, always reflecting between the lecturer and the student, just keeps everyone on the same par of thinking... (D)*

They also noted the different modes of communicating and recording such *reflection* during and after the crit, namely on-screen sketching, two-dimensional and three-dimensional models during the crit, and text to extract the learning and to plan the next steps:

> *On screen sketching, models (physical/3D) for the crit session. I think that student[s] after the crit session should reflect in text what they learned and what the student will be doing to continue the design/concept between now and the next crit. (G8)*

This aligns with the description by Oriol, Tumulty & Snyder (2010:211) of '[r]eflection allow[ing] use of memory, understanding, imagination, and feelings to grasp the essential meaning and value of how one is proceeding.' (Oriol, Tumulty & Snyder, 2010:211). What the student did, becomes an object of study (Collins, 1988). Not only does *reflection* revolve around the subject matter, but also the student assessing her own performance (Dennen, 2004):

> *Crits also give rise to reflection of the problem and ones [sic] self in the process.* (S16)

References to the value of viewing and reflecting on recordings of the live online crits as noted by S11,

> *I always find it beneficial to take a day or two after the crit to reflect on the feedback to my presentation, watch the recordings, review my notes and then write up a post-crit report for myself stating my goals for the next crit, what I need to correct in my presentation and what I need to work on to reach those goals. (S11)*

resonate with Allan Collins' work with John Seely Brown (1987: 17) on how 'reflection is enhanced using techniques for reproducing or 'replaying' the performances of both expert and novice for comparison.' He suggests different ways this can be done, for example the tutor or the student thinking about the process after it has happened. Collins also refers to recording and replaying students whilst they're thinking out loud. I found that the live online webinar is serving this purpose, although it helps more with reflection-on-action and reflection-on-interaction (see section 4.3.1.), than reflection-in-action as noted by Schön.

The data revealed that, although evidence of *reflection* employed by the tutor was found in all three crits, only one student used it, namely in crit 2. See Tabel 12.

Both crit protocol extracts below, one by the student and the other by the tutor, demonstrate Collins' assertion that 'reflection leads to abstraction'. (Collins 1988: 9).

> *Both [on plan and section] you've got the opportunity here to have a really, really interesting on plan section. Righini talks about the plan section relationship. There's some kind of language, so rather than kind of tightly wrapping, it's more a flying and movement. It's not moving enough, I think at this stage...* (Crit 1:43)

> *That's exactly what I was trying to do was break that line up. Instead of having a very straight restricting line to allow people then to disperse, that was part of the concept was to allow that dispersal space.* (Crit 2: 46)

Modeling as a cognitive apprenticeship method will be discussed in the next section.

Modeling

Although the students, tutors and graduates didn't specifically identify *modeling* as a characteristic of the live online crit, their responses resonate with the literature that describes *modeling* as a method of cognitive apprenticeship. Oriol, Tumulty & Snyder (2010:215) define *modeling* as a '[d]emonstration by the expert of how to think about a problem in the real world.'

As suggested by S4 below, the role of the tutor is to provide more than just a response:

> *... Sometimes were [sic] go to crits to hear what the professor thinks not making him/her flow in our design thinking. (S4)*

Through *modeling,* the tutor steps 'into' the student role, demonstrating expert behavior, for the student to imitate (Dennen, 2004:816):

> *You sometimes get the voices of different people [your tutor] in your head ...(B)*

These findings support the literature claiming that '[m]odeling involves an expert performing a task so that the students can observe and build a conceptual model of the processes that are required to accomplish it' (Collins, Brown & Holum, 1991:13). The live online crit scenario described below, promotes *modeling* of expertise as suggested in the literature:

> *I think when you're drawing face to face, it's more like you figure out stuff, whereas online it's more like the lecturer showing you something. When Tutor 1 used to draw something, and you draw, it's*

like your idea, it's not necessary how to figure it out like we'll sit there and work it out, it's more like this is how you think it's supposed to be and then afterwards you will work from there backwards and stuff. It's not like we have to resolve this, let's start drawing, it's more like maybe you should have done this... let's start drawing...it's more like getting to a point and moving on again. (D)

I found that *modeling* as observed in the live online crits, is both about the 'demonstration of the temporal process of thinking' (Dennen, 2004:814) and its application (Collins, 1988). It is the 'showing and telling that is so characteristic of apprenticeship' (Collins 1988:4).

Like *scaffolding* and *coaching, modeling* was found in the crit protocols, associated with the other methods, namely *articulation*, *exploration* and *reflection*. In this learning setting it is only performed by the tutor, and not by the student. In the crit protocols, *modeling* methods were employed by the tutor primarily to demonstrate *exploration* and *reflection*. These methods were observed in all three crits. Only one instance of the tutor *modeling articulation* occurred, namely in crit 2. Here the tutor demonstrated to the student how to elaborate on her practice.

In Crit 1, T2 models reflection. She uses verbal and graphic media to demonstrate how the student might reflect on the design in terms of the architectural language of movement. The tutor suggests that the student draws on theory to further develop his design:

Both [on plan and section] you've got the opportunity here to have a really, really interesting on plan section, Righini talks about the plan section relationship. There's some kind of language so rather than kind of tightly wrapping – it's more a flying and movement. It's not moving enough, I think at this stage. (Crit 1:44)

Further along in the same crit, T1 *models exploration* by demonstrating how the student can use the model to test alternative design solutions:

Well, I think the model you need to, ja, you need to use the model to explore what's closed, what's open, what floats, what's solid. You know again, as part of your concept. Here, all the planes are pretty much the same you know whereas the floor could fold up and become the wall and the roof or the roof could be something completely different you know, ja. (T1)

Only one instance of the tutor *modeling articulation* was found in the data, namely in Crit 2. Through question prompts, the tutor demonstrates how the student should develop the design idea by expanding his thinking:

> *I also wanted to ask, the geometry that you're setting up – is it deliberate, is it specific? Does it speak up anything else or what – you spoke about Table Mountain, you spoke about views. You know are those elements flat? Are they tilted? I'm trying to look for more clues to justify why they look like that?* (Crit 2:63)

These findings support the literature that *modeling* provides a useful strategy for making problem-solving visible to students (Oriol, Tumulty & Snyder, 2010). It adds to the limited literature on the live online crit, specifically with regards to the student-tutor interaction. I found that, in the live online crit, *modeling* is used by the tutor, in conjunction with *articulation, exploration* and *reflection*.

Scaffolding as a cognitive apprenticeship method will be dealt with in the next section.

Scaffolding

Although the students, tutors and graduates didn't specifically identify *scaffolding* as a method of interaction associated with the crit, there were some responses that resonate with the literature. Instead of *scaffolding*, participants referred to 'assistance', 'guidance' or 'help' by the tutor, for example:

> *...A 'crit' is a method of assisting. (T/3)*

> *To provide guidance towards working out our own solutions for our design problems guidance to improve and help to learn into improving the design to move forward. (S12)*

These were provided by the tutor to enable the student to 'move forward' or take the 'next step':

> *The ability to understand that a crit is not a criticism of them personally but rather advice to move forward. (T/4)*

> *[To] [t]ake that next step to your development of your design. (C)*

In the focus group interview, one of the graduates referred to the provision of partial project briefs issued before each crit, to support students with their crit preparation and help them focus their attention:

Yes, these crits were actually really helpful in the way you guys gave us briefs for each crit. You know, do this for this crit, and that was very helpful. (A)

This finding supports Laurillard's (2013: 259) assertion that, through actively 'shaping and structuring the discussion' the tutor scaffolds the learning process. It also speaks to Vanessa Dennen's (2004) view that *scaffolding* provides support to students to manage the task at hand, incrementally building on past knowledge, and sequencing such tasks (Collins, Brown, & Newman, 1989). This strategy helps students to reach skill levels beyond their current ability (Dennen & Burner, 2007).

Both students and tutors elaborated on the role of the tutor in guiding students' learning,

What makes a critique successful is when the 'Ahaa' moment is realised where the student has acquired a form of self-motivation and sense of achievement through guidance. This then is a form of inspiration going forward. (S16)

emphasising the importance of clear and consistent guidance by tutors:

Lecturers should guide student[s] and not provide students with all the answers. How this guidance takes place should be consistent and clear to all lecturers so that students are not left with contradictory viewpoints, particularly undergraduate students. (T/2)

These findings support the literature on guided participation (Wang & Bonk, 2001) as the 'social element of cognitive apprenticeship' (Dennen & Burner, 2007:428) that takes place in the student's zone of proximal development (ZPD). The ZPD is the 'space between actual and potential performance' of a student and is assessed through social interaction between the learner and someone who is more experienced' (Dennen & Burner 2007:428), in this case the tutor. However, Oriol, Tumulty & Snyder (2010:211) warn against too much scaffolding 'interfer[ing] with learning while too little may not provide a rich enough learning environment' (Oriol, Tumulty & Snyder, 2010:211). Further research is needed to establish how much support is needed.

The data revealed instances of *scaffolding* associated with *articulation* (crits 1, 2 and 3), *exploration* (crits 1 and 2) and *reflection* (crits 1, 2 and 3). *Articulation* was *scaffolded* by the tutor in crits 2 and 3, helping the students make their thinking explicit, and in crits 1 and 3 to support *articulation* of their respectice practices.

These findings support the literature that asserts that scaffolding enables sense-making and reflection, inquiry and exploration, and articulation (Quintana *et al.*, 2004).

For example, in Crit 1, T2 *scaffolds reflection*, to help the student perform the task. She does this by providing supports in the form of a reference to a theory source and a suggestion for how to move forward:

> *... if you read Righini [he] talks a lot about the floor and the walls and the roof as space-defining elements and some cases you leave away the wall or you puncture the wall, or you perforate the roof or you omit the roof, or you just have a floor and one wall. So, I think you need to break the box a little bit...(Crit 1: 56)*

Although the issuing of partial crit briefs lauded by participant A above, provides a 'physical' support (Collins *et al.*, 1998) to help students carry out the task, the crit protocols only revealed scaffolds in the form of tips and techniques, suggestions, help or prompts (Oriol, Tumulty & Snyder, 2010) also demonstrated by T2 below:

> *It would be nice to put a person on that model as well, a little cut out and then decide whether it should stay that same height or whether it could vary. Could it build up towards the building or could it ... (Crit 2: 38)*

These findings build on the literature that suggest that scaffolding is a learner-centred strategy that supports student learning of concepts, procedures and strategies (McLouglin, 2002). However, the 'provision of social support for dialogue' suggested by McLouglin (2002:152) as a key element of learning support in distance and online learning, was not present. I did not find any instances of supportive scaffolding affecting students emotionally (Dennen, 2004:823). Instead, all cases of scaffolding that I observed in the live online crit protocols were directive and seem to be cognitively focused.

Supportive scaffolding speaks to the emotive rather than the cognitive, and these were not present in the data. Building on McLouglin's call for an extention of the concept of scaffolding in view of 'technology becom(ing) increasingly integrated into the delivery of learning experiences...' supportive scaffolding deserves further investigation as well.

Coaching as a Cognitive Apprenticeship method is discussed in the next section.

Coaching

Only one participant (G6) referred to *coaching* when asked about the contribution of the tutor in the crit situation. G6 compared the tutor to a sports coach, emphasising that the power resides with the student who decides how to act on the advice, or not:

> ... One could say that a tutor/ lecturer is much like a coach in a sport, the coach can offer guidance and advise to the sportsman, but it is completely up to the sportsman to implement that advise [sic] while training and playing. (G6)

This finding aligns with Attoe and Muggerauer's (1991) view that the coach often negotiates between two roles: the harsh critic or master (Brown, Collins & Newman, 1989) and the caring counsellor. Because of her expertise, familiarity with the goal and in-depth knowledge of what is required to achieve it, the coach can be critical and authoritarian. Attoe and Mugerauer (1991) therefore prefer to view the coach as 'counsellor', who takes on a more sympathetic position towards the student.

When asked what students expect from tutors in the crit, respondents referred to both these approaches. On the one hand, they listed mentorship, challenge and encouragement,

> *Guidance, encouragement, intellectual engagement, mentorship and continuous push towards excellence and exploration of untamed realms and new realities. (G5)*

> *Students want tutors to '...challenge [their] problem solving skills.' (G3)*

and on the other, constructive criticism, understanding and patience:

> *Accountability, learning new ideas, growth in knowledge through constructive criticism. (S5)*

> *Patience, understanding and desire to help students. Someone who has patience to explain themselves and point student in the right direction (not give them the answers though). (G1)*

> *Crits are essential but the panel should always ensure it doesn't crush the spirit and motivation of the student by use of some certain words the panel should concentrate on work done and not only point out bad things done but also point out good things done and advise on the way forward to do a certain task. (S16)*

These responses echo Attoe and Mugerauer's assertion that, in a coaching role, the competent tutor cares for and always has the student's best interests at heart. They are 'in league with the student, not in an adversarial position, or in a dictatorial one' (Attoe & Mugerauer, 1991:45). The excellent tutors whom they interviewed talked about 'balancing negative criticisms with positive comments to keep the student working and moving forward' (Attoe & Mugerauer, 1991: 45; Oriol, Tumulty & Snyder, 2010).

Moreover, Schrand and Eliason (2012) maintain that students need assistance to learn how to take criticism. They explain that defensiveness is an 'emotional hurdle' that hinders learning for some students, and for those it must be overcome.

I found that *coaching* employed by the tutor was associated mainly with *articulation*: showing (crits 1, 2 and 3) and telling (crit 2)*,* less so linked with *reflection* (only in crit 1) and not at all with *exploration*. There is, however, no obvious explanation for the absence of *coaching* instances linked to *exploration*, found in the data, and this finding invites further research.

In crit 1, T1 offers feedback on the student's design process. The feedback is focused on his practice and the tutor, here acting as a coach, compliments the student on his thinking, using it as an example for the other students who are present in the online session. Next the tutor focuses the attention on an aspect of the design that needs further development:

> *Good, I think you've explained it really well. I enjoyed the way in which you refer to the senses and, you know, it's evident that you've thought about that experience and how it will impact on the senses. I just, I'm not sure why it seems as if ... you've almost created an artificial boundary...* (Crit 1:40)

This instance demonstrates how coaching may 'serve to direct students' attention to a previously unnoticed aspect of the task or simply to remind the student of some aspect of the task that is known but has been temporarily overlooked' as suggested by Collins, Brown & Holum (1991:14).

Navigation as a method through which the student and tutor interact, will be dealt with in the next section.

Navigation

In the crit protocols, I found utterances that could not be matched to any of the six cognitive apprenticeship mehods, namely *articulation*, *exploration*, *reflection*, *modeling, scaffolding* or *coaching*. I added *navigation* to describe the method of

online wayfinding used by the student and tutor to direct their interaction in terms of turn-taking and timing:

> *I think there's one more model picture, ja (C1, Crit 2: 72)*

> *It's your turn, yes, please go ahead (T2, Crit 3: 10)*

> *So basically, can I start? (C1, Crit 1: 10)*

> *Oh, go on. (T2, Crit 1: 14)*

and the use of the webinar technology:

> *Do you want to draw? (T2, Crit 1:20)*

> *Ja. Click on the pen on the icon. (T1, Crit 1: 21)*

This method of interaction that is focused not on content but on guiding the learning interaction, represents a significant component of the student-tutor interaction. In the three crit protocols, between a quarter (in crit 2) and half (in crit 3) of the number of turns are taken up by instances of *navigation*.

These findings demonstrate that, in line with Collins and his colleagues' (1989) definition of cognitive apprenticeship as learning-through-guided-experience, specific guidance is needed to help navigate learning online.

Navigation corresponds with *procedural* participation, which is one of the categories identified in Offir and Lev's (2000) model for student and teacher participation in online discourse. The other categories are *social, expository, explanatory, cognitive task engagement* and *learning assistance interactions*. In their model, *procedural* participation includes teacher statements with information on administrative and technical issues related to the course.

The fact that this was the first online crit conducted with this student cohort, and the students were mostly unfamiliar with the webinar technology, could explain the prominent use of *navigation* observed in the crit protocols, especially with regards to the technology. Further research is needed to establish what determines the frequency of *navigation* methods of interaction and what role it plays in the student-tutor interaction in the live online crit.

In the next section I discuss *socialisation* as a method through which the student and tutor interact in the live online crit.

Socialisation

Finally, I found utterances that could not be matched to any of the six cognitive apprenticeship mehods, namely *articulation, exploration, reflection, modeling, scaffolding,* or *coaching,* that are not contributing to wayfinding in the crit. I added *socialisation* to describe the method used by the student and tutor to engage in friendly and informal chat, that is unrelated to the learning content.

In the three crit protocols, on average less than a fifth of the number of turns were taken up by instances of *socialisation.* I observed only three instances out of a total of 80 and 56 turns, respectively, in crits 2 and 3. In crit 1, I found 11 *socialisation* turns out 69 turns in total. These included mainly greetings and brief expressions of grattitude.

> *Ja, that's good now. How are you guys doing? (C1, Crit 1: 5)*

> *Thanks, great, okay, good luck. We'll see you in the journal. (T2, Crit 1:66)*

> *Hi. (T2, Crit 2:5)*

> *Thank you. (C3, Crit 3:38)*

Cognitive apprenticeship methods provide ways to promote the development of expertise (Collins, Brown & Holum, 1991:14) but do not include social and informal interaction with the teacher or tutor. Yet, several authors emphasise the importance of social interaction with the teacher or tutor as a critical part of online learning, that should not be neglected (Offir & Lev, 2000; Salmon, 2000; Lotz, Holden & Jones, 2015). For example, Gilly Salmon's (2000) five-step model for online learning and teaching to show how the e-moderator can support learning, includes *online socialisation.* The other steps in the model are *access and motivation, information exchange, knowledge construction* and *development.*

Literature on the crit (Blair, 2006; Osborne, 2018) and synchronous online interaction specifically (Ligorio, Talamo & Simons, 2002; Burnett, 2003), that these findings support, emphasise the importance of the social role of the tutor to establish a supportive atmosphere and 'help build community and create a friendly and safe environment in which people can feel like people' (Finkelstein, 2006:4). Finally, although not synchronous, but in a study situated in the online design studio, Lotz, Holden and Jones (2015) discovered a link between teachers' social interactions, learning assistance interactions and reported student learning. The limited number of utterances associated with *socialisation,* that were found in the live online crit protocols, suggest that the student-tutor interaction in the live online crit is not

particularly social. Further research is needed to better understand this method of synchronous online interaction in terms of its potential to stimulate social interaction.

Table 12: Methods observed in the crit protocols

	METHODS RQ 3.3	CRIT 1	CRIT 2	CRIT 3
	Navigation (+)	•	•	•
	Socialisation (+)	•	•	•
student	Articulation (telling)	•	•	•
tutor	Articulation (telling)	•	•	•
	Modeling Articulation	-	-	-
	Scaffolding Articulation	-	•	•
	Coaching Articulation	-	•	-
student	Exploration	•	•	•
tutor	Exploration	•	•	•
	Modeling Exploration	•	•	•
	Scaffolding Exploration	•	•	-
	Coaching Exploration	-	-	-
student	Reflection	-	•	-
tutor	Reflection	•	•	•
	Modeling Reflection	•	•	•
	Scaffolding Reflection	•	•	•
	Coaching Reflection	•	-	-
student	Articulation (showing)	•	•	•
tutor	Articulation (showing)	•	•	•
	Modeling Articulation	-	•	-
	Scaffolding Articulation	•	-	•
	Coaching Articulation	•	•	•

Synthesis

In response to Research Question 3.3, '**What are the methods of student tutor interaction in the live online crit and how are they employed in learning through cognitive apprenticeship?**', eight methods were found, namely *articulation, exploration, reflection, modeling, scaffolding, coaching, navigation* and *socialisation.*

This research draws on literature on learning through cognitive apprenticeship (Kolb, 1984; Lewin, 1957; Dewey, 1938; Carey *et al.*, 1999; Blair, 2006; McLeod, 2013; Gunawardena, Lowe & Anderson, 1998) to explore how the student and tutor interact in the live online crit. The first six methods contained in the conceptual framework, were found in the student, tutor and graduate responses and observed in the live online crit protocols. I added two methods, namely *navigation* and *socialisation*.

The first three methods were employed by students and tutors and the latter three by the tutors only, and in conjunction with the first three. The crit protocol data revealed evidence of two additional methods that are not focused either on the content or the cognitive but serve to mediate the learning interaction between the student and the tutor. I named these *navigation* and *socialisation*.

