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INFORMATION BEHAVIOUR IN ACADEMIC SPACES OF CREATIVITY: A BUILDING SCIENCE PSEUDO-MAKERSPACE

by

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RESEARCHER DECLARATION OF ORIGINALITY

I declare that the mini-dissertation: **Information Behaviour in Academic Spaces of Creativity: a Building Science Pseudo-Makerspace**, which I hereby submit for the degree **Master of Information Technology** at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution. The author, whose name appears on the title page of this mini-dissertation, obtained the applicable research ethics approval to conduct the research described in this work. The author declares that she has observed the ethical standards required in terms of the University of Pretoria's *Code of ethics for researchers* and the *Policy guidelines for responsible research.*

Signed: xxxxx Date: 2017-01-01

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ABSTRACT

In the past decade, the maker or Do-It-Yourself (DIY) movement has been booming worldwide as the latest re-imagination of creative spaces, especially for STEAM education (science, technology, engineering, arts and mathematics) and libraries. Limited literature is available on information behaviour and creative spaces such as makerspaces. This study reports on the information behaviour of a group of architecture students in using various physical spaces, which were approached as a pseudo-makerspace in this study, to produce creative design projects. An exploratory research study exploring third-year architecture students' information behaviour, attitudes and interactions when using a makerspace for tasks of creativity in an academic institution was conducted.

The main research question was: *Which information activities and information interactions feature in the information behaviour of architecture students during the design stages of a project?*

A selection of documents based on makerspaces and architecture in relation to information behaviour and creativity were analysed for the literature review. The empirical component of the study focused on the architecture students' information activities and interactions during a third-year design project, how the students drew on their personal experiences and resources during their projects, how their curriculum influenced their information behaviour, on resources to inspire creativity, on physical spaces (i.e. the space of creativity) for finding solutions and to be creative, and the role of libraries too in supporting the students during the design stages of their projects in spaces of creativity. Data was collected in September and October 2016. Maniotes' (2005) third space in guided inquiry model served as a theoretical framework for the research.

A mixed methods research approach was used. Quantitative data were collected through a self-administered online (web-based) profile questionnaire, and qualitative data through individual self-administered semi-structured interviews with the acting head of department, a lecturer and nineteen third-year architecture students. Quantitative data were analysed using Google Forms and Excel, and the qualitative data through thematic analysis. A purposive sampling method was used for the selection of three participating groups from a leading South African university and

department of architecture, namely: (1) acting head of department, (2) lecturer and (3) third-year architecture students.

Findings from the exploratory study revealed: creativity was noted as being extremely important during the completion of architecture projects, as was the importance of information resources in stimulating creativity. The students' preference for working individually during their design projects was prominent, but on the other hand collaboration for idea and solution generation and sharing with peers and lecturers was also highly advocated. Lastly, it was found that a range of theoretical, technical, artistic and practical skills and knowledge must be integrated to produce creative outcomes.

Recommendations for theory, practice and further research included assessing how components and elements from information behaviour models such as Kuhlthau's (1991) information search process (ISP) model can be incorporated in the third space and guided inquiry model (Maniotes 2005). Creativity models such as Webster's (2002) model of creative thinking or Velikovsky's (2012) creative practice theory model can also be integrated. Furthermore, incorporating context-sensitive support or guidance during the various design stages in spaces of creativity, and the skills and competencies of library and information science professionals should be more prominently highlighted and advertised in spaces of creativity. Lastly, information literacy training programmes should be integrated in creative spaces, including visual, media and digital literacy training.

LIST OF ABBREVIATIONS AND ACRONYMS

ACRL	Association of College Research Libraries
DIY	Do-It-Yourself
EBIT	Engineering, Built Environment and Information Technology
IB	Information Behaviour
IL	Information Literacy
IR	Information Retrieval
ISP	Information Search Process
LIS	Library and Information Science
STEAM	Science, Technology, Engineering, Arts and Mathematics