This study responds to a call by Dennen (2004) for more research on cognitive apprenticeship 'that will lead to greater generalizability of results and the development of prescriptive knowledge to guide practitioners.' (Dennen, 2004:825). It also addresses a gap in the current literature on the architectural crit (Webster, 2004; Blair, 2006; Oh *et al.*, 2013; Olweny, 2015; 2017) and the live online crit specifically (Ng, 2007).

In the three crit protocols, both students and tutors actively employed *articulation* in their interactions, and they did so to communicate their thinking and doing (practice). Articulation makes thinking and doing visible, through telling and showing (Collins, 1988). Here *articulation* takes on multiple media, including verbalisation as well as two- and three-dimensional representations. These findings support the literature on *articulation* as a method of cognitive apprenticeship through which students 'explicitly state their knowledge, reasoning- and problem-solving process in a domain' (Collins, Brown & Holum, 1991:41; Oriol, Tumulty & Snyder, 2010); and through questions and prompts, they are invited to consider, explain and show their practices (Collins, 1988). In turn, the tutor as expert helps the student gain expertise through demonstration, support, providing examples' (Dennen & Burner, 2007), and feedback in the form of hints, comments (Murphy, Ivarsson & Lymer, 2012), and explanations to clarify design practices (Dennen, 2004).

Both students and tutors actively employed the method of *exploration* in the live online crits. This finding supports the literature suggesting that, through *exploration,* students are encouraged to form hypotheses, to test them to see their effects, and to generate new ideas and viewpoints (Enkenberg, 2001, cited in Dennen, 2004; Dennen & Burner, 2007:426). These productive *exploration* skills are necessary to put students in control of problem solving (Collins, 1988; Enkenberg, 2001, cited in Dennen,

2004), which is particularly relevant in the context of architectural education (Oh *et al.*, 2013; Olweny, 2015, 2017).

Although *reflection* is used extensively by the tutor to demonstrate the abstraction process (Collins, 1988) to the student during the crit, there is limited use of this move by students in the live online crit. However, it appears that, through viewing of the crit recordings, *reflection* by the student also happens after the live online crit, through reflection-on-interaction. This method of reflection adds to the current literature on reflection (Schön, 1983, Webester, 2004). The live online crit in this study supports reflection-on-action, but not reflection-in-action. This observation suggests that the interaction in the live online crit focuses on design work presented in the crit, rather than design work produced during the crit. Furthermore, this research adds to the different modes of communicating and recording such *reflection* during and after the crit, namely on-screen sketching, two-dimensional and three-dimensional models discussed during the crit, and text to extract the learning and to plan the next steps (Oriol, Tumulty & Snyder, 2010).

Like *scaffolding* and *coaching, modeling* is only performed by the tutor, and used primarily to demonstrate *exploration* and *reflection.* This research shows that *modeling* as observed in the live online crit, is both about the 'demonstration of the temporal process of thinking' (Dennen, 2004:814) and its application (Collins, 1988). It is the 'showing and telling that is so characteristic of apprenticeship' (Collins 1988:4).

This research shows that *modeling* provides a useful strategy for making problem-solving visible to students (Oriol, Tumulty & Snyder, 2010), adding to the limited literature on the live online crit, specifically with regards to the student-tutor interaction.

As expected, I found that, like *modeling* and *coaching, scaffolding* is only performed by the tutor, and used in conjunction with *articulation*, *exploration,* and *reflection*. This research builds on Laurillard's (2013:259) assertion that, through actively 'shaping and structuring the discussion' the tutor scaffolds the learning process. It also speaks to Vanessa Dennen's (2004) view that *scaffolding* provides support to students to manage the task at hand, incrementally building on past knowledge, and sequencing such tasks (Collins, Brown, & Newman, 1989).

This research builds on the literature on guided participation (Wang & Bonk, 2001) as the 'social element of cognitive apprenticeship' (Dennen & Burner, 2007:428) However, Oriol, Tumulty & Snyder (2010:211) warn against too much scaffolding 'interfer[ing] with learning while too little may not provide a rich enough learning

environment' (Oriol, Tumulty & Snyder, 2010:211). The tutor must accurately assess how much support is needed.

These findings build on the literature that suggest that scaffolding is a learner-centred strategy that supports student learning of concepts, procedures and strategies (McLouglin, 2002). However, the 'provision of social support for dialogue' suggested by McLouglin (2002:152) as a key element of learning support in distance and online learning, was not present. I did not find any instances of supportive scaffolding affecting students emotionally (Dennen, 2004:823). Instead, all cases of scaffolding that I observed in the live online crit protocols were directive and seem to be cognitively focused.

Supportive scaffolding speaks to the emotive rather than the cognitive, and these were not present in the data. Building on McLouglin's call for an extention of the concept of scaffolding in view of 'technology becom(ing) increasingly integrated into the delivery of learning experiences at primary, tertiary and secondary levels' supportive scaffolding deserves further investigation as well.

In this study I found that *coaching* employed by the tutor was associated mainly with *articulation,* less so with *reflection* and not at all with *exploration*. There is, however, no obvious explanation for the absence of *coaching* instances linked to *exploration*, found in the data. Furthermore, in this research, *coaching* is aligned with the role of the coach as councellor, who takes on a more sympathetic position towards the student (Attoe & Muggerauer, 1991) rather than a harsh critic or master (Brown *et al.*, 1989). This instance demonstrates how coaching may 'serve to direct students' attention to a previously unnoticed aspect of the task or simply to remind the student of some aspect of the task that is known but has been temporarily overlooked' as suggested by Collins, Brown & Holum (1991:14). However, further research is needed to understand the role of coaching as a method of interaction in the crit generally, and in the live online crit more specifically.

Navigation was added to describe the method of online wayfinding used by the student and tutor to direct their interaction in terms of turn-taking and timing and the use of the webinar technology. This method of interaction that is focused not on content but on guiding the learning interaction, represents a significant component of the student-tutor interaction. These findings demonstrate that, in line with Collins and his colleagues' (1989) definition of cognitive apprenticeship as learning-through-guided-experience, specific guidance is needed to help navigate learning online. *Navigation* corresponds with procedural participation (Offir & Lev, 2000) that includes teacher statements with information on administrative and technical issues related to the course. The fact that this was the first online crit conducted with

this student cohort, and the students were unfamiliar with the webinar technology, might explain the prominent use of *navigation* observed in the crit protocols, especially with regards to the technology. Further research is needed to establish what determines the frequency of *navigation* methods of interaction and what role it plays in the student-tutor interaction in the live online crit.

Finally, I added *socialisation* to describe the method used by the student and tutor to engage in informal chat, that is unrelated to the learning content. Cognitive apprenticeship methods provide ways to promote the development of expertise (Collins, Brown & Holum, 1991:14) but does not include social and informal interaction with the teacher or tutor. Yet, several authors emphasise the importance of social interaction with the teacher or tutor as a critical part of online learning, that should not be neglected (Offir & Lev, 2000; Lotz, Holden & Jones, 2015; Salmon, 2000). The utterances associated with *socialisation*, included greetings and brief expressions of gratitude. However, these were limited, suggesting that the student-tutor interaction in the live online crit is not particularly social.

4.3.4 Discussion

To find the answer to the Research Question 3, '**How do students and tutors interact in the live online crit**, I explored:

- the moves that students and tutors make in the live online crit and how they are employed in learning through conversation (RQ3.1),
- the modes of student-tutor interaction in the live online crit and how they are employed in learning through experience (RQ3.2), and
- the methods of student-tutor interaction in the live online crit and how they are employed in learning through cognitive apprenticeship (RQ3.3).

Based on the findings, the conceptual framework that guided these explorations, was expanded, as illustrated in Table 13 ('+' symbols indicate elements that were added).

Table 13: Moves, modes and methods observed in the crit protocols

	MOVES RQ 3.1	CRIT 1	CRIT 2	CRIT 3	MODES RQ 3.2	CRIT 1	CRIT 2	CRIT 3	METHODS RQ 3.3	CRIT 1	CRIT 2	CRIT 3
									Navigation (+) Socialisation (+)	● ●	● ●	● ●
student / Discursive/ CLARIFY	**present** **question** **comment**	● - ●	● - ●	● - -	**NEGOTIATION** Operating on concepts (abstract/ theory)	●	●	●	Articulation (telling)	●	●	●
tutor / Discursive/ CLARIFY	**present** **question** (+) **comment**	- - ●	● - ●	- - ●					Articulation (telling) Modeling Articulation Scaffolding Articulation Coaching Articulation	● - - -	● - ● ●	● - ● -
student / Adaptive/ TEST	**adapt** (adapts practice)	●	●	●	**EXPLORATION** Applying concepts	●	●	●	Exploration	●	●	●
tutor / Adaptive/ TEST	**adapt** (adapts task goal)	●	●	●					Exploration Modeling Exploration Scaffolding Exploration Coaching Exploration	● ● ● -	● ● ● -	● ● - -
student / Reflective/ ELICIT	**reflect** on feedback **reflect** on practice (+)	- -	● ●	- -	**REFLECTION** Building concepts	●	●	●	Reflection	-	●	-
tutor / Reflective/ ELICIT	**reflect** on learning practice	●	●	●					Reflection Modeling Reflection Scaffolding Reflection Coaching Reflection	● ● ● ●	● ● ● -	● ● ● -
student / Interactive/ DECIDE	**present** (action) **present** (revises action) **question** (+) **comment** (+)	● ● - ●	● ● - ●	● - - ●	**APPLICATION** Operating on application (concrete/ practice)	●	●	●	Articulation (showing)	●	●	●
tutor / Interactive/ DECIDE	**present** **question** (+) **comment**	- - ●	- ● ●	- - ●					Articulation (showing) Modeling Articulation Scaffolding Articulation Coaching Articulation	● - ● ●	● ● - ●	● - - ●

I found that the *present, question,* and *comment* moves that were made to clarify meaning, were closely associated with the *negotiation* mode. The methods include *articulation* (telling), *modeling, scaffolding, coaching, navigation,* and *socialisation*. These operated on the abstract (discursive) level and are represented with a rectangle located above the dotted line on the crit notation.

Adapt as a move to test design ideas, with its corresponding *exploration* mode and *exploration* method is shown as an L-shaped symbol moving downward from the discursive or abstract level to the experiential or concrete.

Present, question and *comment* moves that are made to demonstrate decisions, were associated with the *application* mode. The methods are *articulation* (showing), *modeling, scaffolding, coaching, navigation,* and *socialisation*. These operated on the concrete (experiential) level and can be represented as a rectangle located below the dotted line on the crit notation.

Finally, *reflect* as a move to elicit or build concepts, with its corresponding *reflection* mode and *reflection* method is shown as an L-shaped symbol moving upward from the experiential or concrete level to the discursive or abstract.

Through an understanding of how the moves, modes and methods are linked, it is possible to both represent and interpret the crit protocols using the crit notation/ visualisation method.

Considering the moves that students and tutors make, the modes in which the moves are made and the methods that they use, I discovered that, in the live online crit, students and tutors interact through tutor feedback on student presentation, interconnected thinking and doing, tutor modeling of design expertise, student support through cognitive scaffolding and coaching, and limited socialisation but frequent online navigation. These findings are discussed below.

Tutor feedback on student presentation

The frequency of *present* moves employed by the student, compared to the tutor, suggests that the student-tutor interaction in the live online crit is characterised by the student presenting her work to clarify and negotiate understanding, and to demonstrate her design decisions. The live online crit does not resemble a lecture, nor a 'tutor monologue', that is associated with the traditional crit (Blair 2006:33). Instead, through its focus on the student's performance that is 'judged' by the tutor, the interaction more closely resembles an assessment. Although the student presentation is not formally graded, tutor feedback is valued by the student who seeks reassurance from the tutor that she is 'on the right track'. Feedback is offered

in the form of *questions* to prompt the student for further clarification, and *comments* on the work presented.

Students employ *articulation* as a method of cognitive apprenticeship to 'explicitly state their knowledge, reasoning- and problem-solving process in a domain' (Collins, Brown & Holum, 1991:41; Oriol, Tumulty & Snyder, 2010); and through questions and prompts, they are invited to consider, explain, and show their practices (Collins, 1988). In turn, the tutor helps the student to gain expertise through modeling, support, providing examples (Dennen & Burner, 2007), and feedback in the form of hints, comments (Murphy, Ivarsson & Lymer, 2012), and explanations to clarify design practices (Dennen, 2004).

Students, tutors and graduates noted the importance of *articulation* as a method of crit interaction to communicate their design reasoning, and to master the language of the profession. Lave and Wenger's (1991) observation that the ability to use the vocabulary and to practice within the context of a discipline, is fundamental to learning, is underscored. As suggested by Winberg (2004:325), 'students learn to talk like architects before they learn to be architects.' It follows that the student-tutor interaction in the live online crit promotes the development of verbal and graphic *articulation* and *presentation* skills. This finding is significant considering Murphy, Ivarsson and Lymer's (2012:530) assertion that the architectural reasoning process is 'highly visual rather than primarily linguistic'. Therefore, it can be deducted that the live online crit supports the development of students' linguistic presentation and reasoning ability, that is not generally associated with desk and other interim crit practices yet is considered an important skill around which academic assessment is centred (Winberg, 2004). However, Percy (2004) warns against excessive use of 'description and explanation of process and technique over a demonstration. She found that '[I]n participating in a critique of their work, students were able to demonstrate learning of complex processes, through their descriptions of methods and procedures, but failed to demonstrate how that learning had enabled them to engage with the most abstract conceptions of their subject' (Percy, 2004:152). It follows that the student presentation (telling and showing) should be complimented with stages of critical reflection and argument (Percy, 2004).

Both *negotiation* and *application* modes of student-tutor interaction involve brief tutor responses, mainly confirmation, acknowledgement of the student's demonstration and feedback in the form of hints and occasional questions and compliments. From this finding I conclude that this learning setting provides a degree of student control and autonomy, in contrast to the general understanding that the crit is tutor-dominated (Blair, 2006; Stuart-Murray, 2010; Ellmers, 2014).

Since the student-tutor interaction in the live online crit is not associated with the tutor lecturing, it is not surprising that no instances of student *question* moves, seeking clarification from the tutor, were observed in the three crit protocols. Instead, *question* moves were employed by the tutor to prompt the student's thinking about her understanding and practice. Therefore, *question* as a tutor move was added to the conceptual framework, towards formulating a model for the student-tutor interaction in the live online crit.

In the literature *question* is emphasised as an important tutor move (Atto & Mugerauer, 1991; Hitge, 2016) as 'dialogue facilitator', performing the role of 'questioner that students should take up after they become comfortable with the method' (Lam, 2011:40). However, the analysis of the crit interactions revealed that, although the participants value *question* as an important crit move, it was absent from two of the three crits. Further research is needed to explore how this move is employed in the live online crit, responding to Christine Percy's (2004) assertion that questions remain about the potential of online learning to achieve deep engagement in debate.

I found that the student-tutor interaction in the live online crit contains extensive use of *comment* moves by both the student and the tutor, in response to *present* and *question* moves performed by the other. These include tutor feedback and students' comments on feedback, or responses to tutor questions, for clarification, helping the student consider the results of her design acts and reasoning (Goldshmidt *et al.*, 2014). This finding reinforces the conversational nature of the crit as mechanism for formative feedback. Therefore, I added *comment* as a student move, to the conceptual framework. Moreover, these findings support the literature that suggests that, for formative feedback to help improve learning, both student and tutor should take an active part in it (Blair, 2006; Ellmers, 2014).

Negotiation was concentrated in the first half and *application* in the second half of the respective crits. These findings demonstrate the general pattern of the crit interaction as starting with the abstract and theoretical and ending with concrete and practical episodes.

Modeling and scaffolding interconnected thinking and doing
The presence of *negotiation* and *application* modes of interaction performed by the student and tutor supports the literature that claims professional education requires complex iterative transactions between the student and tutor, to 'modulate... concepts and practice' (Laurillard 2013:121; Gunawardena, Lowe & Anderson, 1998; Carey *et al.*, 1999; Percy, 2004; Blair, 2006; Stuart-Murray, 2010; Laurillard, 2012; McLeod, 2013).

Adapt moves were employed extensively by the student to test and *explore* ideas, and the tutor to model *exploration*. These findings support the literature that emphasise the importance of design reasoning and exploratory thinking in design (Cross, 1990; Blair, 2006; Oh *et al.*, 2013; Ellmers, 2014). In their responses, the students, tutors and graduates noted *exploration* as a method through which alternative design solutions are considered. Participants agree that part of the role of the tutor is to prompt the student to generate original ideas through exploring alternative solutions, as suggested by Collins *et al.* (2011:14), 'pushing students into a mode of problem solving on their own'. These findings support the literature suggesting that, through *exploration,* students are encouraged to form hypotheses, to test them to see their effects, and to generate new ideas and viewpoints (Enkenberg, 2001, cited in Dennen, 2004; Dennen & Burner, 2007:426). Productive *exploration* skills are necessary to put students in control of problem solving (Collins, 1988; Enkenberg, 2001, cited in Dennen, 2004), which is particularly relevant in the context of architectural education (Oh *et al.*, 2013; Olweny, 2015, 2017), especially considering the frequency of asymmetrical power relations.

Reflect moves were dominated by the tutor rather than the student. Instances of reflection-on-action were observed, but not reflection-in-action. This finding suggests that the interaction in the live online crit focuses on design work presented during the crit, rather than producing design work during the crit.

It appears that, through viewing of the crit recordings, the student also *reflects* after the live online crit, through reflection-on-interaction. This method of reflection corresponds with Wang and Bonk's (2001) assertion that reflection in an online cognitive apprenticeship environment also happens after the interaction, and it adds to the current literature on reflection (Schön, 1983; Webster, 2004).

Furthermore, the findings support the literature that 'reflection leads to abstraction' (Collins, 1988:9) as it helps to link doing and thinking (Maftei & Harty 2015: 54), bringing about 'discovery of new meanings which will inform the further process' (Schön & Wiggins, 1992: 154).

Considering the importance of reflection to promote learning from experience through meaning-making (Ellmers, 2014), and Christine Percy's (2004) concern that the crit lacks opportunities of sensemaking through reflection, are noted. Although her research does not focus on the live online crit, she found that '[I]n participating in a critique of their work, students were able to demonstrate a learning of complex processes, through their descriptions of methods and procedures, but failed to demonstrate how that learning had enabled them to engage with the most abstract conceptions of their subject' (Percy, 2004:152). In her work on the

asynchronous online crit, she found that 'students privileged description and explanation of process and technique over a demonstration of their command of critical exposition and an ability to conceptualise' (Percy, 2004:147).

Modes of *exploration* and *reflection* were found grouped together in alternating episodes. Considering the need for students to constantly move from the concrete to the abstract and back again, in order to learn (Laurillard, 2012; Bates, 2016; Gunawardena, Lowe & Anderson, 1998; Carey *et al.*, 1999; Percy, 2004; Blair, 2006; Stuart-Murray, 2010; McLeod, 2013), it can be assumed that these episodes provide the key learning interactions to 'modulate… concepts and practice' (Laurillard, 2013: 121). This finding adds to the literature on the construction of knowledge 'about how thinking and doing, or the thought and act processes of designing are interconnected' (Uluoglu, 2000: 35).

Moreover, based on who initiates the change in experiential learning level (from abstract to concrete and *vice versa*), in other words who initiates *exploration* and *reflection*, it appears that the tutor lead crit 1 and the student lead crit 2. Crit 3 shows a more equal distribution of initiation of 'reflect' and 'explore' interactions. This finding contests the literature on the common understanding that the crit is tutor-dominated (Blair, 2006; Stuart-Murray, 2010; Ellmers, 2014). The data shows that the live online crit is not always tutor dominated. A degree of student control is observed in crit 2, containing the media-rich presentation.

Various factors may be ascribed to the difference in the patterns of interaction of crit 2 compared to crits 1 and 3 and this question requires further research. This study did not consider the role of graphic media specifically, in the student-tutor interaction. However, the dominance of the use of physical models by C2 was noted. The use of physical models is the only obvious difference between the crit protocols and could therefore be a possible reason for the different patterns of crit interaction. Not only did the prominence of physical models appear to have assisted the student to continuously reflect on his own practice, but it seems to have helped navigate the conversation more equally between the concrete and the abstract; the practical and theoretical. Further research is needed to uncover what role graphic media plays in the student interaction in the crit generally, and the live online crit specifically.

Although tutors do not design with students in the live online crit, nor seeking design solutions together, they make problem-solving visible to students, through demonstration or *modeling articulation, exploration* and *reflection*. Oriol, Tumulty & Snyder (2010:215) define *modeling* as a '[d]emonstration by the expert of how to think about a problem in the real world.' Through *modeling,* the tutor steps 'into' the

student role, demonstrating expert behavior, for the student to imitate (Dennen, 2004:816).

These findings support the literature that claims '[m]odeling involves an expert performing a task so that the students can observe and build a conceptual model of the processes that are required to accomplish it' (Collins, Brown & Holum, 1991:13). I found that *modeling* as observed in the live online crits is both about the 'demonstration of the temporal process of thinking' (Dennen, 2004:814) and its application (Collins, 1988). It is the 'showing and telling' that is so characteristic of apprenticeship (Collins, 1988). These findings support the literature that *modeling* provides a useful strategy for making problem-solving visible to students (Oriol, Tumulty & Snyder, 2010).

Limited socialisation, coaching and supportive scaffolding

In the three crit protocols, on average less than a fifth of the number of turns were taken up by instances of *socialisation*. I observed only three out of a total of 80 and 56 socialisation turns, respectively, in crits 2 and 3. In crit 1, I found 11 *socialisation* turns out of 69 turns in total. These included mainly greetings and brief expressions of grattitude.

Socialiasation is the second method of student-interaction that emerged from the data, that was not contained in the conceptual framework. It is not focused either on the content or the cognitive but serves to mediate the learning interaction between the student and the tutor. *Socialisation* describes the method used by the student and tutor to engage in informal chat, that is not directly related to the content. Cognitive apprenticeship methods provide ways to promote the development of expertise (Collins, Brown & Holum, 1991) but does not include social and informal interaction with the teacher or tutor.

Yet, several authors emphasise the importance of social interaction with the teacher or tutor, and informal exchanges, as a critical part of online learning, that should not be neglected (Offir & Lev, 2000; Salmon, 2000; Lotz, Holden & Jones, 2015; Salmon, 2000; Finkelstein, 2006). According to Finkelstein (2006:4), these social and informal exchanges 'help build community and create a friendly and safe environment in which people can feel like people'. The utterances associated with *socialisation* included greetings and brief expressions of gratitude. However, these were limited, suggesting that the student-tutor interaction in the live online crit is not social.

Similarly, limited instances of *coaching* methods were found in the live online crits. I found that *coaching* employed by the tutor was associated mainly with *articulation,* less so with *reflection* and not at all with *exploration*. There is, however, no obvious explanation for the absence of *coaching* instances linked to *exploration*, found in

the data. In this research, *coaching* is aligned with the role of the coach as councellor, who takes on a more sympathetic position towards the student (Attoe & Muggerauer, 1991) rather than a harsh critic or master (Brown, Collins, & Duguid, 1989). This instance demonstrates how coaching may 'serve to direct students' attention to a previously unnoticed aspect of the task or simply to remind the student of some aspect of the task that is known but has been temporarily overlooked' as suggested by Collins, Brown and Holum (1991).

Some instances of scaffolding were observed. However, these instances were directive and seem to be cognitively focused, rather than supportive and nurturing. Scaffolding is an important Cognitive Apprenticeship method, through which students are supported to reach skill levels beyond their current ability (Dennen & Burner, 2007, McLouglin, 2002). Through actively 'shaping and structuring the discussion' (Laurillard 2013:259), the tutor scaffolds the learning process. It is a learner-centred strategy supporting student learning of concepts, procedures, strategies, and meta-cognitive skills so that they can manage the task at hand, incrementally building on past knowledge (Dennen, 2004), and sequencing such tasks (Collins, 1988).

I did not find any instances of supportive *scaffolding* affecting students emotionally (Dennen, 2004). This discovery contributes to the limited literature on the live online crit, in this case, responding to the call by McLouglin (2002:152) for an extention of the concept of scaffolding in view of 'technology becom(ing) increasingly integrated into the delivery of learning experiences...' Further research is needed to explore the role of *socialisation, coaching and supportive scaffolding* in the live online crit, and how it should best be facilitated.

Frequent online navigation and wayfinding

The method of interaction that is focused not on content but on guiding the learning interaction, represents a significant component of the student-tutor interaction. In the three crit protocols, between a quarter (in crit 2) and half (in crit 3) of the number of turns account for instances of *navigation*.

These findings demonstrate that, in line with Collins and his colleagues' (1989) definition of cognitive apprenticeship as learning-through-guided-experience, specific guidance is needed to help navigate learning online.

Navigation corresponds with *procedural* participation, which is one of the categories identified in Offir and Lev's (2000) model for student and teacher participation in online discourse. In their model, *procedural* participation includes teacher statements with information on administrative and technical issues related to the course.

Navigation is one of the two methods of student-tutor interaction that emerged from the data and were added to the conceptual framework. It is not focused either on the content or the cognitive but serves to mediate the learning interaction between the student and the tutor. *Navigation* was added to describe the method of online wayfinding used by the student and tutor to direct their interaction in terms of turn-taking and timing and the use of the webinar technology.

The fact that only tutor screens are shared, that this was the first online crit conducted with this student cohort, and that the students were unfamiliar with the webinar technology, might explain the prominent use of *navigation* observed in the crit protocols. Further research is needed to establish what determines the frequency of *navigation* methods of interaction and what role it plays in the student-tutor interaction in the live online crit.

4.4 Consolidation

The ten characteristics of the live online crit setting covered in section 4.1, the four student-tutor relationships discussed in section 4.2, and the four ways in which the student and tutor interact, presented in section 4.3, together, point to four main dimensions of the live online crit. These are the formative, iterative, formal, and immersive dimensions (refer to addenda 2.1 – 2.5).

4.4.1 Formative

Considering the characteristics of the live online crit (RQ1), the types of student-tutor relationships (RQ2) and the ways in which the student and tutor interact (RQ3), in terms of the moves that they make (RQ3.1), the modes in which they make them (RQ3.2), and the methods that they use (RQ3.3), the student-tutor interaction in the live online crit can be characterised as formative.

In the formal setting of the live online crit, the student-tutor relationship is a novice-expert type of relationship where the student as novice makes a formal presentation to the tutor seeking approval and constructive feedback to measure her progress, and for guidance to improve on the work. The tutor does not present content like a lecture or what is known as a tutor monologue, and therefore the student does not typically ask questions for clarification. Instead, the student presents her work to clarify and negotiate her understanding, and to demonstrate her design decisions. In response, the tutor responds with feedback as comments, hints, and explanations, and prompts the student for explanation and clarification.

The first half of the crit is typically dedicated to the student negotiating meaning through engaging with the theory, and the second half of the crit is characterised by the student demonstrating the application of theory. Potential asymmetrical

power relations associated with the master and apprentice relationship are mitigated by mutual respect, a sense of responsibility and a commitment towards the shared goal of learning, which might be ascribed to most of the students in this study.

The negotiation and application modes of the crit are student-dominated. The tutor does not demonstrate design competence, and therefore the live online crit can not be likened to a design session. Instead, the tutor presents her work, both the application, in other words, what design decisions were made, as well as negotiating meaning, explaining why design decisions were made. The tutor's role is focused on prompting the student for clarification and articulating feedback.

The student-tutor interaction in the live online crit is characterised by the student as novice, looks to the tutor as expert, for feedback on the work presented. The live online crit in this context, therefore, is more like an assessment than a design session, and more like a student presentation than a lecture.

4.4.2 Iterative

Considering the characteristics of the live online crit (RQ1), the types of student-tutor relationships (RQ2) and the ways in which the student and tutor interact (RQ3), in terms of the moves that they make (RQ3.1), the modes in which they make them (RQ3.2), and the methods that they use (RQ3.3), the student-tutor interaction in the live online crit can be characterised as iterative.

The live online crit is characterised by complex iterative transactions that involve different media and multiple communication channels. The tutor takes on the role of mentor, coach and caring councellor, using modeling and cognitive scaffolding to guiding and prompting students to connect their thought and act processes, through reflection (sense-making/ thinking) and exploration (testing/ doing).

The mode and method of exploration, associated with adapt moves are employed extensively by the student to test, adapt and explore alternative design solutions. The tutor models exploration to make problem-solving visible.

Reflection moves, modes and methods, which lead to abstraction, are modelled by the tutor. Only one of the three students made extensive use of reflection in the live online crit. Reflection-on-action rather than reflection-in-action, dominates, which points to the discursive nature of the live online crit which is less of a design session than an assessment. Reflection-on-interaction is possible through students' viewing of the crit recording, which makes it possible for the complex iterative transactions to extend beyond the live online crit itself.

4.4.3 Formal

Considering the characteristics of the live online crit (RQ1), the types of student-tutor relationships (RQ2) and the ways in which the student and tutor interact (RQ3), in terms of the moves that they make (RQ3.1), the modes in which they make them (RQ3.2), and the methods that they use (RQ3.3), the student-tutor interaction in the live online crit can be characterised as formal.

The student-tutor interaction in the live online crit is formal and focused with limited social or serendipitous engagement. In the structured, organised, work-oriented and formal setting of the live online cit, the student work is displayed, while the student and tutor remain 'invisible'. The drawings form the visual focus of the interaction, and the student feels less exposed through the sharing of audio only, and without potential visual distractions caused by facial expressions and gestures.

The relationship between the student and the tutor is formal like an architect and client relationship where the student takes on the role of an architect, presenting a proposal to the client, which is the role taken on by the tutor. In this relationship which mimics architectural practice, the feedback is focused on ways to improve the work, rather than directed at the author - the student. In this simulated professional relationship, the tutor is the expert, but with the student in a simulated role of the architect, the power relation is potentially more balanced.

The student-tutor engagement displays limited social and informal interaction, supportive scaffolding, and serendipitous interaction.

4.4.4 Immersive

Considering the characteristics of the live online crit (RQ1), the types of student-tutor relationships (RQ2) and the ways in which the student and tutor interact (RQ3), in terms of the moves that they make (RQ3.1), the modes in which they make them (RQ3.2), and the methods that they use (RQ3.3), the student-tutor interaction in the live online crit can be characterised as immersive.

The student-tutor interaction in the live online crit is immersive, accommodating different media and multiple channels of communication, and it extends beyond the crit through reflection-on-interaction by viewing of the recording after the session.

Through the online medium, the live online crit setting allows students and tutors to interact, regardless of their location, promoting inclusion and access to large numbers of students with internet availability, eliminating the need for printing and travel, which can be costly and, in some contexts, dangerous. However, a

considerable amount of time is spent on navigation and wayfinding in terms of turn-taking, timing, and the use of webinar technology.

The synchronous online setting eliminates the front row advantage, by bringing the design artefacts (drawings and models) close to students and tutors alike. Allowing a student to choose her learning space, can promote comfort and reduce stress. The live online crit accommodates different media, multiple sources, and channels of communication. Through access to recorded sessions, learning can continue beyond the crit instance, and through multiple channels of communication, learning experiences can be stacked and layered. For example, in addition to reflection-on-action, which happened prior to the crit, through viewing of the recorded sessions, reflection-on-interaction is also possible. This allows students to reflect on the learning interaction, based on which they can further develop their work.

4.5 Crit Interaction Model

Through the exploration of the data (Figure 26), the conceptual framework was refined and developed into the Crit Interaction Model (CIM) - see Figure 27 for the condensed and Figure 28 for the expanded version - that describes the links and relationships between the moves that the students and tutors make, the modes in which they make them and the methods that they use. This model demonstrates 'how thinking and doing, or the thought and act processes of designing are interconnected' as suggested by Belkis Uluoglu (2000:35), 'linking doing and thinking' (Maftei and Harty 2015: 54) and bringing about 'discovery of new meanings' as suggested by Schön and Wiggins (1992:154).

	notation				
moves	CLARIFY present question comment	TEST adapt	DECIDE present question comment	ELICIT reflect	
modes	NEGOTIATION	EXPLORATION	APPLICATION	REFLECTION	
methods	articulation: telling	exploration	articulation: showing	reflection	
	modeling scaffolding coaching	modeling scaffolding coaching	modeling scaffolding coaching	modeling scaffolding coaching	
	navigation socialisation	navigation socialisation	navigation socialisation	navigation socialisation	

Figure 26: Crit Interaction Model: Development

Drawing on Laurillard's Conversational Framework, Kolb's Experiential Learning Cycle and Collins, Brown & Holum's Cognitive Apprenticeship model, the CIM describes learning through conversation, experience, and cognitive apprenticeship through the moves that students and tutors make, the modes in which they make them and

the methods that they use. The CIM (refer to Figures 27 and 28) explain how *present, question* and *comment* moves by students and tutors can occur at both the abstract and the concrete level:

When present, question and *comment* **moves** operate on concepts, negotiation is used as a **mode** to <u>clarify</u> concepts. This can happen through articulation (telling), modelling, scaffolding, coaching, navigation or socialisation **methods**.

Conversely, when *present, question and comment* **moves** *operate on the concrete level, application is used as a* **mode** *to* <u>decide</u> *on an appropriate response through articulation (showing), modelling, scaffolding, coaching, navigation or socialisation* **methods**.

When *reflect* ***moves*** are used to <u>elicit</u> conceptual meaning from a concrete practice, reflection is used as a **mode** and associated **methods** includes reflection, modelling, scaffolding, coaching, navigation and socialisation.

Finally, when *adapt* **moves** are used to <u>test</u> theoretical ideas through **exploration** as a **mode**, the **methods** of exploration, modelling, scaffolding, coaching, navigation and socialisation can be employed.
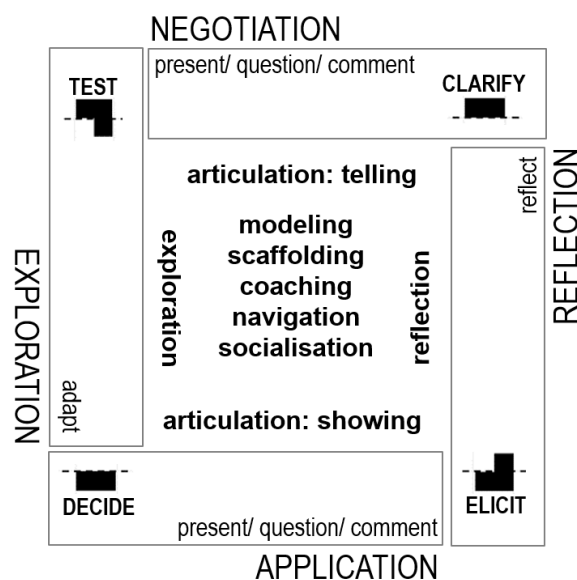
Figure 27: Crit Interaction Model (CIM): Condensed
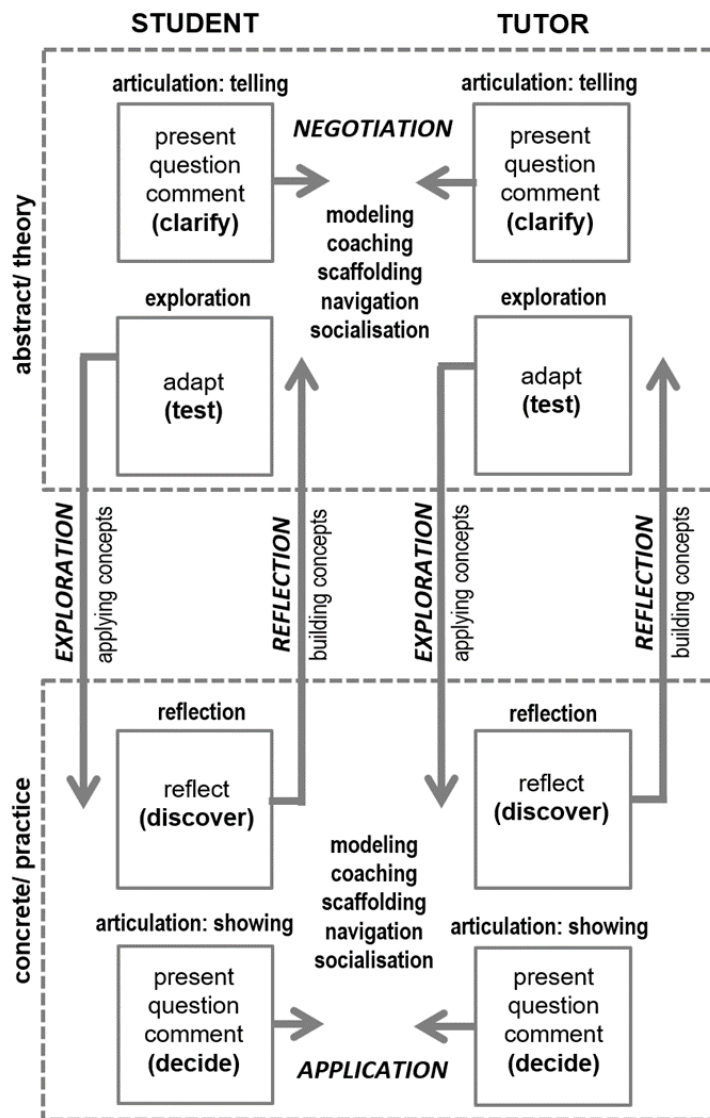
<p align="center">*Figure 28: Crit Interaction Model (CIM): Expanded*</p>

4.6 Summary

In this chapter I discussed the characteristics of the live online crit setting (RQ 1), the types of student–tutor relationships (RQ2), and how students and tutors interact (RQ3) in terms of the moves that they make (RQ3.1.), the modes in which they make them (RQ3.2), and the methods that they employ (RQ3.3).

I formulated ten characteristics of the live online crit setting, grouped in three clusters namely *stress experienced by students*, *sources of engagement,* and *socialisation and interaction*. The characteristics that I found, are *internet-reliance*, *participant-invisibility* and *ubiquity* (stress experienced by students), *media-intensity, multi-communicability* and *resource-efficiency* (sources of engagement), *formality, accessibility, work-orientation,* and *inclusivity (socialisation and interaction).*

Four student-tutor relationships emerged from the data, namely *novice-expert*, *architect-client, mentee-mentor* and *child-parent* relationships. The latter did not feature prominently in the live online crit.

Considering the moves, modes and methods, I formulated four ways in which the student and tutor interact in the live online crit, namely through tutor feedback on student presentation, modeling and scaffolding interconnected thinking and doing, limited socialisation, coaching and supportive scaffolding; and frequent online navigation and wayfinding.

The ten characteristics of the live online crit setting, the four student-tutor relationships and the four ways in which the student and tutor interact, point to four main dimensions of the student-tutor interaction in the live online crit. These are the formative, iterative, formal, and immersive dimensions.

The Crit Interaction Model that developed from the conceptual framework describes the relationship between the moves that students and tutors make, the modes in which they make them and the methods that they use to make them.

In the next chapter I reflect on the findings and contribution and present my recommendations.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

In this final chapter I present a summary of the research findings in response to the research questions through which I explored the student-tutor interaction in the live online crit, as well as the contribution of the research. In closing, I reflect on the limitations of the study and make recommendations for future research.

5.1 Summary

The aim of the study was to explore the student-tutor interaction in the live online crit. The purpose of this exploration was to develop an understanding of the live online crit, to guide crit practices in online and blended studio contexts.

When this research was conducted, instances of online learning in architectural education was limited (Salama & Crosbie, 2021). In the meantime, the sudden global shift to online learning in response to the coronavirus pandemic has highlighted the need for a better understanding of how design learning is mediated and supported online (Delport *et al.*, 2020; Morkel *et al.*, 2021; Liow, 2021; Gorman, Morkel, Delport & Burton, 2022). Also, in architectural education, during the pandemic, there's been a strong reliance on the synchronous online interaction between tutors and students, via a range of webinar platforms; yet this field is still under-researched (Banou & Tahsiri, 2021).

The research method employed for this study is a qualitative exploratory or hypothesis-generating method. It is used to discover patterns and relationships in the data, through analysis and interpretation (Auerbach & Silverstein, 2003; Braun & Clarke, 2006). The research questions that guided this research are:

RQ1: What are the characteristics of the live online crit setting?

RQ2: What are the types of student-tutor relationships in the live online crit?

RQ3: How do students and tutors interact in the live online crit?

RQ3.1: What are the moves that students and tutors make in the live online crit and how are they employed in learning through conversation?

RQ3.2: What are the modes of student-tutor interaction in the live online crit and how are they employed in learning through experience?

RQ3.3: What are the methods of student-tutor interaction in the live online crit and how are they employed in learning through cognitive apprenticeship?