TABLE OF CONTENTS

CHAPTER 4: DATA ANALYSIS AND REPORTING RESEARCH FINDINGS

CHAPTER 5: FINDINGS, RECOMMENDATIONS, SUGGESTIONS FOR FURTHER RESEARCH AND CONCLUSION

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF GRAPHS

CHAPTER 1: INTRODUCTION AND BACKGROUND OF THE RESEARCH PROBLEM

1.1 INTRODUCTION

Many questions have been raised about makerspaces in the literature of various disciplines ranging from arts and crafts (Barniskis, 2014[1]; Daley & Child, 2015; Peppler & Bender, 2013) to education and library and information science (Burke, 2014, 2015; Koh & Abbas, 2015; Rivas, 2014). What is a makerspace? What is the value of a makerspace to students? Where is the science in a makerspace? What is the purpose of a makerspace in the context of a library? Why are makerspaces important for teaching and learning? These are the type of questions raised throughout academic institutions, resulting in the pursuit of the true meaning of makerspaces (Bowler, 2014; Canino-Fluit, 2014; Colegrove, 2013; McLaughlin, 2014), and inquiry into the potential of makerspaces in academic departments and libraries. Makerspaces are mostly portrayed as "a place where people come together to create and collaborate, to share resources, knowledge, and stuff" (Britton, 2012: 30).

"The whole art of teaching is only the art of awakening the natural curiosity of young minds for the purpose of satisfying it afterwards" (France, 1920: n.p. [2]). For some the key to fruitful teaching and learning in the 21st century lies in the creative spirit and innovative thinking of students, which can be facilitated by makerspaces to stimulate innovation, hands-on practice with technology, and developing social skills (Koh & Abbas, 2015: 115). Anderson (2011: n.p.) notes that to comprehend information in the context of the 21st century, one must take into consideration human behaviour and technology.

"Some information-related behavior is truly creative in its origins – it is not driven by the need to provide a response to a situation" (Case, 2007: 328). People often seek information to solve problems, make decisions or to find explicit answers to specific questions through a constructive approach to learning. Creativity and innovation may even enter the picture to provide the solution to an information need. Anderson (2011: n.p.) speaks about the "eureka moment" which emphasises the influential role that information and more precisely the

[1] In-text references are arranged alphabetically according to the authors' surnames.
[2] n.p. – No page number due to being an electronic source from the internet.

contexts of our activities with information play in research, innovation and other kinds of creativity. For that reason, Case (2007: 163) notes that creativity is well worth exploring in association to information behaviour. Makerspaces as additional spaces for creativity can provide an appropriate physical space along with other means of support (Provenzano, 2015: n.p.).

Reading the work of Hira, Joslyn and Hynes (2014) and Kurti, Kurti and Fleming (2014a), some questions come to mind: can makerspaces be used with constructive learning approaches in an academic learning and information context?; can there be a formation of a learning space (makerspace) where a student's world (i.e. personal knowledge) meets the curriculum (i.e. tertiary education) to form a third space (i.e. development of innovation through deep learning)?; and how can this be linked to the use of information sources? It is important to note that some physical spaces, especially that support learning in the 21st century, might not be called makerspaces (Davee, Regalla & Chang, 2015; De Boer, 2015; Harris, 2010).

Tertiary academic learning seems abstract or irrelevant and immaterial. But what if the third space concept, grounded on guided inquiry-based learning, as envisioned by Kuhlthau, Maniotes and Caspari (2007, 2012, 2015), could offer a meaningful intersection? The intersection forms between a student's personal experiences and knowledge outside school or university (first space) and a student's tertiary curriculum (second space) inside school or university to create a dynamic learning space. Within this learning space (known as the third space) literary, intellectual, expressive and social or emotional learning could arise (Kuhlthau & Cole, 2012; Kuhlthau, Maniotes & Caspari, 2007, 2012; Maniotes, 2005; Mills, Knezek & Khaddage, 2014), as well as, information channels, information resources and library support services could be provided. Against the latter, an understanding of human information behaviour (HIB) could support the creative learning and teaching occurring within these dynamic learning space.