The data includes online surveys completed by graduates, students and tutors, a focus group interview with graduates, and three online crit protocols. The focus group interview and the online survey data were collected to explore the students', graduates' and tutors' perceptions of the online learning setting, the student-tutor relationships, and the student-tutor interaction in the live online crit. The online crit protocol data were collected to further explore how the students and tutors interact in the live online crit.

The analysis was guided by the conceptual framework to uncover the moves that students and tutors make, the modes through which they make them and the methods that they use to make them. The concepts of the moves, methods, and modes were drawn from Conversation Theory, Experiential Learning Theory, and Cognitive Apprenticeship, respectively, to explore the learning mediated through conversation, facilitated through experience, and supported through cognitive apprenticeship by the student-tutor interaction in the live online crit. These theories on which the conceptual framework was built, were selected for their association with the respective practices of the architectural design crit, which feature prominently in the literature.

I formulated four dimensions to describe the student-tutor interaction in the live online crit, namely formative, iterative, formal, and immersive. The student-tutor interaction in the live online crit resembles an assessment (formative), comprises iterative interactions (iterative); it is formal and focused (formal), and it extends beyond the live online event (immersive).

These conclusions are based on ten characteristics of the live online crit setting (answer to RQ 1), four types of student-tutor relationships (answer to RQ 2) and five ways of interaction found in the data (answer to RQ 3).

Characteristics that describe the live online crit setting are organised around the stress experienced by students, the sources of engagement, and socialisation and interaction. The ten characteristics are internet reliance, participant visibility, ubiquity, media-intensity, multi-communicability, resource-efficiency, formality, accessibility, work-orientation, and inclusivity. The four types of student-tutor relationships that emerged from the data, are the novice-expert, architect-client, mentee-mentor, and to a lesser degree, the parent-child relationship. Considering the moves that students and tutors make, the modes in which they make them and the methods that they use, five themes that describe their interaction in the live online crit were identified. These are tutor feedback on student presentation; interconnected thinking and doing; and student support provided through modeling

and cognitive scaffolding; limited socialisation, supportive scaffolding, and coaching; and frequent online navigation and wayfinding.

Although this study was conducted in a specific cultural setting, namely a blended part-time undergraduate programme in Architectural Technology at a University of Technology in South Africa, the findings should inform blended learning approaches to live online learning interactions in architectural education more broadly.

5.2 Discussion

In this section I discuss which lessons can be learned from this research. It includes a methodological reflection, substantive reflection, and a scientific reflection.

5.2.1 Methodological reflection

The research method employed for this study is a qualitative exploratory or hypothesis-generating method. I used it to discover patterns and relationships in the data, through analysis and interpretation (Auerbach & Silverstein, 2003; Braun & Clarke, 2006).

The limitations of the study are mainly related to the size of the study group, and the specifics of the context. The findings are based on a single case and therefore these cannot be generalised to all cases and situations. The size of the student group was limited (40 in total) and although the online surveys were completed by a good representation of the total group, the protocol analyses focused on three students only, and the face-to-face focus group interview, because of the location, was limited to students residing in Cape Town.

A larger and more varied study group would have allowed more variation and depth in the findings. However, the present findings reflect phenomena that are valid in the specific context, namely a blended architecture studio at a large University of Technology in South Africa. In view of the subsequent sudden pivot to remote and online learning and teaching in 2020, that amplified problems with student inequalities in the architecture studio globally (Morkel *et al.*, 2021; Gorman *et al,* 2021), the research results should be even more widely transferrable.

In this research I did not attempt to compare online learning with the traditional onground alternative, and I did not evaluate its success. Through the qualitative exploratory approach, I sought to provide a deep understanding of the student-tutor interaction in the live online crit, as the most prominent synchronous learning interaction component of the blended learning design. Therefore, although I noted the instances when certain behaviours were observed, I did not measure the frequency of these occurrences.

Furthermore, although I used the crit graphics to support the audio data, in my analysis I focused on the concepts and meaning expressed and communicated via the audio that was recorded and transcribed. I did not analyse the graphic content that was exchanged between the student and the tutor. In a future study, rather than a Thematic Analysis, Content Analysis might be employed as a methodology to reveal a broader range of the textual matter, symbols, messages, information, mass-media content, and technology supported social interactions (Krippendorff, 2004; Hsieh & Shannon, 2005), that were mediated between the student and the tutor. Finally, in a future study, Discourse Analysis through which detail like gestures and pauses would be recorded, can also be considered.

Although a small sample was selected for this study, a range of participants were represented, including students, tutors and graduates involved. Thick and rich data was gathered from the focus group interview even though participation was limited to the graduates residing in Cape Town. This meant that the average demographics of the complete group was not reflected in the focus group interview. It is possible that if the the demographic composition had been different, the results might have been different too. However, it is assumed that this 'imbalance' might have been rectified through the the online surveys which included a wide range of participants.

Although the open-ended questions prompted reflection on the crit more generally rather than specifically related to individual kinds of crit practices, the online survey sought feedback on the different kinds of learning interactions specifically.

Guided by the conceptual framework, the exploration of the student-tutor interaction in terms of learning through conversation, learning through experience and learning through cognitive apprenticeship, has proven to reveal overlapping moves, modes and methods of interaction. These theories were chosen based on their prominent association with the practice of the design crit, as set out in the conceptual framework. Laurillard's conversational theory has been used to investigate architectural education practices, most recently employed by Iftikhar, Crowther & Burton (2021) to investigate the student and tutor roles in the traditional crit. However, it has not yet been applied in combination with experiential learning and cognitive apprenticeship, nor has it been used to explore the student-tutor interaction in the live online crit specifically. Although experiential theory is often used to describe the practical and experiential nature of architectural eduction, it has not yet been employed to investigate the live online crit specifically. Finally, cognitive apprenticeship which has made a meaningful contribution to the methodological approach of this study, is a much-neglected framework for

exploring design education, specifically architectural education (Hitge, 2016; Carey, 2017).

The visualisation technique, namely the Crit Notation Method (CNM) that was developed in this study, has proven to be an effective tool to map the different crit instances in terms of the moves, methods and modes displayed in the student-tutor interaction for each crit. In e mail correspondence with one of the authors (Carey, 2017) of a similar tool, the Mediated Conversations for Cognitive Apprenticeship (MCCA) tool (Carey *et al.*, 1999), Tom Carey expressed his disappointment that they were unable to develop the tool further at the time (in the late 1990s) and he confirmed that he felt that the need for such a tool still exists. After I had already developed the basic structure for the notation, I discovered the the MCCA which is an adaptation of Laurillard's (1993) Conversational Framework, used for the design of mediated learning environments within the Cognitive Apprenticeship model of learning.

Finally, in this research the crit protocols were coded per turn, and the most prominent move assigned to the respective turn, regardless of the duration of the turn. Dividing each turn into individual moves, for a more fine-grained analysis, might have delivered more nuanced findings.

5.2.2 Substantive reflection

In this section I reflect on the lessons learned from this research. I discuss these in terms of the answers to the three main research questions, that address the characteristics of the live online crit, the student-tutor relationships, and the student-tutor interaction in terms of the moves that they make, the modes in which they make them, and the methods that they use. Consolidating these answers follow the four concluding dimensions of the student-tutor interaction in the live online crit, namely formative, iterative, formal, and immersive (see addenda 2.4 and 2.5).

Characteristics of the live online crit setting

To understand the student-tutor interaction in the live online crit, I was interested to first identify the characteristics of this learning setting. I asked the question '**what are the characteristics of the live online crit**' (RQ1), and I found ten characteristics clustered around the *stress experienced by students*, the *sources of engagement* and *socialisation and interaction in the live online crit*. These characteristics are *internet-reliance*, *participant-invisibility*, *ubiquity*, *media-intensity*, *multi-communicability*, *resource-efficiency*, *formality*, *accessibility*, *work-orientation*, *inclusivity*.

Since the data had been collected for this study, research on architectural pedagogy for online and blended learning in response to the covid-19 impact on the physical design studio, has increased marginally. However, published research that focus on online and blended studio characteristics specifically, remain limited (Ceylan *et al.*, 2020; Fleischmann, 2021).

Although this research shows that the live online crit is a setting for engaging and effective learning, it must be considered in the context of a blended learning design. This finding is consistent with post-covid literature that shows that, despite the relative ease with which studio learning was able to transition to online spaces during the pandemic, students and tutors remain hesitant about the studio moving fully online, preferring blended learning settings instead (Salama & Burton, 2022; Olweny, 2020; Olweny *et al.*, 2021; Morkel *et al.*, 2022).

The risk of losing internet connectivity was found to be easily addressed through advanced planning and clear rules of engagement. However, it should be noted that the students who formed part of the research population in this study, are working individuals with access to devices and data at their workplaces. The equity issues around affordability and access to online learning settings highlighted by the covid-experience remains a priority.

The finding that the absence of a physical online presence appears to remove some of the stress barriers, reduce the imbalance in power relations between student and tutor and contribute to the attentiveness of students, complements the current research that shows that the use of the webcam can expose students' living environments, and therefore its use, instead of being mandatory, should be negotiated with the students involved (Olweny *et al.*, 2021; Burton *et al.*, 2021; Morkel *et al.*, 2021).

Characteristics of ubiquity, media-intensity, multi-communicability, and resource-efficiency associated with the live online crit provides choice and savings and supports flexibility for lifelong learning. These findings echo the findigs of Ceylan *et al.* (2020) that students welcomed the flexibility provided by a combination of synchronous and asynchronous online learning, as well as the choice of communication modes, media, and software.

The final four characteristics are linked to socialisation and the nature of the interaction of participants, namely formality, accessibility, work-orientation, and inclusivity. The findings of the study that the formal and organised nature of the online crit inhibits informal and serendipitous learning is aligned with recent research by Yu *et al.* (2021:2) who claim that '… it may be difficult to translate the socialisation component of the studio into an online form' based on the results of a

survey of 88 students enrolled in 15 courses at 3 Australian Universities, and three in-depth interviews with their course convenors.

The live online crit setting allows for any number of students to access and focus on the content and conversations, and through the recordings, students can revisit the sessions. However, inclusivity can only be promoted by blended and online learning where students are supported with devices and data (Olweny *et al.*, 2021; Burton *et al.*, 2021).

Student-tutor relationships in the live online crit

In response to Research Question 2, '**what are the types of student-tutor relationships in the live online crit**', four types were identified, namely novice-expert, architect-client, mentee-mentor, and the child-parent relationship.

The four types of student-tutor relationships that emerged from the data, support Wallace's (2003) view that tutors take on multiple roles in learning relationships. The student-expert relationship featured as the most prominent, followed by the architect-client relationship. The mentee-mentor, and child-parent relationships were also identified, but were not as prominent. These findings support the literature that refers to the student-expert (Cronjé *et al.*, 2006; Oh *et al.*, 2013; Oh, 2010; Goldschmidt *et al.*, 2014), architect-client (Oh *et al.*, 2013; Oh, 2010), mentee-mentor (Attoe and Mugeraurer, 1991; Cronjé *et al.*, 2006; Oh *et al.*, 2013; Oh, 2010), and child-parent (Attoe & Mugeraurer, 1991; Cronjé *et al.*, 2006). This research adds to the limited body of knowledge on the student-tutor relationship in online learning settings generally (Wallace, 2003), in synchronous online learning settings (Burnett, 2003; Cronjé *et al.*, 2006; Ng, 2007), and in studio type synchronous online learning settings specifically (Oh *et al.*, 2013).

In a recent paper by Iftikhar, Crowther & Burton (2021), focusing on the Australian context of the traditional undergraduate studio, the authors found that the tutor role shifts and changes over time. They identified the student in roles as presenter and reflector, which corresponds with two of the moves (present and reflect) identified in this study. These authors, who also employed Laurillard's conversational theory as a lens to explore their findings, call for further exploration of the phases, roles, and interactions in postgraduate and online architecture studios. Although the student-tutor roles in this study were explored at the start of the academic year and did not consider how the roles might change as the academic year progresses, it highlights the tutor in an expert role (novice-expert) and simulating a professional relationship (architect-client).

Student-tutor interaction in the live online crit

To explore how the student and tutor interact in the live online crit, I asked three sub-questions namely '**what are the moves that students and tutors make in the live online crit and how are they employed in learning through conversation**?' (Q3.1); '**what are the modes of student-tutor interaction in the live online crit and how are they employed in learning through experience**?' (Q3.2), and '**what are the methods of student tutor interaction in the live online crit and how are they employed in learning through cognitive apprenticeship**?' (Q3.3).

I found that the moves that the student and tutor make in the live online crit are *present, question, comment, adapt*, and *reflect*; the modes in which they make these moves are *negotiation* and *application, exploration,* and *reflection*; and the methods that they use to make them, include *articulation, exploration, reflection, modeling, scaffolding, coaching, navigation*, and *socialization*.

I found that *present, question* and *comment* moves operate on both the discursive level (to clarify meaning), and on the interactive level (to demonstrate decisions). *Adapt* moves are associated with the testing of alternatives and through *reflect* moves meaning is elicited. The frequency of *present* moves employed by the student compared to the tutor, in the live online crits, suggests that the student-tutor interaction in the live online crit is dominated by the student presenting her work to clarify understanding and demonstrate her design decisions.

Similarly, the modes most frequently employed by students are negotiation, application, and exploration, and less so reflection. In both negotiation and application modes, the student dominated the interaction. Based on the case that was studied, negotiation is generally concentrated in the first half and application in the second half of the live online crits. These findings demonstrate the general pattern of the crit interaction as starting with abstract and theoretical and ending with concrete and practical episodes.

The methods that I found in the live online crit that were not included in the cognitive apprenticeship model, are *navigation* and *socialisation*. In the three crit protocols, both students and tutors actively employed *articulation* in their interactions, and they did so to communicate their thinking and doing (practice). Articulation makes thinking and doing visible, through telling and showing (Collins, 1988). Here *articulation* takes on multiple media, including verbalisation as well as two- and three-dimensional representations. These findings support the literature on *articulation* as a method of cognitive apprenticeship through which students 'explicitly state their knowledge, reasoning- and problem-solving process in a domain' (Collins, Brown & Holum, 1991:41; Oriol, Tumulty & Snyder, 2010); and through

questions and prompts, they are invited to consider, explain and show their practices (Collins, 1988). In turn, the tutor as expert helps the student gain expertise through demonstration, support, providing examples' (Dennen & Burner, 2007), and feedback in the form of hints, comments (Murphy, Ivarsson & Lymer, 2012), and explanations to clarify design practices (Dennen, 2004).

Consolidation

Considering the moves, modes, and methods, I formulated five ways that the student and tutor interact, namely through tutor feedback on student presentation, interconnected thinking and doing, student support through modeling and cognitive scaffolding, limited socialisation, coaching and supportive scaffolding; and frequent online navigation. When these five ways that students and tutors connect in the live online crit are considered in the context of the characteristics of the live online crit and the most prominent student-tutor relationships present in the live online crit, four dimensions can be identified namely formative, iterative, formal and immersive. The student-tutor interaction in the live online crit resembles an assessment (formative), comprises complex iterative interactions (iterative); it is formal and focused (formal), and it extends beyond the live online event (immersive).

Formative

The student-tutor interaction in the live online crit is formative: it is more like a formative assessment than a design session, and more like a student presentation than a lecture. In this study I found that this kind of crit does not resemble a lecture, nor a 'tutor monologue', that is often associated with the traditional crit (Blair 2006:33). Instead, through its focus on the student's performance 'judged' by the tutor, the interaction resembles an assessment. These findings are broadly in line with those of Iftikhar, Crowther & Burton (2021), who, based on blended studio interactions during the pandemic, identified the student in presenter and reflector roles. However, I found in this study that the student's behaviour was dominated by present moves, and less so reflective. This finding supports the literature that '(d)esign critiques set an environment for students to get feedback on their design (Milovanovic & Gero, 2018:2). A similar protocol followed in an online studio that was the object of a recent study by Ceylan *et al.* (2020:207), revealed that 'in order not to waste time during the lesson… studying of uploads by the instructors before design studio and discussing of the proposals during the studio' formed the focus of the live online crits.

Because the tutor is not lecturing, the student does not typically ask questions. However, instead, the tutor may ask questions to prompt student reflection. Furthermore, the tutor may provide hints, comments, and explanations. Because it is

not a design session, there is no reflection-in-action. In the first half of the crit the student would mostly employ negotiation of meaning around the theory by presenting, and in the second half of the crit she will typically switch to application, which is more like a demonstration, in other words, to show how the theory would be applied.

Because the student-tutor interaction in the live online crit is more like a formative assessment than a design session, there is limited potential for creating and making. This finding is in line with recent studies that found that the making aspect of the online studio is lacking and needs further investigation (Fleischman, 2021).

Iterative

The live online crit demonstrates the capacity for complex iterative transactions that involves exploration and reflection, to alternate working on concepts and experience (Laurillard, 2002, 2013; Lam, 2011). These design crit behaviours of students and tutors echo what McDonald, Michele & Rich (2021:n.p.) describe as 'navigat(ing) the complex worlds of significance associated with studio pedagogy.' However, the results confirm Christine Percy's (2004) concern that the crit lacks opportunities of sensemaking through reflection. In her work on the asynchronous online crit, she found that 'students privileged description and explanation of process and technique over a demonstration of their command of critical exposition and an ability to conceptualise' (p. 147).

The iterative dimension of the student-tutor interaction in the live online crit describes the interconnected thinking and doing where exploration happens as the testing of alternatives by both the students and the tutor and reflection is about making sense during and after the crit. Reflection during the crit is generally dominated by the tutor, who would typically model reflective behaviour to the student to make problem-solving visible. This involves reflection-on-action, in response to the work that students prepared for the crit, and reflection-in-action, which was limited because the live online crit has shown to be less of a design session than an assessment. An added reflection dimension discovered in this study, is reflection-on-interaction through the students' viewing of the crit recording. This finding is supported in a recent study by Ceylan *et al.* (2020), who found that students valued the availability of recordings of online sessions to revisit important discussions and feedback. In fact, they found that students wish to view these recordings repeatedly, to make sure they don't miss any important guidance, and to galvanise their understanding.

In this study I found that, similarly to Milovanovic and Gero (2018:11) that 'students present and defend their design solution while tutors analyze and question the design situation.' These findings further correlate with a recent study by Nespoli, Hurst and Gero (2021) who studied verbalisations of tutors' and students' discussions in 13 weekly sessions using topic modelling and Function-Behavior-Structure (FBS) ontology analysis. This research focused on movements in the problem-solution continuum, and interactions between student and tutors. They found that tutors' cognitive behaviour was more focused on the theoretical abstraction of the design challenge and its communication and students' cognitive behavior more concrete and focused on the practical considerations of the project.

The crit (C2) that best performed in terms of student reflection, was also the one that contained the largest variety of media, including photos of physical models. This student's crit behaviour demonstrated the crit strategy described by Cindioglu (2021:n.p.) as 'taking advantage of digital design tools in the early design phase to reduce their fear of failure and their procrastination tendencies related to perfectionism.' Milovanovic and Gero (2018:11) refers to the work of Nigel Cross (1982) suggesting that, in the context of the design studio, the challenge is for students to learn how to reflect in creative designerly ways. This remains a challenge in the live online crit and requires further investigation.

Formal

Compared to the traditional desk crit, described by Shrand and Eliason (2011: 60) as 'a private conversation with a tutor' and Goldschmidt (2002) as 'informal', the live online crit is particularly formal. The student-tutor engagement displays limited social and informal interaction, coaching or small talk, and serendipitous interaction is largely absent. This finding is supported by a recent study by Yu *et al.* (2021:2) that 'it may be difficult to translate the socialisation component of the studio into an online form.'

The formal and focused, structured, and systematic protocol associated with the present study is mimicked by the evaluation by Ceylan *et al.* (2020:210) of the online architectural design studios during the pandemic outbreak:

> 'The organization of table critiques is revised as online critiques that of the student works pre-evaluated by the instructor, which may give opportunity to the instructor to think about the students works in a wider perspective. In that case, the pre-evaluations are transferred verbally to the students one by one and questions have been answered by instructor during online studio hours. That conversion might have brought a more systematic approach for students to develop their works.'

The live online crit provides opportunity for cognitive apprenticeship to promote the development of expertise (Collins, Brown & Holum, 1991) in a structured and systematic fashion, but it does not normally include social and informal interaction with the tutor, not coaching or extensive scaffolding methods. Yet, several authors emphasise the importance of social interaction with the teacher or tutor as a critical part of online learning, that should not be neglected (Offir & Lev, 2000; Lotz, Holden & Jones, 2015; Salmon, 2000), and requires further investigation (Fleischman, 2021; Ceylan *et al.*, 2020).

Immersive

The student-tutor interaction in the live online crit is immersive, accommodating different media and multiple channels of communication, and it extends beyond the crit through reflection-on-interaction by viewing of the recording after the session. These findings contradict the assertion by Yu *et al.* (2021:2) that '… virtual studios tend to prioritize digital presentation techniques at the expense of hand drawn presentations.' However, they also admit that '(I)n architectural studios, Blackboard Collaborate Ultra is particularly popular since it allows tutors to draw on top of students' work, which to a large extent simulates the sketching process of traditional face-to-face studios' (p.3).

The online medium of the live online crit requires, for example, time for navigation and internet-reliance which can cause stress for students. On the other hand, it promotes inclusivity, through students' ability to study remotely and whilst working, making use of workplace resources. Wayfinding and navigation can be time-consuming, but these can be managed through assigning screensharing roles and responsibilities and negotiating efficient online 'housekeeping' rules. These aspects, too, require further exploration.

5.2.3 Scientific reflection

This research contributes to the limited body of knowledge in the field of online architectural design education generally, and the student-tutor interaction in the live online crit specifically. Although research in this domain is growing, there is limited empirical research on synchronous online learning facilitated through the webinar platform, and less so focusing on the ways that students and tutors interact. In this section I reflect on two scientific contributions that resulted from this research, in addition to the findings prompted by the research questions.

Crit Notation Method (CNM)

The development of the crit notation method (CNM) as research visualisation is discussed in section 3.7. I used this graphic instrument to represent the different

moves, methods, and modes of the student-tutor interaction, thereby developing a graphic language or syntax that can be employed to 'read' such interactions, to map them and reflect on them.

Crit Interaction Model (CIM)

Drawing on Laurillard's Conversational Framework, Kolb's Experiential Learning Cycle and Collins, Brown & Holum's (1991) Cognitive Apprenticeship model, has proven to be useful. These three models have not been combined in this way before, to explore the student-tutor interaction in the live online crit. A recent study by Iftikhar, Crowther, and Burton (2018) draws on Laurillard's Conversational Framework to explain the dialogic interactions between the students, design tutors and unit coordinators. However, this framework has not yet been used to explore the student-tutor interaction.

I mapped the data to a large extent over the conceptual framework, in terms of the moves, modes, and methods associated with the student-tutor interaction. It provided a useful tool to analyse the complex interactions between the student and tutor. The diagrams below show the evolution of the conceptual framework, into a provisional Crit Interaction Model (CIM), that represents the different dimensions of the student-tutor interaction in the context of this study. The CIM should be tested with other sets of data to establish whether it can be further developed into a tool to guide explorations of student-tutor interactions in the future, ideally at different levels of study, and in a range of different learning settings.

My study offers suggestive evidence that the live online crit as a learning setting provides for a specific kind of learning interaction between the student and the tutor. Although the live online crit has become a popular format to overcome lockdown restrictions and social distancing requirements, there is limited research available on the use of the webinar tool in architectural design education generally and exploring the live online interactions of students and tutors, specifically. In this study I referred to limited available research, some of which refer to asynchronous online interactions more generally.

5.3 Recommendations

In the section below, I discuss a range of recommendations for practice and further research.

5.3.1 For policy and practice

The literature suggests that most tutors do not make explicit plans or develop strategies for conducting crits (Oh *et al.*, 2013), and most tutors rely on their experience as students and fall back on the legacy model of architectural education

(Salama & Crosbie, 2020; Olweny, 2015, 2017). The Crit Notation Method (CNM) discussed in chapter 3 and section 5.2 of chapter 5, provides a visualisation – a language or graphic syntax – technique for tutors and learning designers to reflect on crit practices, specifically the interaction between the student and the tutor, towards improving the interactions between students and tutors for effective and durable learning. The Crit Interaction Model (CIM) that developed from the conceptual framework, offers a model that can be used to explore current crit practices, and test future models and practices, in different blended learning settings that may reveal different roles, power relations and kinds of interactions between students and tutors for the future.

The case on which this study is based, has demonstrated that it is possible to facilitate learning in architectural design across time and space, in online, blended, and flexible learning settings. It has further demonstrated the value of the live online crit as a key component of the blended learning design. Although most of the students in this case, made use of resources provided by their workplaces, access, affordability and equity issues of online and blended learning settings should remain a priority.

Since hands-on demonstrations are less effective in the online learning environment, this important component of developing design expertise should be accommodated elsewhere in a 'purposefully' blended learning design as suggested by Fleischman (2021:126).

Project briefs should be designed to encourage students to explore different media and, where possible, onground hands-on sessions should be accommodated to complement the live online sessions as part of a blended learning design, including opportunity for serendipitous learning opportunities, for example through group work. Care should be taken to accommodate social and informal interactions, with tutors and student peers, and the employment of student mentors to provide coaching on multiple channels, online and onground. Finally, tutors should model reflective practices, and design project briefs to reward exploration and reflection modes of interaction.

The recommendations are not limited to the student-tutor interaction in the live online architectural crit and can be expanded to other design and project-based learning contexts as well. As explained by Jody Nyboer (Zollinger & Nyboer, 2021), design crit practices, whether formative, which is the focus of this study, or summative, are not limited to the design professions, but can be transferred to any field where creative output is reviewed.

5.3.2 For further research

Further research can build on the results of this study, as follows:

- Expand the research to include student-tutor interactions where the students are younger and full-time students. The case that was explored in this research, is based on a group of part-time students at a University of Technology in South Africa. Part-time students are typically working individuals who are more mature than their full-time counterparts. Because the live online crit has become a more common practice since the start of the pandemic, further research should explore the live online crit in learning contexts that also involve younger, mostly full-time students.

- Explore the student-tutor interaction in different online learning settings, e.g., also including asynchronous and informal learning engagements. Future studies could explore different learning interactions in different settings, that may reveal different roles, power relations and interactions.

- Investigate the student-tutor interaction in crits of varying duration, at different project stages, and different stages of the academic cycle, and also how may change over time. In this research the focus is on one crit instance at the start of the academic year, nearing the end of the project, for 3 students, but future research can investigate how the interaction changes over time, through the exploration of a range of crit instances, and looking at crits at different stages of a project.

- Study the student-tutor interaction in the live online crit, considering tutors with different levels of experience, a variety of facilitation strategies, and students at different levels of design expertise.

- Consider the student-tutor interaction in terms of the duration of each turn, undertaken by the student and tutor, respectively. The crit protocols were coded per turn, and the most prominent move assigned to the respective turn, regardless of the duration of the turn. In future research it might be valuable to break each turn into individual moves, for a more fine-grained analysis. It might also help to better understand the power relations in the live online crit in terms of the comparable duration of turns taken by the tutor and the student.

- Explore how the *question* move is employed in the live online crit, to better understand the potential of online learning to achieve deep engagement in debate.

- Investigate the potential of the live online crit to help students demonstrate their ability to critically reflect and conceptualise.

- Explore the degree to which supportive scaffolding, which speaks to the emotive rather than the cognitive, can be promoted in the live online crit.
- Explore the types of blended learning contexts that would best supplemet the learning mediated through the live online crit. For example, to ensure that students can develop their skills to articulate design proposals, and to receive clear feedback, whilst also allowing students and tutors to interact in more social and informal learning settings, that will allow for more serendipitous learning through discovery to occur. For example, since hands-on demonstrations are less effective in the online environment, it should be accommodated elsewhere in the blend.
- Investigate the frequency of *navigation* methods of interaction and what role these play in the student-tutor interaction in the live online crit.
- Explore the role of socialisation, coaching and supportive scaffolding in the live online crit, and how it should best be facilitated.
- Consider different webinar technologies to support the student-tutor interaction in the live online crit.

5.4 Autobiographical reflection

Undertaking this research study has been an invaluable learning experience for me. It supported me to help transform onground architecture studios to blended and online contexts, where the live online crit remained the most prominent learning activity for students to master design competence with their tutors and peers. My curiosity about the potential of the online architecture studio, and specifically the live online crit, was initially prompted by my own students. Whilst some architecture colleagues remained sceptical, generous support and encouragement was offered mostly by those colleagues outside of the architecture community and others forming part of supportive online learning and instructional design communities. Some members of senior management at the university had the foresight to encourage a blended pilot project in architecture, which eventually became the focus of my investigation.

At the time when I started out with this research, I could not find a single architecture school in Africa offering design studios online, and even globally there was only a handful. Only recently did we discover that around the same time that the blended part-time programme was first implemented at this university, there were five others around the globe, namely one each in Canada, Australia and three in the United States of America that offered online studios. These pioneering programmes and online sites of learning provided much needed examples for the sudden and massive pivot to remote and online learning brought about by the COVID-19

pandemic in 2020, whilst these studios continuing largely uninterrupted during the global lockdowns.

What transpired during this period at schools of architecture globally, was a general reliance on online synchronous tools like Zoom, Teams, Google Meet, Blackboard Collaborate and others, to conduct online design crits. These tools were employed to duplicate onground studio engagements online, as part of Emergency Remote Teaching and Learning (ERTL) strategies. However, it soon became apparent that ERTL is not sustainable and should not be confused with purposefully designed online learning experiences. Hopefully, the findings of the research reported in this thesis will inform the design of live online crit sessions to support productive and inclusive student-tutor interactions, as part of a range of durable blended learning experiences, suited to each specific context.

5.5 Summary

The aim of this study was to explore the student-tutor interaction in the live online crit, specifically seeking to uncover the characteristics of the live online crit, the types of student-tutor relationships in the live online crit, and to understand how students and tutors interact in this learning setting.

I formulated ten characteristics of the live online crit setting, grouped in three clusters namely *stress experienced by students*, *sources of engagement*: and *socialisation and interaction*. The characteristics that I found, are *internet-reliance*, *participant-invisibility,* and *ubiquity* (stress experienced by students), *media-intensity, multi-communicability,* and *resource-efficiency* (sources of engagement), *formality, accessibility, work-orientation,* and *inclusivity (socialisation and interaction)*.

Four student-tutor relationships emerged from the data, namely *novice-expert*, *architect-client, mentee-mentor,* and *child-parent* relationships. The first three featured most prominently in the live online crit. Considering the moves, modes, and methods, I formulated five ways in which the student and tutor interact, namely through tutor feedback on student presentation, interconnected thinking and doing, student support through modeling and cognitive scaffolding, limited socialisation, coaching and supportive scaffolding; and frequent online navigation.

Considering the characteristics of the live online crit, the most prominent student-tutor relationships present in the live online crit, and the ways in which students and tutors interact in terms of the moves that they make, the methods that they employ and the modes in which they employ them, I found four dimensions to the student-

tutor interaction in the live online crit namely formative, iterative, formal, and immersive. The student-tutor interaction in the live online crit is like a formative assessment comprising complex iterative transactions that are formal and focused, and which extend beyond the crit.

The live online crit explored in this research displays limited opportunity for informal, social, and serendipitous interaction. Instead, it provides effective opportunity for tutor feedback on student presentations, for students to gauge their progress in relation to clear and set outcomes. Although the online medium allows for participation that is not limited by proximity, access is still dependent on power and internet availability. Furthermore, the online medium, which is limited to a screen and keybord, demands communication for navigation, which might be timeconsuming and disruptive, especially to students struggling to remain attentive. The live online crit, however, clearly demonstrates the capacity for complex iterative transactions that involve exploration and reflection, to alternate working on concepts and experience (Laurillard, 2002, 2013; Lam, 2011). However, the results confirm Christine Percy's (2004) concern that the crit lacks opportunities of sensemaking through reflection. In her work on the asynchronous online crit, she found that 'students privileged description and explanation of process and technique over a demonstration of their command of critical exposition and an ability to conceptualise' (Percy 2004: 147). The live online crit provides opportunity for cognitive apprenticeship to promote the development of expertise (Collins, Brown & Holum, 1991:14) but it does not normally include social and informal interaction with the teacher or tutor. Yet, several authors emphasise the importance of social interaction with the teacher or tutor as a critical part of online learning, that should not be neglected (Offir & Lev, 2000; Lotz, Holden & Jones, 2015; Salmon, 2000).

Future research looking at blended learning contexts, should explore how the student-tutor interaction in the live online crit can form part of a series of blended learning experiences, to ensure that students would still have an opportunity to develop their skills to articulate design proposals, and to receive clear feedback, but that opportunities will also be created for students and tutors to interact in more social and informal learning settings, that will allow for more serendipitous learning through discovery to occur. A range of learning settings as part of a blended learning design can help to enrich current crit practices, as called for by McCarthy (2011), *Yu et al.* (2021), Olweny *et al.* (2021), Salama and Burton (2022) and others, towards expanding the design studio beyond time and place.

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ADDENDA

1. Addendum 1: Crit descriptions and analyses

1.1 Crit 1

The crit starts with greetings and a brief social conversation, followed by the student's project presentation. He refers to the slides, explaining the background to the project, design influences and conceptual idea. Other than advancing the slides and acknowledging his presentation, the tutors do not give any feedback at this stage. At some point the student stops the presentation and turns to the tutors to find a pen and to move to the next slide in the presentation. He continues, but now focusing on the application of his ideas, whilst making use of on-screen drawing. After another short interruption to find the right drawing, he again talks to the conceptual aspects of the project, followed by a further explanation of the application of the design intent. At this point the tutors join in with feedback through alternating moves of reflection and exploration. Reflection shifts the conversation from the concrete to the abstract and exploration achieves the opposite. During this up and down weaving between practice and theory, there's a lot of on-screen marking and sketching activity. The next phase involves a focus on the application of concepts, with only one short reference to theory, again with on-screen sketching. The crit ends with a short social phase.

Below follows a translation of the crit protocol organised in turn-taking sections, employing the language of moves, methods and modes. It draws on the conceptual framework, towards uncovering links and patterns in the student-tutor interaction in the live online crit. It is followed by a tabled summary and a reflection on the findings.

Crit 1 comprises of episodes a to l, as follows:

Episode a: turns 1 to 12

Turns 1 to 12 comprise of greetings, social conversation and orientation.

Episode b: turns 13 to 18

The student describes the spatial design concept of the group project, that provided the starting point for his project development. He explains the design intent and shares information about the site and chosen precedent study. On-screen images are advanced, but no on-screen drawing takes place during this stage. The interaction focuses on the conceptual aspects of the work, with the student presenting conceptions as products and the tutors giving minimal hinting and commenting input, to allow the student to continue to explain his design reasoning process.

So basically, like I said there, the spatial design and the concept is enhancing the human senses by moving through spaces. The idea of using architectural and natural elements to enhance certain human senses by manipulating form and function. So that's the spatial design concept. (a)

Episode c: turns 19 to 25

Eventually the student realises he needs on-screen drawing to show the application of his ideas and therefore the next 7 turns are taken up finding a pen and navigating to the right place in the presentation.

Oh, okay. Where do you want to be – on page 5? (T2)

Episode d: turns 26 to 27

During this next episode, the student demonstrates how his group created the spaces they proposed. T2 responds with an acknowledgement as feedback on action. During this episode the interaction focuses on the implementation of design ideas, with active on-screen drawing by the student:

…. So we came up with the idea of making this – creating this kind – some kind of maze element [student markings in red] but I chose to move away from that because for me it didn't – it worked for creating these human senses but it's too – how can I say it [student markings in red] – like next to each other. So – but we had – we created these transition spaces over here by treating each space differently because [unclear] more enhance these senses. We can go on. (a)

DESIGN DEVELOPMENT
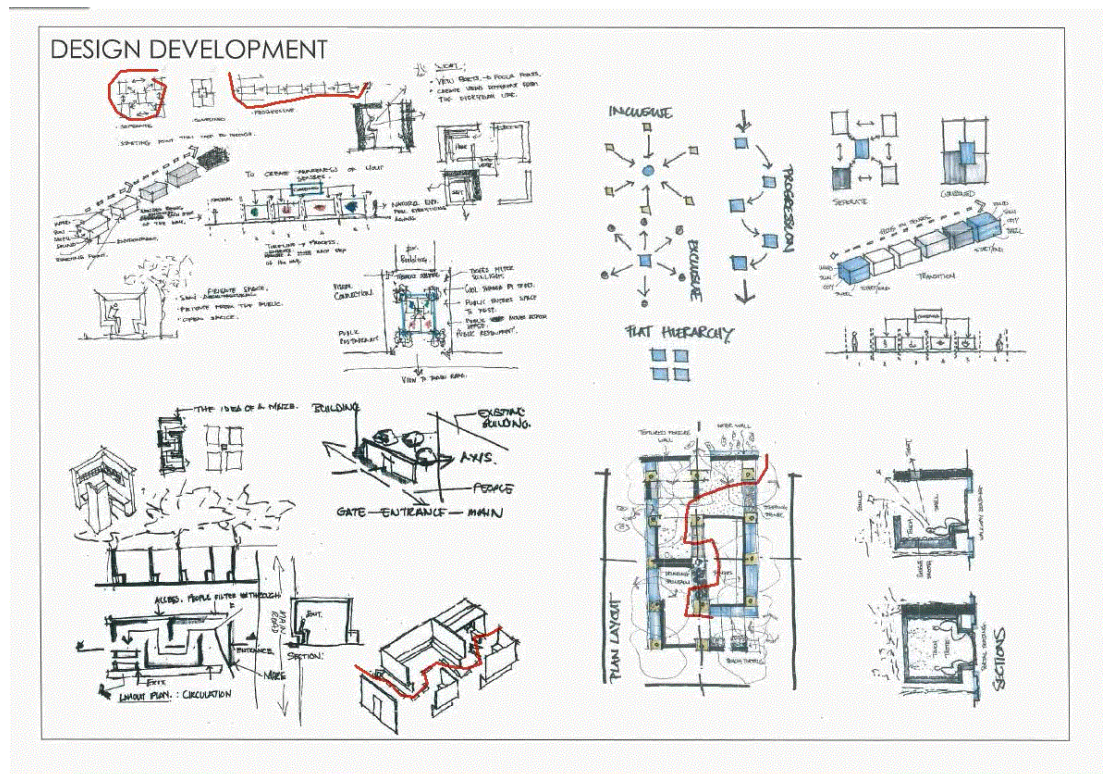
Episode e: turns 28 to 31

Another brief navigational phase follows to allow the student to find the on-screen material he wants to talk to.

Episode f: turns 32 to 36

The student moves the interaction back to the discursive level, explaining the influences of the site on his design whilst actively drawing on-screen. The tutor acknowledges his inputs but does not participate in the on-screen drawing, allowing the student to continue presenting his thinking.

> *And then for me, the site had a big influence on enhancing these human senses. So, I had to understand the site and the context better in order to create these – or enhance these senses, like other people move across the site [student markings in red] and where the key areas are to create smell or where the strong smell will occur from the [student markings in red] – and in this instance Burger King and the other – I think it's Mariam's Restaurant and then it's the strong southerly wind which can carry the smells into the design, into the structure. And of course, there are the trees that create the natural smell of wood or timber. (a)*

Episode g: turns 37 to 39

The student briefly switches to the experiential level, demonstrating his design decisions, structure and choice of materials, in line with his chosen concept, while actively drawing on-screen [see markings in red]. Then he stops, waiting for tutor feedback.

Episode h: turns 40 – 41

The tutor compliments the student on a clear explanation and then she proceeds to reflect on the execution of the ideas, moving the conversation from the experiential mode (what the student did), back to the discursive mode (what the student intended to achieve). Tutor markings are visible in blue. The student confirms his understanding.

> *Good, I think you've explained it really well. I enjoyed the way in which you refer to the senses and, you know, it's evident that you've thought about that experience and how it will impact on the senses. I just, I'm not sure why it seems as if the, you've almost created an artificial boundary. So, you've taken a line and to me, at the moment, this is just the very first observation, it looks quite restrained. So, it's almost as if it's been pushed into a form, it's quite tight and I think perhaps the design can loosen up a little bit... (T2)*

Turns 42 to 43 (episode h continued)

T2 adapts the task by moving the conversation 'down' to the experiential, by demonstrating the testing of different alternatives - modeling exploration. T1 provides learning scaffolding to support the student's learning experience and the student confirms his understanding.

Turns 44 to 45 (episode h continued)

T2 models reflection by moving the conversation back to the discursive level through reference to design theory, whilst pointing to the on-screen graphics. T1 takes it down to the experiential level, modeling exploration through showing relevant examples.

> *Both [on plan and section] you've got the opportunity here to have a really, really interesting on plan section, Righini talks about the*

plan section relationship. There's some kind of language so rather than kind of tightly wrapping – [tutor pen moving] it's more a flying and movement. It's not moving enough, I think at this stage. This is now just a – off the cuff, personal response. (T2)

Turn 46 (episode h continued)

The student confirms his understanding and revises action. There's no movement of on-screen images or markings.

> *Ja, and build a better model to explain the space. (a)*

Turns 47 to 49 (episode h continued)

During this episode, T1 models exploration by demonstrating how the student might use the model to test alternative design solutions. The student mimics exploration followed by another exploration move modelled by T1. Tutor markings are visible in yellow; red and blue markings from previous tutor (blue) and student (red) turns.

> *Well, I think the model you need to, ja, you need to use the model to explore what's closed, what's open, what floats, what's solid. You know again, as part of your concept. Here, all the planes are pretty much the same you know whereas the floor could fold up and become the wall and the roof or the roof could be something completely different you know, ja. (T1)*

NEW DESIGN IDEA
SPACIAL ORGANIZATION AND SECTION

Episode i: turns 50 to 53

This episode is in the experiential mode, but with no on-screen markings. The student and T1 exchange ideas about the design execution through feedback on action and student comments.

> *Ja, I don't want you to lose you know that idea of the focusing on particular senses but I think that it can be done in a much looser way without constructing huge buildings in that space.* (T2)

Episode j: turns 54 to 56

The next episode consists of three turns taken by T2 and the student: T2 reflects on learning practice, the student explores, followed by another reflection by T2. She provides scaffolds for the student's learning, through examples and repetition.

In the first reflection by T2, she moves the conversation from the concrete to the abstract. Tutor markings are in yellow and blue; student markings in red.

> *... [tutor markings in blue] You said earlier that it's got to be confined or closed, yes. But then those slits that you've already provided, so kind of a glimpse out. You know, to make something really closed, you want to see a little bit of openness and you know, so variety. It's*

like music, if everything is according to the same beat and the same volume and the same tone, it's really boring. You need those – to make the closedness more dramatic you need to offset it with some openness and some light etcetera. [student markings in red] (T2)

The student then attempts to apply the idea in practice:

So maybe this space over here can just be like an open space in the ground where you can like – there's an open – no roof – roof structure over and you can just hang like … (a)

Finally, T2 reflects on the student's attempt to explore an alternative, based on the abstract idea, and moves the interaction back to the abstract in the discursive mode, through reflective observation:

… if you read Righini it talks a lot about the floor and the walls and the roof as space defining elements and some cases you leave away the wall or you puncture the wall or you perforate the roof or you omit the roof, or you just have a floor and one wall…(T2)
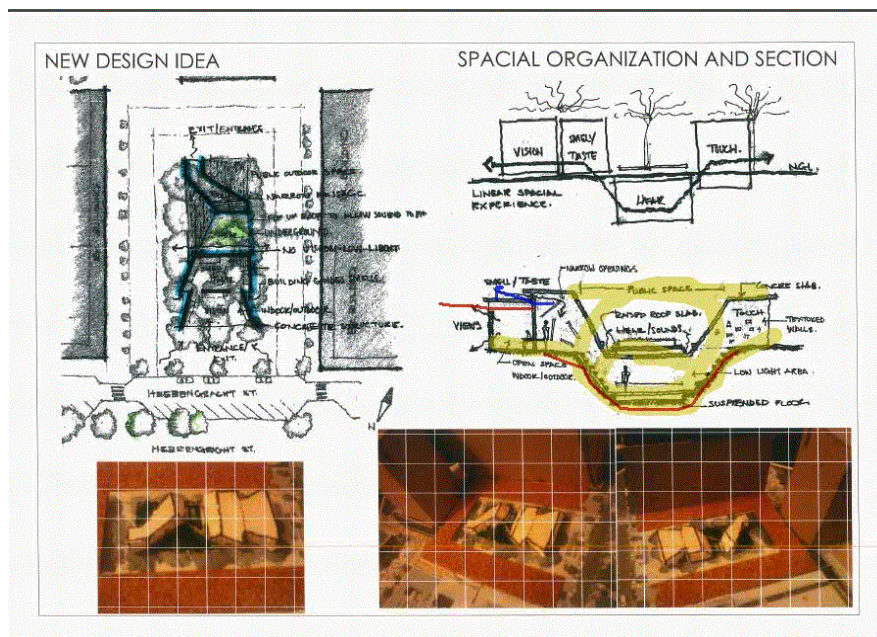
Episode k: turns 57 to 62

The next six turns focus on the experiential level with T1, T2 and the student exchanging final ideas about next steps, and both tutors complimenting the student on a clear and competent presentation. During this stage, there are no further on-screen markings or drawing.

So maybe this space over here can just be like an open space in the ground where you can like – there's an open – no roof – roof structure over and you can just hang like ... (a)

Episode l: turns 63 to 69

This final episode of the crit contains the social interaction, namely the thank yous and good byes, but with no on-screen drawing or markings.

Good, nice but it's a very nice presentation for us to respond to. I just think for everybody on one page, we've got a model, a plan, diagram section. I mean this is a really useful single page to cross-reference. I think it's been very valuable in this discussion. (T2)

The findings were articulated in a graphic notation to visualise the moves, methods and modes of interaction, for each of the three crit protocols. The graduate responses were sought through a focus group interview, and online surveys were used to gather data on the student, graduate and tutor experiences of the live online crit in terms of the methods of interaction. These were thematically analysed and the findings used to interpret the crit notations, seeking patterns to draw conclusions about how the moves, modes and methods of student-tutor interaction were employed in the live online crit.

The result of translating the online crit protocol into a notation (episodes in brackets), illustrated as notations:

Crit 1, titled 'Architecture and Human Senses' starts with greetings and a brief social conversation (a), followed by the student's project presentation (b). He refers to the images, explaining the background to the project, design influences and conceptual idea. Other than advancing the pdf slides and acknowledging his presentation, the tutors don't give any feedback at first. Then the student stops the presentation and turns to the tutors to find a pen and to move to the next slide in the presentation (c). The student continues, but now explaining how he applied his ideas (d), whilst making use of on-screen drawing. After another short interruption to find the right drawing (e), he elaborates on the conceptual aspects of the project (f), followed by

a further explanation of the application of the design intent (g). At this point the tutors join in with feedback alternating between the theory (abstract) and practice (application), making use of on-screen marking and sketching. The next phase involves a focus on the application of concepts (i and k), with only one reference to theory (j), again using on-screen sketching. The crit ends with a brief period of social exchange (l).
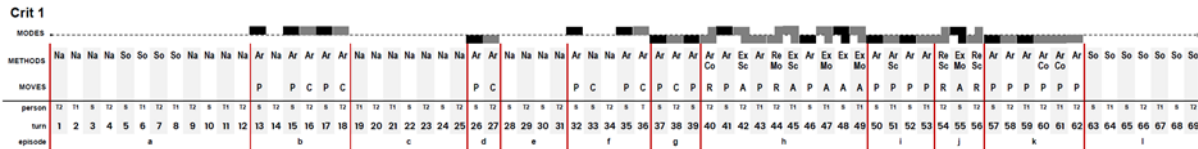
Episodes	CRIT 1	a	b	c	d	e	f	g	h	i	j	k	l
MOVES	Discursive		●				●		●				
	Interactive				●			●	●	●	●	●	
	Reflective								●		●		
	Adaptive								●		●		
	Online marking				●		●	●	●		●		
METHODS	Modeling								●	●	●	●	
	Scaffolding								●	●	●		
	Coaching								●			●	
	Articulation		●		●		●	●	●	●	●	●	
	Reflection								●		●		
	Exploration								●		●		
	Socialisation*	●											●
	Navigation*	●		●		●	●						
MODES	Negotiation		●				●		●				
	Application				●			●	●	●	●	●	
	Reflection								●		●		
	Exploration								●		●		

CRIT 1		
MOVES	**METHODS**	**MODES**
CONVERSATION THEORY	**COGNITIVE APPRENTICESHIP**	**EXPERIENTIAL LEARNING**
Laurillard, 2012	**Collins *et al*, 1989**	**Kolb, 1984**
PRESENT	**say**	**DISCURSIVE LEVEL**
S questioning (-)	Articulation (S)	Abstract conceptualisation
S presents conception as product		NEGOTIATION
S comments*		Theory/ conceptual
T presents concepts (-)	Modeling articulation (T)	
T hints, comments		
T questioning, prompting*		
REFLECT	**think**	Reflective observation
S reflects on feedback	Reflection (S)	(moves up from experiential to discursive)
S reflects on practice*		REFLECTION
		Build concept
T reflects on learning practice	Modeling reflection (T)	**Sense-making**
		Meaning-making
ADAPT	**test**	Active experimentation
S adapts practice	Exploration (S)	(moves down from discursive to experiential)
		EXPLORATION
T adapts task goal	Modeling exploration (T)	**Test concept**
		Apply theory
ACT	**act**	**EXPERIENTIAL LEVEL**
S action towards goal	Articulation (S)	Concrete experience (experiential level)
S revises action		
S comments*		APPLICATION
T sets task goal	Modeling articulation (T)	
T feedback on action		
T hints, comments*		
T questioning, prompting*		

	Scaffolding: Cognitive **support/ suggest** <mark>With reflection, articulation, exploration.</mark>	205 | P a g e
	Coaching: Affective support/ **care** <mark>With articulation and reflection</mark>	
	Socialisation* **talk** <mark>Beginning and end: a, I</mark>	
	Navigation* **direct** <mark>Present in 5 episodes: a, b, c, e, f</mark>	

1.2 Crit 2

The crit starts with a social phase an introduction about the crit process and the student testing the on-screen drawing tool. The student starts to explain the context of his project in terms of the group project, the influences on the project, moving from slide to slide, but without on-screen drawing. The tutors give minimal input, but compliments the student on his use of a cardboard model to explore the design. He then moves from the theory to describe the application of theory, using the on-screen drawing tool. This is where the tutors join in, first prompting the student for further explanation and clarification on his design decisions related to scale and then starting to move the discourse up and down between theory and practice, using images of the models and on-screen drawing. The remainder of the crit stays mostly focused on practice, with occasional references to theory to justify design decisions. The final stage of the crit revolves around the theoretical value of the model.

Below follows a translation of the crit protocol organised in turn-taking sections, using the language of moves, methods and modes. It draws on the conceptual framework, towards uncovering links and patterns in the student-tutor interaction in the live online crit. It is followed by a tabled summary.

Crit 2 comprises of episodes a to j, as follows:

Episode a: turns 1 to 13

Episode a is dominated by social interaction and navigation.

Episode b: turns 14 to 15

During this episode the student presents his design concept and the tutor acknowledges his explanation.

> *It was the – a quote from the – 'From Our House to Bauhaus book. It was more about how American students were travelling to Europe, post World War 11 and then back to the States just before the war. So, it was that idea of moving to one space congregating and then dispersing once again, once experiencing a specific event. So that's what we tried to convey in our group work, so and then I tried conveying that back through my individual work. (b)*

Episode c: turns 16 to 21

Next the student explains his actions in response to the conceptual idea, in other words, how he applied the idea. This short episode is of the student adapting his

practice, moving from the discursive to the experiential mode through active experimentation, with navigation happening before and after.

> *Okay, there we go. That was just my thoughts and reasons why specific things were done and how they were done. The main difference between my group work and individual work is I took out the single use walkway that ran diagonally along the site and more split it up into covered congregation areas that fed off those pathways... (b)*

Episode d: turns 22 to 29

The student continues to present his project idea, with the tutors acknowledging, and briefly complimenting him, but not yet giving any concrete feedback, to allow the student to continue with his presentation. The conversation is on the discursive level. No on-screen drawing is happening at this stage and the student is talking to the graphics on the screen.

> *This was just further analysis of my site greenery on the top and then more, how the sun would move through the space and the mountain because that was a specific thing that I wanted to keep was that view of the mountain because I thought it was really one of the better views I've seen in the city. (b)*

Episode e: turns 30 to 37

Next the conversation moves to the experiential level with the student explaining the application of ideas his design ideas through.

> *Ja, because the bottom image shows the private spaces along the southern end over here. [student markings in red] There we go. It's just – it creates – I tried playing with covered, enclosed tight spaces or more private contemplation spaces and then the open, bigger areas or areas for people to congregate in and then disperse. (b)*

The tutors start to give feedback on action, including compliments and questioning.

> *Ja, I'm just asking what – what – in terms of scale you know [tutor's marking in blue - pen moving up and down along the column line on the lower image] What height and why that height? (T2)*

followed by the student revising action:

Okay that height was I think 2.7 because the height at the back there [student marking in red] Was 4 or 3, sorry. So it was just lower. (b)

During this episode, both student and tutors start to use the on-screen drawing tool.
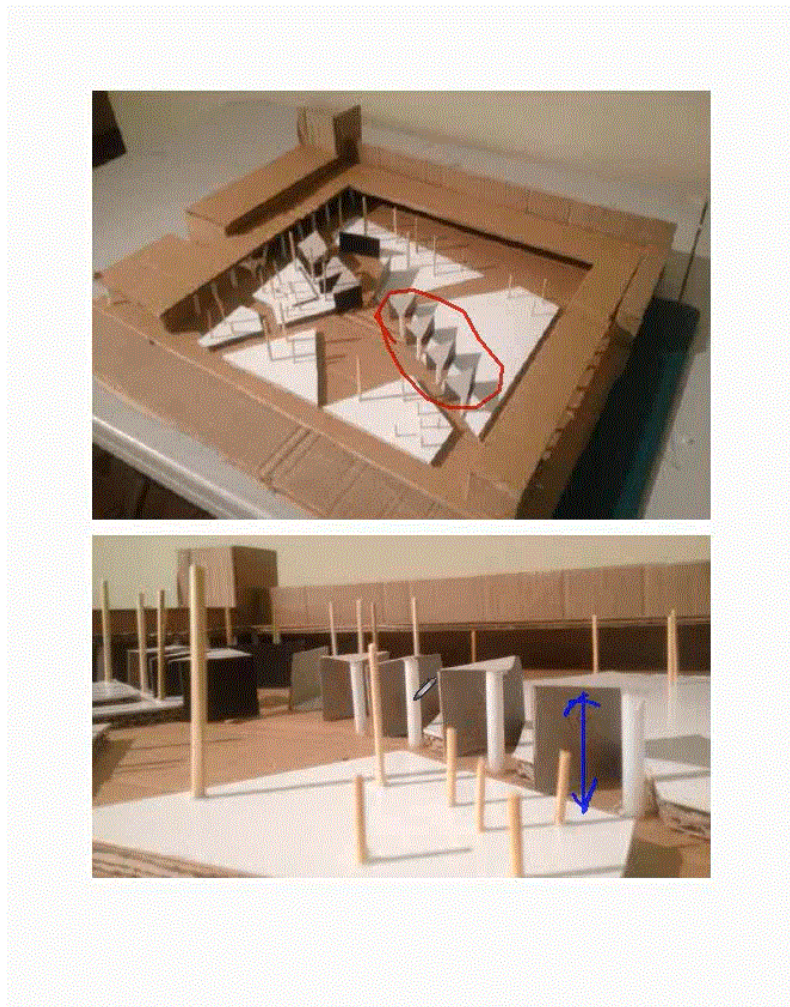
Episode f: turns 38 to 40

In the next three turns T1 models exploration using on-screen markings [on-screen markings in blue], the student reflects on practice, followed by another explorative move by T1. The conversation moves up and down between the discursive and experiential modes.

After I finished building the model and looked at it I thought it would have been an interesting idea to vary those heights because I am playing with the horizontal elements of the ground level itself but I hadn't thought about that further in the sheltered areas. (b)
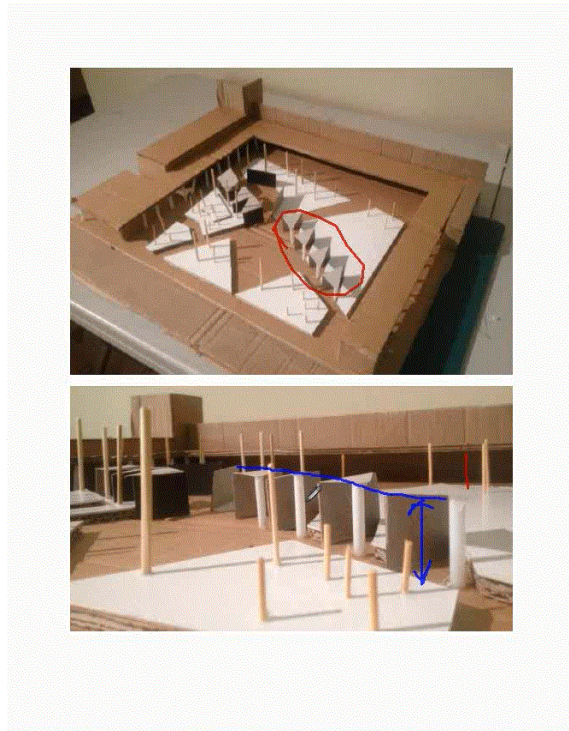
Episode g: turns 41 to 47

During this episode, the student demonstrates his practice, the tutors model reflection on the student's practice, followed by the student's reflection on his practice as he makes sense of the design decisions in terms of the concept.

> *That's exactly what I was trying to do was break that line up. Instead of having a very straight restricting line to allow people then to disperse, that was part of the concept was to allow that dispersal space. (b)*

The interaction happens in the experiential mode with the student and both tutors, on four occasions, taking it up to the discursive level, using on-screen marking.

Episode h: turns 48 to 60

The student demonstrates and explains his design practice in response to tutors' prompting to explain, justify and elaborate. The discourse remains on the experiential level and T1 uses on-screen markings [in blue] while the student presents.

> *No, they're multi-use spaces. You can pause in them, but they're not designed to have a bench and a lock up area for a trader in specifically. But the trader could put their wares out, pack it up and then it could still be in [noise]. (b)*
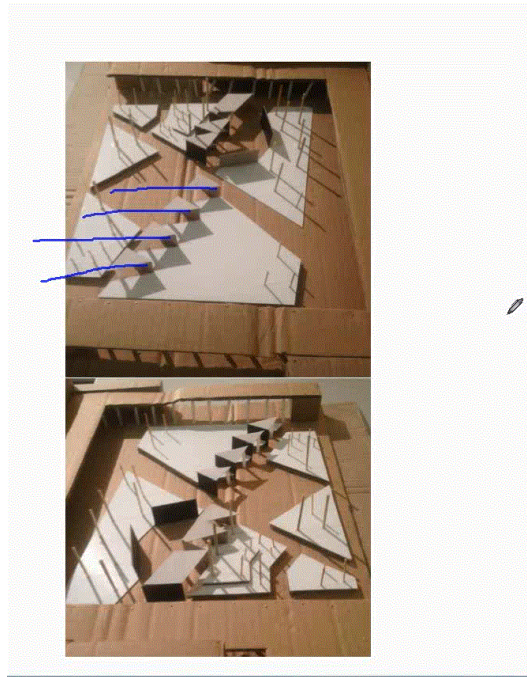
Episode i: turns 61 to 73

The conversation continues to focus on the execution of the design, with two instances where the tutors reference the concept, thereby modeling exploration and scaffolding the student's learning.

Ja, I also just, one more thing linked to what T1 has said. [tutor's pen moving and pointing on the top image] For those spaces if you imagine people in those spaces, they'll be sitting or standing and you know what will happen? I think you need to think about the detail as well. But I think that we've already said that, ja.
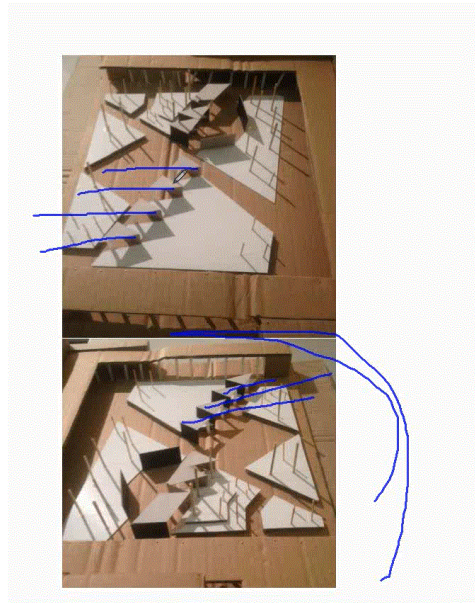
Episode j: turns 74 to 79

During the final episode of the crit, the student twice reflects on his own practice in response to the tutor's compliment on his use of physical models and the value thereof for design exploration.

> *Definitely. It allowed me to perceive the space because I'm in*
> *Joburg, so while drawing I built a bit of the model and drew a bit of*
> *it again and then built a bit of the model again. So, it was definitely*
> *a co-generation of ideas. (b)*

The main mode of this stage, is discursive. The tutor uses the student's reflection on the value of using physical models and analytical sketches for design, to motivate others to use models too.

> *But I think – and the thing is that the model is just conceptual. It's*
> *exploring but it's using you know very simple elements to explore*
> *different options you know. So, one reads the model in different*
> *ways, but I also think that the little sketches, the analytical sketches*
> *that you did are something that will be useful for everyone to do in*
> *the space that they're working in... (T1)*

The findings were articulated in a graphic notation to visualise the moves, methods and modes of interaction, for each of the three crit protocols. The graduate responses were sought through a focus group interview, and online surveys were used to gather data on the student, graduate and tutor experiences of the live online crit in terms of the methods of interaction. These were thematically analysed and the findings used to interpret the crit notations, seeking patterns to draw conclusions

about how the moves, modes and methods of student–tutor interaction were employed in the live online crit.

Result of translating the online crit protocol into a notation (episodes in brackets), illustrated as notations:

Crit 2, titled 'Pathways and Planes', starts with a social phase and introduction about the crit process and the student testing the on-screen drawing tool (a). Student C2 starts to explain the context of his project in relation to the group project, the influences on the project, moving from slide to slide, but without any on-screen drawing (b). The tutors give minimal input but compliment the student on his use of several cardboard models employed for design exploration, in-between finding the relevant slides (c to f). The student then moves from the theory to describe the application of theory, using the on-screen drawing tool (g). The tutors join in, first prompting the student for further explanation and clarification on his design decisions related to scale, and then moving between theory and practice (h), using images of the models and on-screen drawing. The remainder of the crit is focused on practice (i), with occasional references to theory to justify his design decisions (j). The final stage of the crit revolves around the value of the model as design tool (k), after which the crit is concluded (l).

Episodes	Crit 2	a	b	c	d	e	f	g	h	i	j
MOVES	Discursive		●	●	●						●
	Interactive					●		●	●	●	
	Reflective						●	●			●
	Adaptive						●			●	
	Online marking					●	●	●	●	●	
METHODS	Modeling					●	●	●	●		

MODES		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
	Scaffolding						●	●		●	●
	Coaching				●	●				●	●
	Articulation		●	●	●	●		●	●		
	Reflection						●	●			
	Exploration			●			●				
	Socialisation*	●									
	Navigation*	●		●	●	●					
MODES	Negotiation		●		●						
	Application			●		●					
	Reflection						●				
	Exploration						●				

CRIT 2		
MOVES	**METHODS**	**MODES**
CONVERSATION THEORY	**COGNITIVE APPRENTICESHIP**	**EXPERIENTIAL LEARNING**
Laurillard, 2012	**Collins et al, 1989**	**Kolb, 1984**
NEGOTIATE S questioning ( ) S presents conception as product S comments*	**say** Articulation (S)	**DISCURSIVE LEVEL** Abstract conceptualisation
T presents concepts ( ) T hints, comments T questioning, prompting*	Modeling articulation (T)	
REFLECT S reflects on feedback S reflects on practice*	**think** Reflection (S)	**REFLECTIVE** Reflective observation (moves up from experiential to discursive)
T reflects on learning practice	Modeling reflection (T) **show**	**Build concept** **Sense-making**
ADAPT	Exploration (S)	**ADAPTIVE**

S adapts practice	**test**	Active experimentation (moves down from discursive to experiential) **Test concept** **Apply theory**
T adapts task goal	Modeling exploration (T) **show**	
DEMONSTRATE S action towards goal S revises action S comments*	Articulation (S) **act**	**EXPERIENTIAL LEVEL** Concrete experience (experiential level)
~~T sets task goal~~ T feedback on action T hints, comments* T questioning, prompting*	Modeling articulation (T) **show**	
	Scaffolding: Cognitive **support/ suggest** With reflection, articulation, exploration	
	Coaching: Affective support/ **care** With articulation	
	Socialisation* **talk** One brief incidence at the start: a	
	Navigation* **direct** Present in 6 episodes: a, c, d, e, h, I, j	

1.3 Crit 3

The crit starts with a navigation phase, followed by the student explaining the design concept and design informants, using the on-screen drawing tool. Short intermittent interruptions occur for the advancement of slides and finding the relevant drawings. Then the student explains the practical implementation of his ideas, still using the drawing tool. The final part of his presentation again focuses on the theory, and then he shows how he implemented the theoretical ideas generated from the precedent. After a short break interspersed with tutor's complements, the tutor moves the discourse back to the conceptual level with up and down movements between the theory and practice aspects of the project. After another short navigation phase, the crit ends with practical tips and encouragement by the tutor.

Below follows a translation of the crit protocol organised in turn-taking sections, using the language of moves, modes and methods. It draws on the conceptual framework, towards uncovering links and patterns in the student-tutor interaction in the live online crit. It is followed by a tabled summary.

Crit 3 comprises of episodes a to h, as follows:

Episode a: turns 1 to 10

Episode a contains introductions by and orientation of the two tutors and student c.

Episode b: turns 11 to 21

The student starts with his presentation, explaining the concept of the group project, twice interrupted to find the right pages. While the student presents, the tutors draw their interpretation on the screen.

> *… And then we found a crow[d]ed flower market between Adderley Street and Parliament Street… Basically, that is the flower garden. That is the – there is just the orientation of the site, everything and the few photos we took just to see the surroundings. Now, you can go back to the first page, where I'm explaining. (c)*
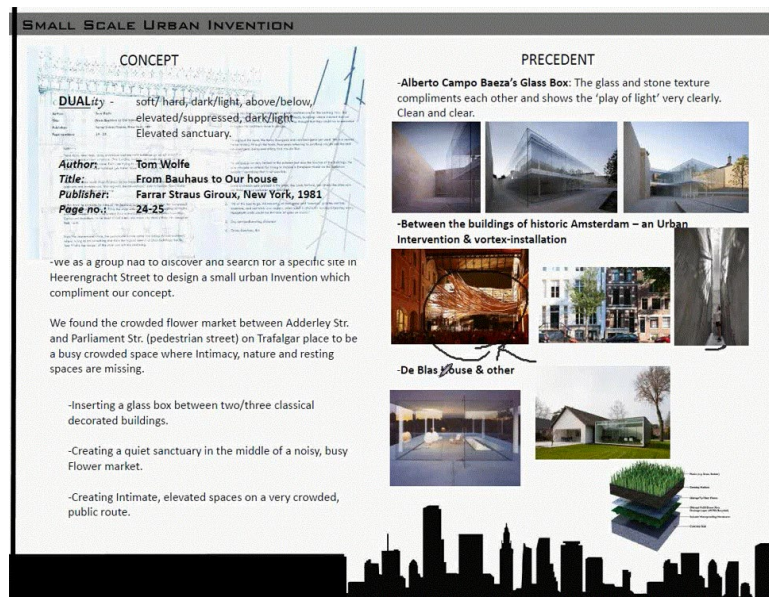
Episode c: turns 22 to 33

Next the student, whilst demonstrating through on-screen drawing, takes the tutors through his group work proposal.

> *...There's a lot of obstacles to walk around but you have to walk kind of through that and you look at the flowers. But you can't see all the flowers and we decided okay, we have to do something to actually get away from that and to actually enhance the flower market and the flow of the flower market. So I think the best place to see that here is on this one, let me just mark that. [Student markings in green] There you can see there's little pillars that's going actually through and that will serve, that will mean that the people enter on this side and then they circulate around the flowers. ...* (c)

During this episode there are two navigational interruptions to find the right drawings and for the tutor to explain the reason for delays in the transmission of images.

Episode d: turns 34 to 37

This episode starts on the discursive level with the student articulating his understanding of the project brief, with minimal tutor input. He then takes the presentation to the experiential mode through demonstrating his exploration, the application of his design idea and the process that he followed, using on-screen marking to communicate his thinking.

> *... So, I decided maybe make it a timber construction where you have greater timber or open timber like on this picture, you see*

[student's markings in green] – either like that – I'm not sure if that will work. So I have to go explore that but there you can see it's actually open in between, let's say 40mm in between and that – if you walk past the flower garden, you can smell the flowers and that's actually [nice]… You can incorporate the smells through the top. Ja and there you just see - the last picture is on this one….
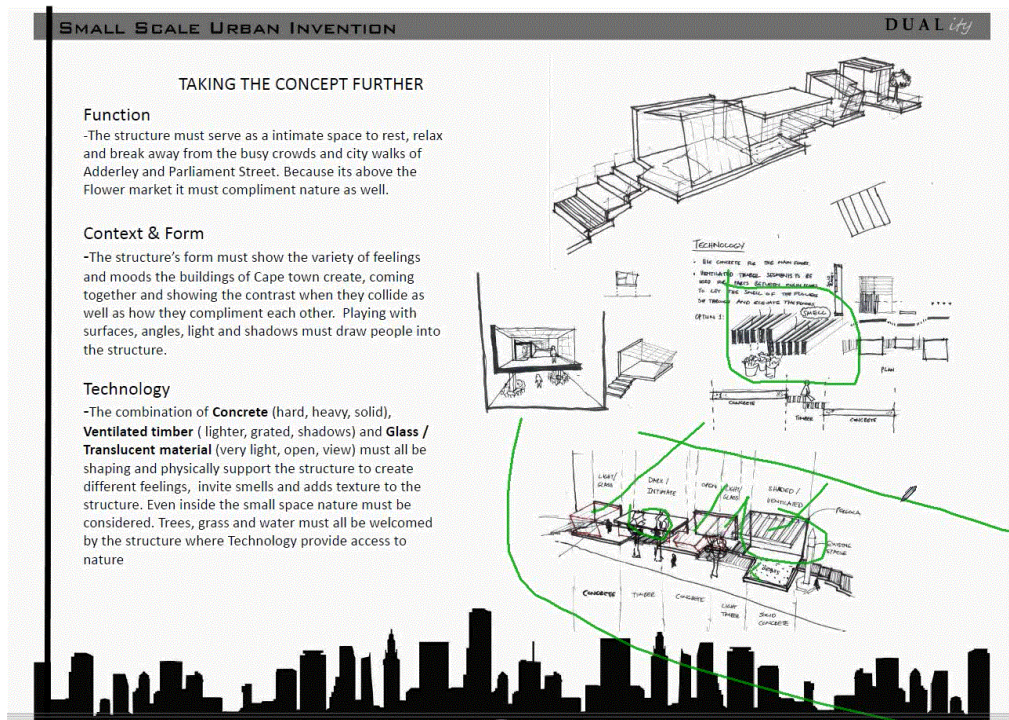
Episode e: turns 38 to 40

This is a short episode of greetings and acknowledgement.

Episode f: turns 41 to 47

Next follows an episode of alternating reflection and exploration by the student and both tutors, initiated by the student. On-screen markings are by the tutors only.

Episode g: turns 48 to 49

A short episode of switching pen colours for improved legibility follows.

Episode h: turns 50 to 56

The final episode of the crit contains feedback by the tutor on the student's presentation format. It is focused on his practice and the tutor, acting as coach, scaffolds the student's learning, also for the sake of the other students present in the online session.

The findings were articulated in a graphic notation to visualise the moves, methods and modes of interaction, for each of the three crit protocols. The graduate responses were sought through a focus group interview, and online surveys were used to gather data on the student, graduate and tutor experiences of the live online crit in terms of the methods of interaction. These were thematically analysed and the findings used to interpret the crit notations, seeking patterns to draw conclusions about how the moves, modes and methods of student-tutor interaction were employed in the live online crit.

The result of translating the online crit protocol into a notation (episodes in brackets), illustrated as notations:

Crit 3, titled 'Duality' starts with greetings and finding the right starting point (a), followed by the student explaining the design concept and design informants (b), using the on-screen drawing tool. Short interruptions occur for the advancement of slides and navigating the material. The student continues with an explanation of the practical implementation of his ideas (c), whilst using the drawing tool. The final phase of his presentation focuses on the theory (d), followed by a demonstration (e) of how he implemented the theoretical ideas generated from the precedent. After a short social phase interspersed with tutors' compliments, the tutor takes the conversation to the conceptual level (f) with some references to the practice aspects of the project. After another short navigation phase (g) the crit ends with practical tips and encouragement by the tutor (h).

Episodes	Crit 3	a	b	c	d	e	f	g	h
MOVES	Discursive		●		●				
	Interactive			●		●			●

	Reflective					●	●		
	Adaptive					●	●		
	Online marking		●	●		●	●		
METHODS	Modeling						●		
	Scaffolding				●		●		●
	Coaching					●			●
	Articulation		●	●	●	●			●
	Reflection					●	●		
	Exploration					●	●		
	Socialisation*					●			
	Navigation*	●	●	●				●	
MODES	Negotiation		●		●				
	Application			●		●	●		●
	Reflection					●	●		
	Exploration					●	●		

CRIT 3		
MOVES	**METHODS**	**MODES**
CONVERSATION THEORY	**COGNITIVE APPRENTICESHIP**	**EXPERIENTIAL LEARNING**
Laurillard, 2012	**Collins et al, 1989**	**Kolb, 1984**
PRESENT ~~S questioning (-)~~ S presents conception as product S comments*	Articulation (S) **say**	**DISCURSIVE LEVEL** Abstract conceptualisation
~~T presents concepts (-)~~ T hints, comments T questioning, prompting*	~~Modeling articulation (T)~~ **show**	
REFLECT ~~S reflects on feedback~~	~~Reflection (S)~~ **think**	Reflective observation

S reflects on practice*		(moves up from experiential to discursive) **Build concept** **Sense-making**
T reflects on learning practice	Modeling reflection (T) **show**	
ADAPT S adapts practice	Exploration (S) **test**	Active experimentation (moves down from discursive to experiential) **Test concept** **Apply theory**
T adapts task goal	Modeling exploration (T) **show**	
ACT S action towards goal S revises action S comments*	Articulation (S) **act**	**EXPERIENTIAL LEVEL** Concrete experience (experiential level)
T sets task goal T feedback on action T hints, comments* T questioning, prompting*	Modeling articulation (T) **show**	
	Scaffolding: Cognitive **support/ suggest** With reflection, articulation	
	Coaching: Affective support/ **care** With articulation	
	Socialisation* **talk** One brief episode about midway: e	
	Navigation* **direct** Present in 4 episodes: a, b, c, g	

MOVES	METHODS	MODES
CONVERSATION THEORY	**COGNITIVE APPRENTICESHIP**	**EXPERIENTIAL LEARNING**
Laurillard, 2012	**Collins et al, 1989**	**Kolb, 1984**
PRESENT S questioning (-) S presents conception as product S comments*	Articulation (S) **say** **elicit/ clarify (Lam, 2011)**	**DISCURSIVE LEVEL** Abstract conceptualisation
T presents concepts (-) T hints, comments T questioning, prompting*	Modeling articulation (T) **show**	
REFLECT S reflects on feedback S reflects on practice*	Reflection (S) **think** **decide**	Reflective observation (moves up from experiential to discursive) **Build concept** **Sense-making**
T reflects on learning practice	Modelling reflection (T) **show**	
ADAPT S adapts practice	Exploration (S) **test**	Active experimentation (moves down from discursive to experiential) **Test concept** **Apply theory**
T adapts task goal	Modeling exploration (T) **show**	
ACT S action towards goal S revises action S comments*	Articulation (S) **act** **elicit/ clarify (Lam, 2011)**	**EXPERIENTIAL LEVEL** Concrete experience (experiential level)
T sets task goal T feedback on action T hints, comments*	Modeling articulation (T) **show**	
	Scaffolding: Cognitive **support**	
	Coaching: Affective support/ **care**	
	Socialisation* **talk**	

2. Addendum 2: Schedule of findings

2.1 Research Question 1

Below follows a summary of the answers to the RQ1.

Summary: RQ1 findings		
STRESS		
1.	Internet-reliance	Internet access is required
2.	Participant-invisibility	Students and tutors are heard, not seen
		Microphone challenge
		Focused, not distracted
		Less exposed, more relaxed
3.	Ubiquity	More relaxed, own space
SOURCES		
4.	Media-intensity	Different media, 2D, 3D models, digital and analog
5.	Multi-communicability	Different platforms and channels used concurrently
6.	Resource-efficiency	Save time and money for travel and printing
SOCIALISATION AND INTERACTION		
7.	Formality	Like a presentation
		Limited serendipity
8.	Accessibilty	Large groups possible
		Dial-in experts
		Eliminates the front row advantage
		Later viewing of recordings
9.	Work-orientation	Not webcam
		Focus
		Focused, limit distractions
10.	Inclusivity	Wide range of students, also working students
		Remote access

2.2 Research Question 2

Below follows a summary of the answers to the RQ2.

Summary: RQ2 findings	
1. NOVICE-EXPERT	
Approval and evaluation	Constructive feedback Judgement and criticism are seen to be supportive and constructive Assessor and facilitator roles often blurred
Master and apprentice	Working students accept a degree of control by the tutor, but asymmetrical power relations through race, gender, age, and role or position were not found Control of the screen by tutor
Respect and familiarity	Potential asymmetrical power relations are mitigated by mutual respect, a sense of responsibility and a commitment towards the shared goal of learning Although the relationship is formal, it is also close and personal
2. ARCHITECT-CLIENT	
Feedback for improvement	Feedback is not directed at the author of the work, but seen to add value to the project
Partners in practice	Power relations more balanced; student and tutor roles and hierarchy like the real-life practice situation
Preparation for the profession	Tutor is expert, but more balanced relationship; the student takes one a more professional role (architect)
3. MENTEE-MENTOR	
Guidance and advice	Tutor as a guide or facilitator, prompting students to think critically on their own
Coaching to full potential	Tutor as guide, student in charge of the learning process
Trust and openness	Tutor less authoritative than the expert role
4. CHILD-PARENT	
Compassion	Tutor takes the role of carer

2.3 Research Question 3

Below follows a summary of the answers to the RQ3.

Summary: RQ3 findings		
RQ3.1 – MOVES	RQ3.2 – MODES	RQ3.3 – METHODS
Present Like a presentation (S present, T present practice) Student dominates present moves Live online crit is not a lecture It is like an assessment **Question** Not for student questions, but Tutor prompts, for student action (dialogue facilitator/ questioner) Lam 2011 **Comment** In response to present, question Extensively used by S and T That suggests learning is happening (Goldschmidt *et al.,* 2014, Blair, 2006, Ellmers, 2014) **Adapt** Not mentioned, but observed S and T use it **Reflect (elicit)** Often by T, seldom by S No reflection-in-action (feedback on student work produced prior to the crit) Reflection-on-interaction (new) after the crit Reflection-on-action: 3 types 1. Reflects on work prepared for the crit, 2. Reflection-in-action that happened prior to the crit, whilst preparing. 3. Reflection on feedback that happened before the crit T reflection on action	**Negotiation** Operates on theory 1st half of the crit Student-dominated (based on the frequency): student-control **Application** More like a demonstration than working together on a design problem 2nd half of the crit Student-dominated (based on the frequency): student-control **Exploration (test, adapt)** Testing of alternatives Complex iterative transactions (lit) 2nd half of the crt Often grouped with Reflection (Tony Bates (2016): up and down) **Reflection (elicit)** Complex iterative transactions (lit) Not often used by the student, only the tutor Often grouped with Exploration (Tony Bates (2016): up and down)	**Articulation** Language of the profession Context of a profession Different media Makes knowledge explicit through telling and showing Different media Feedback in the form of hints and comments and explanations (links methods with moves) Explanation to clarify **Exploration (test, adapt)** Alternative design solutions Needed to put students in control, Student and Tutor both actively explore, linked to reflection **Reflection (elicit)** Making sense during and after, different modes, subject matter and own performance, reflection leads to abstraction, Tutor extensively, Student rarely **Modeling** Tutor models, Student imitates, showing and telling, Tutor models exploration and reflection, making problem-solving visible **Scaffolding** Guided participation, in ZPD, how much is enough scaffolding? Scaffolding is learner-centred Why is supportive scaffolding challenging? **Coaching** Harsh critic and caring councellor, with student and not adversarial or dictatorial, how to take criticism Direct students' attention **Navigation** Wayfindig ito turn-taking and timing and use of webinar technology, a lot **Socialisation** Limited friendly informal chat,

		Greetings and gratitude, little social and informal interaction

STUDENT **TUTOR**

abstract/ theory

articulation: telling

present question comment **(clarify)**

NEGOTIATION

present question comment **(clarify)**

modeling coaching scaffolding navigation socialisation

exploration

adapt **(test)**

exploration

adapt **(test)**

EXPLORATION applying concepts

REFLECTION building concepts

EXPLORATION applying concepts

REFLECTION building concepts

concrete/ practice

reflection

reflect **(discover)**

reflection

reflect **(discover)**

modeling coaching scaffolding navigation socialisation

articulation: showing

present question comment **(decide)**

APPLICATION

articulation: showing

present question comment **(decide)**

2.4 Research Questions 1–3: summary

Below follows a summary of the answers to the research questions, plus the consolidation that brings these together

RQ1 What are the characteristics of the live online crit setting?	RQ2 What are the types of student-tutor relationships in the live online crit?	RQ3 How do students and tutors interact in the live online crit?	Consolidation
Stress experienced by students - internet reliance - participant visibility - ubiquity **Sources of engagement** - media-intensity - multi-communicability - resource-efficiency **Socialisation and interaction** - formality - accessibility - work-orientation - inclusivity	novice–expert -approval and evaluation -master and apprentice -respect and familiarity **architect-client** -feedback for improvement -partners in practice -preparation for the profession **mentee-mentor** -guidance and advice -coaching to full potential -trust and openness **child-parent** - compassion	**Moves** Present, question, comment, adapt, reflect **Modes** Negotiation, application, exploration, and reflection **Methods** articulation, exploration, reflection, modeling, scaffolding, coaching, navigarion and socialisation -tutor feedback on student presentation -interconnected thinking and doing - student support through modeling and cognitive scaffolding - limited socialization, supportive scaffolding, and coaching - frequent online navigation and wayfinding	The student interaction in the live online critique (crit): FORMATIVE **Formative assessment** -novice-expert -tutor feedback on student presentation ITERATIVE **Iterative transactions** -architect-client -interconnected thinking and doing - student support through modeling and cognitive scaffolding FORMAL **Formal and focused** -formality -work-orientation -mentee-mentor -child-parent -limited socialization, supportive scaffolding, and coaching IMMERSIVE **Extends beyond the crit** -accessibility -inclusivity -internet reliance -participant visibility -ubiquity -media-intensity -multi-communicability -resource-efficiency -frequent online navigation

2.5 Research Questions 1–3: consolidation

Below follows a consolidation of the answers to the research questions, organised around the four themes of formative, iterative, formal, and immersive.

FORMATIVE		
RQ1:	RQ2:	RQ3:
Formality Like a presentation	**Novice-expert:** **-Approval and evaluation** Constructive feedback Judgement and criticism are seen to be supportive and constructive Assessor and facilitator roles often blurred **-Master and apprentice** Working students accept a degree of control by the tutor, but asymmetrical power relations through race, gender, age, and role or position were not found Control of the screen by tutor **-Respect and familiarity** Potential asymmetrical power relations are mitigated by mutual respect, a sense of responsibility and a commitment towards the shared goal of learning Although the relationship is formal, it is also close and personal	**MOVES:** **-Present** Student presents her work to clarify and negotiate understanding, and to demonstrate her design decisions Tutor does not present a lecture **-Question** Student does not typically question Tutor prompts student for clarification **-Comment** Student comments in response to tutor questions Tutor comments and provides feedback (hints and explanations) on student presentation **MODES:** **-Negotiation** Negotiation (theory) is student-dominated (1st half of the crit) **-Application** Application (like a demonstration) is student-dominated (2nd half of the crit) **METHODS:** **-Articulation** Design reasoning Language of the profession Different media Verbal and graphic articulation and presentation skills Makes knowledge explicit through telling and showing Feedback in the form of hints and comments and explanations (links methods with moves) Students state their knowledge Explanation to clarify Tutor does not demonstrate design expertise The live online crit therefore is not a design session **-Modeling** Tutor demonstrates expert behaviour Student imitates

		showing and telling, Tutor makes problem-solving visible

ITERATIVE		
RQ1	**RQ2**	**RQ3**
Media-intensity Different media, 2D, 3D models, digital and analog **Multi-communicability** Different platforms and channels used concurrently	**Mentee-mentor** **-Guidance and advice** Tutor as a guide or facilitator, prompting students to think critically on their own **-Coaching to full potential** Tutor as guide, student in charge of the learning process **-Trust and openness** Tutor less authoritative than the expert role Like a caring councellor	**MOVES:** **-Adapt** Adapt moves employed extensively by the student to test and explore ideas, and the tutor to model exploration **-Reflect** Dominated by the tutor Reflection-on-action, rather than reflection-in-action Also: reflection-on-interaction through viewing of crit recording **MODES:** **-Exploration** Links thinking and doing **-Reflection** Leads to abstraction **METHODS:** **-Exploration** Test, adapt Alternative design solutions Testing of alternatives by student and tutor **-Reflection** No reflection-in-action Reflection-on-action (reflects on work prepared for the crit, reflection-in-action that happened before the crit, reflection on feedback that happened before the crit) Reflection-on-interaction: making sense during and after the crit Elicit, making sense during and after, different modes, on subject matter and own performance Tutor extensively models reflection Student rarely (only C2) **-Modeling** Tutor models, student imitates, showing and telling Tutor models exploration and reflection, making problem-solving visible

FORMAL		
RQ1	**RQ2**	**RQ3**
Work-orientation Focused, not distracted, no webcam **Formality** Like a presentation **Participant-invisibility** Heard, not seen, microphone challenge, less exposed, more relaxed	Architect-client -**Feedback for improvement**: Feedback is not directed at the author of the work, but seen to add value to the project -**Partners in practice**: Power Relations more balanced Student and tutor roles and hierarchy like the real-life practice situation -**Preparation for the profession**: Tutor is expert, but more balanced relationship; the student takes one the professional role as architect	METHODS: -**Scaffolding** Tutor scaffolds towards guided participation Scaffolding is student-centred No supportive scaffolding -**Coaching** Cognitive rather than supportive or nurturing Coaching focused on articulation rather reflection or exploration Coach as councellor -**Socialisation** Limited social and informal interactions

IMMERSIVE		
RQ1	**RQ2**	**RQ3**
Inclusivity Wide range of students, working, remote **Accessibility** Large groups possible, dial in experts, unlike front row advantage, recording of sessions **Ubiquity** Anywhere and anytime **Media-intensity** Different media, 2D, 3D models, digital and analog **Resource-efficiency** Saves time and money **Internet-reliance** Need internet connection to connect and interact **Multi-communicability** Different platforms and channels	-**Child-parent** Care and compassion Tutor takes the role of carer – minimal reference to this type of student-tutor relationship	MOVES: Present Question Comment Adapt Reflect MODES: Negotiation and application Exploration and reflection METHODS: -**Reflection** Reflection-on-interaction Reflection-on-interaction Not reflection-in-action -**Navigation** Wayfindig ito turn-taking and timing and use of webinar technology

3. Addendum 3: Notations

3.1 Notation Crit 1

episode	turn	person	MOVES	METHODS	MODES	Crit 1
	1	T2	[new slide]	NAVIGATION*		
	2	T1		NAVIGATION*		
	3	S		NAVIGATION*		
	4	T2		NAVIGATION*		
	5	S		SOCIALISATION*		
a	6	T1		SOCIALISATION*		
	7	T2		SOCIALISATION*		
	8	T1		SOCIALISATION*		
	9	T2		NAVIGATION*		
	10	S		NAVIGATION*		
	11	T1		NAVIGATION*		
	12	T2		NAVIGATION*		
	13	S	presents conception as product	ARTICULATION	Abstract conceptualisation	
	14	T2		NAVIGATION*		
b	15	S	presents conception as product [new slide]	ARTICULATION	Abstract conceptualisation	
	16	T2	hints, comments [new slide]	ARTICULATION	Abstract conceptualisation	
	17	S	presents conception as product [new slide]	ARTICULATION	Abstract conceptualisation	
	18	T2	hints, comments	ARTICULATION	Abstract conceptualisation	
	19	T1		NAVIGATION*		
	20	T2		NAVIGATION*		
	21	T1		NAVIGATION*		
c	22	S		NAVIGATION*		
	23	T2		NAVIGATION*		
	24	S		NAVIGATION*		
	25	T2	[new slide]	NAVIGATION*		
d	26	S	action towards goal [markings]	ARTICULATION	Abstract conceptualisation	
	27	T2	feedback on action	ARTICULATION	Abstract conceptualisation	
	28	S		NAVIGATION*		
e	29	T2		NAVIGATION*		
	30	S		NAVIGATION*		
	31	T2		NAVIGATION*		
	32	S	presents conception as product [markings]	ARTICULATION	Abstract conceptualisation	
	33	S	comments*	NAVIGATION*		
f	34	T2	[markings]	NAVIGATION*		
	35	S	presents conception as product [markings]	ARTICULATION	Abstract conceptualisation	
	36	T	hints, comments	ARTICULATION	Abstract conceptualisation	
	37	S	action towards goal [markings]	ARTICULATION	Concrete experience	
g	38	T2	feedback on action [new slide]	ARTICULATION	Concrete experience	
	39	S	action towards goal [markings]	ARTICULATION	Concrete experience	
	40	T2	reflects on learning practice [markings]	COACHING REFLECTION	Reflective observation	
	41	S	comments*	ARTICULATION	Abstract conceptualisation	
	42	T2	adapts task goal [points and markings]	SCAFFOLDING EXPLORATION	Active experimentation	
	43	T1	hints, comments	ARTICULATION	Concrete experience	
h	44	T2	reflects on learning practice [pen moving]	MODELING REFLECTION	Reflective observation	
	45	T1	adapts task goal [markings]	SCAFFOLDING EXPLORATION	Active experimentation	
	46	S	revises action	ARTICULATION	Concrete experience	
	47	T1	adapts task goal	MODELING EXPLORATION	Active experimentation	
	48	S	adapts practice	EXPLORATION	Active experimentation	
	49	T1	adapts task goal	MODELING EXPLORATION	Active experimentation	
	50	S	comments*	ARTICULATION	Concrete experience	
i	51	T1	feedback on action	SCAFFOLDING ARTICULATION	Concrete experience	
	52	S	revises action	ARTICULATION	Concrete experience	
	53	T1	feedback on action	ARTICULATION	Concrete experience	
	54	T2	reflects on learning practice [markings]	SCAFFOLDING REFLECTION	Reflective observation	
j	55	S	adapts practice [markings]	MODELING EXPLORATION	Active experimentation	
	56	T2	reflects on learning practice	SCAFFOLDING REFLECTION	Reflective observation	
	57	S	revises action	ARTICULATION	Concrete experience	
	58	T2	feedback on action	ARTICULATION	Concrete experience	
k	59	T1	hints, comments	ARTICULATION	Concrete experience	
	60	T2	feedback on action	COACHING ARTICULATION	Concrete experience	
	61	T1	hints, comments	COACHING ARTICULATION	Concrete experience	
	62	T2	hints, comments	ARTICULATION	Concrete experience	
	63	S		SOCIALISATION*		
	64	T1		SOCIALISATION*		
	65	S		SOCIALISATION*		
l	66	T2		SOCIALISATION*		
	67	T1		SOCIALISATION*		
	68	S		SOCIALISATION*		
	69	T2		SOCIALISATION*		

3.2 Notation Crit 2

episode	turn	person	MOVES	METHODS	MODES	Crit 2
a	1	T2		NAVIGATION*		
	2	T1 [new slide]		NAVIGATION*		
	3	T2		SOCIALISATION*		
	4	S		SOCIALISATION*		
	5	T2		SOCIALISATION*		
	6	S [tests pen]		NAVIGATION*		
	7	T1		NAVIGATION*		
	8	S		NAVIGATION*		
	9	T2		NAVIGATION*		
	10	S		SOCIALISATION*		
	11	T2		SOCIALISATION*		
	12	S [new slide]		SOCIALISATION*		
	13	T2 [new slide]		NAVIGATION*		
b	14	S	presents conception as product	ARTICULATION	Abstract conceptualisation	
	15	T2	hints, comments	ARTICULATION	Abstract conceptualisation	
c	16	S		NAVIGATION*		
	17	T2 [new slide]		NAVIGATION*		
	18	S	adapts practice [new slide]	ARTICULATION	Active experimentation	
	19	T2	feedback on action	ARTICULATION	Concrete experience	
	20	S [new slide]		NAVIGATION*		
	21	T2		NAVIGATION*		
d	22	S	presents conception as product	ARTICULATION	Abstract conceptualisation	
	23	T2	hints, comments	ARTICULATION	Abstract conceptualisation	
	24	S	presents conception as product [new slide]	ARTICULATION	Abstract conceptualisation	
	25	T1	hints, comments	COACHING ARTICULATION	Abstract conceptualisation	
	26	S	comments*	ARTICULATION	Abstract conceptualisation	
	27	T1		NAVIGATION*		
	28	S	presents conception as product [new slide]	ARTICULATION	Abstract conceptualisation	
	29	T1	hints, comments [new slide]	ARTICULATION	Abstract conceptualisation	
e	30	S	adapts practice [new slide]	EXPLORATION	Abstract conceptualisation	
	31	T2	hints, comments	COACHING ARTICULATION	Concrete experience	
	32	T1	hints, comments	COACHING ARTICULATION	Concrete experience	
	33	S		NAVIGATION*		
	34	T1		NAVIGATION*		
	35	S	adapts practice [markings]	EXPLORATION	Active experimentation	
	36	T2	feedback on action [markings]	MODELING ARTICULATION	Concrete experience	
	37	S	revises action	REFLECTION	Concrete experience	
f	38	T2	adapts task goal [markings]	SCAFFOLDING EXPLORATION	Active experimentation	
	39	S	reflects on practice*	REFLECTION	Reflective observation	
	40	T1	adapts task goal	MODELING EXPLORATION	Active experimentation	
g	41	S	comments*	ARTICULATION	Concrete experience	
	42	T1	hints, comments	ARTICULATION	Concrete experience	
	43	S	reflects on feedback [markings]	REFLECTION	Reflective observation	
	44	T1	hints, comments	ARTICULATION	Concrete experience	
	45	T2	reflects on learning practice [markings]	SCAFFOLDING REFLECTION	Reflective observation	
	46	S	reflects on feedback	REFLECTION	Reflective observation	
	47	T1	reflects on learning practice	MODELING ARTICULATION	Reflective observation	
	48	S	comments*	ARTICULATION	Concrete experience	
	49	T1	hints, comments	ARTICULATION	Concrete experience	
	50	S	action towards goal	ARTICULATION	Concrete experience	
	51	T1	hints, comments	ARTICULATION	Concrete experience	
	52	T2 [new slide]		NAVIGATION*		
	53	S		NAVIGATION*		
h	54	T2	questioning, prompting*	MODELING ARTICULATION	Concrete experience	
	55	S	action towards goal	ARTICULATION	Concrete experience	
	56	T2	hints, comments	ARTICULATION	Concrete experience	
	57	T1	questioning, prompting*	MODELING ARTICULATION	Concrete experience	
	58	S	comments* [markings by T]	ARTICULATION	Concrete experience	
	59	T1	[start of turn 61]	ARTICULATION		
	60	S	comments* [markings by T]	ARTICULATION	Concrete experience	
i	61	T1	adapts task goal	SCAFFOLDING EXPLORATION	Active experimentation	
	62	S	comments* [markings by T]	ARTICULATION	Concrete experience	
	63	T2	questioning, prompting* [markings]	MODELING ARTICULATION	Concrete experience	
	64	S	action towards goal	ARTICULATION	Concrete experience	
	65	T1	hints, comments	ARTICULATION	Concrete experience	
	66	T2	hints, comments	ARTICULATION	Concrete experience	
	67	T1	hints, comments	ARTICULATION	Concrete experience	
	68	T2	adapts task goal [pen moving and pointing]	EXPLORATION	Active experimentation	
	69	T1	feedback on action	COACHING ARTICULATION	Concrete experience	
	70	T2	hints, comments	ARTICULATION	Concrete experience	
	71	T1		NAVIGATION*		
	72	T2 [new slide]		NAVIGATION*		
	73	T1	hints, comments	COACHING ARTICULATION	Concrete experience	
j	74	S	reflects on feedback	REFLECTION	Reflective observation	
	75	T1	hints, comments	ARTICULATION	Abstract conceptualisation	
	76	T2	hints, comments	COACHING ARTICULATION	Abstract conceptualisation	
	77	S	reflects on feedback	REFLECTION	Reflective observation	
	78	T2	hints, comments	SCAFFOLDING ARTICULATION	Abstract conceptualisation	
	79	T1	presents concept	SCAFFOLDING ARTICULATION	Abstract conceptualisation	
	80	T2		NAVIGATION*		

3.3 Notation Crit 3

episode	turn	person	MOVES	METHODS	MODES
a	1	T1		NAVIGATION*	
	2	S		NAVIGATION*	
	3	T1		NAVIGATION*	
	4	T2		NAVIGATION*	
	5	S		NAVIGATION*	
	6	T2		NAVIGATION*	
	7	S		NAVIGATION*	
	8	T2		NAVIGATION*	
	9	S		NAVIGATION*	
	10	T2		NAVIGATION*	
b	11	S	presents conception as product [new slide]	ARTICULATION	Abstract conceptualisation
	12	T2		NAVIGATION*	
	13	S		NAVIGATION*	
	14	T1		NAVIGATION*	
	15	S	presents conception as product [markings by T]	ARTICULATION	Abstract conceptualisation
	16	T1	hints, comments	ARTICULATION	Abstract conceptualisation
	17	S	presents conception as product [T pen moves]	ARTICULATION	Abstract conceptualisation
	18	T1	hints, comments	ARTICULATION	Abstract conceptualisation
	19	S		NAVIGATION*	
	20	T2		NAVIGATION*	
	21	S	presents conception as product [T markings]	ARTICULATION	Abstract conceptualisation
c	22	S		NAVIGATION*	
	23	T2		NAVIGATION*	
	24	S	action towards goal [new slide]	ARTICULATION	Concrete experience
	25	T2		NAVIGATION*	
	26	S		NAVIGATION*	
	27	T2		NAVIGATION*	
	28	S	action towards goal [markings]	ARTICULATION	Concrete experience
	29	T2	hints, comments	NAVIGATION	Concrete experience
	30	S	action towards goal [markings]	ARTICULATION	Concrete experience
	31	T1		NAVIGATION*	
	32	S		NAVIGATION*	
	33	T2		NAVIGATION*	
d	34	S	presents concept as product [new slide]	SCAFFOLDING ARTICULATION	Abstract conceptualisation
	35	T2	hints, comments	ARTICULATION	Abstract conceptualisation
	36	S	adapts practice [markings]	EXPLORATION	Active experimentation
	37	T1	feedback on action	COACHING ARTICULATION	Concrete experience
e	38	S		SOCIALISATION*	
	39	T1		SOCIALISATION*	
	40	S		SOCIALISATION*	
f	41	T2	reflects on learning practice [markings]	SCAFFOLDING REFLECTION	Reflective observation
	42	S	adapts practice	EXPLORATION	Active experimentation
	43	T1	adapts task goal	MODELING EXPLORATION	Active experimentation
	44	T2	reflects on learning practice [markings]	MODELING REFLECTION	Reflective observation
	45	S	adapts practice	EXPLORATION	Active experimentation
	46	T1	adapts task goal	MODELING EXPLORATION	Active experimentation
	47	T2	adapts task goal [markings]	MODELING EXPLORATION	Active experimentation
g	48	T1		NAVIGATION*	
	49	T2		NAVIGATION*	
h	50	T1	hints, comments	SCAFFOLDING ARTICULATION	Concrete experience
	51	T2	hints, comments	SCAFFOLDING ARTICULATION	Concrete experience
	52	T1	hints, comments	SCAFFOLDING ARTICULATION	Concrete experience
	53	S	comments*	ARTICULATION	Concrete experience
	54	T1	hints, comments	COACHING ARTICULATION	Concrete experience
	55	T2	hints, comments	COACHING ARTICULATION	Concrete experience
	56	S	comments*	ARTICULATION	Concrete experience

4. **Letter of Consent for Participants**

5. **Template for Focus group interviews**

6. **Template for online surveys**