1.2 BACKGROUND INFORMATION

In some academic disciplines, such as architecture, creativity is very significant (Sidawi, 2013; Tzonis, 2014). These disciplines require special spaces and tools (Dayaratne, 2013; Shaaban, Lockley & Elkadi, 2001; Siestrzewitowska, 2015). Alomar (2003: 12) explains that "creativity is a kind of socially recognized achievement", acknowledging the social, psychological and

contextual needs of the individuals generating creative ideas. Even more notably, Alomar (2003: 3, 6) indicates the significance of adequate access, use and sharing of information in working spaces during idea generation in architectural projects. For some academic disciplines, such as architecture, there might be a lesser need for intervention but a stronger need for access, process and representing of information resources (Alomar, 2003: 3). Many authors, such as Dayaratne (2013), Sidawi (2013), and Szabó, Mutic and Szamosközi (2015), state the importance of creativity in architectural education and the use of supportive spaces (e.g. design studios). However, no explicit mention of makerspaces was noted in the architecture literature.

"Creativity is a valuable resource -- and a makerspace is the perfect tool to enhance and harness it" (Provenzano, 2015: n.p.). Makerspaces have been flourishing all around the world, in school, public or academic libraries or outside the library in community working spaces, providing individuals with tools, expertise, guidance and valuable skills to construct, tinker, design and invent (Abram, 2013; Fisher, 2012; Hatch, 2014; Kelly, 2013). Fisher (2012: n.p.) believes that makerspaces emerged about 2005 as an offshoot of the Do-It-Yourself (DIY) movement. Lotts (2015b: 409) states that the DIY movement has contributed towards the advancement of makerspaces. He notes that the history of making centric spaces began in New York as early as 1873 (Lotts, 2015b: 409). Makerspaces were born out of the early hackerspaces, which were shared spaces, where computer programmers would meet to work and share knowledge (Abram, 2013; Kelly, 2013; Slatter & Howard, 2013). Kelly (2013: n.p.) explains that the change from hackerspace to makerspace was attributed to marketing, as the word "hacker" had negative connotations, whereas the more accurate term "maker" does not. Consequently, the terms makerspace and hackerspace are used interchangeably (Abram, 2013; Kelly, 2013).

Studying the makerspace literature, one comes across various terms for makerspaces such as makerhoods, medialabs, makelabs, hacklabs, learning labs, fab labs, tech workshops, hackerspaces, creative spaces, content-creation spaces and co-working spaces (Abram, 2013; Kelly, 2013; Koh & Abbas, 2015; Slatter & Howard, 2013).

> "Making is fundamental to what it means to be human. We must make, create, and express ourselves to feel whole. There is something unique about making physical

things. Things we make are like little pieces of us and seem to embody portions of our soul" (Hatch, 2014: 11).

Makerspaces are ideal in academic disciplines, especially where creativity is important to nurture independent exploration and support inquiry-based learning (Hatch, 2014). Guided inquiry is the process of carefully planned and supervised intervention by a teacher to guide students throughout the process of inquiry to construct a higher level of thinking and personal understanding (Kuhlthau, Maniotes & Caspari, 2007: 28; Kuhlthau, 2010: 20). Kuhlthau, Maniotes and Caspari (2015: 53) indicate that "guided inquiry is based on principles of *constructivist learning*, the need to create *third space* for optimal learning, and Kuhlthau's model of the information search process (ISP) describing the dynamic process of learning from a variety of sources". Against the preceding definition, guided inquiry can be useful in any information behaviour study involving creative spaces, as it consists of and indicates associations to these three main concepts:

i. **Constructivist learning:** The constructive process of guided inquiry establishes a zone of intervention, which was modelled on Vygotsky's zone of proximal development (1978). Kuhlthau (1994: 62) writes that "this concept provides a way for understanding intervention into the constructive process of another person". This is important since architectural training is often based on the student understanding a concrete problem fully to devise a solution (Asasoglu, Gur & Erol, 2010: 3539).
ii. **Third space:** Guided inquiry helps educators and librarians to recognise when students require assistance and guidance by building on what the student already knows (*student's world – first space)* and actively learns (*tertiary curriculum – second space*), thus constructing a dynamic learning and teaching space called the *third space* (Kuhlthau, Maniotes & Caspari, 2007, 2012, 2015; Maniotes, 2005). For an information behaviour study at an academic institution, it is important to note the supporting role required from academic staff and libraries.
iii. **The ISP model of Kuhlthau (1991):** Supports guided inquiry by providing a theoretical basis for exploring information-seeking attitudes and behaviour (Kuhlthau, Maniotes & Caspari, 2007; Mills, Knezek & Khaddage, 2014). Kuhlthau's information search process Model (Figure 1.1) exemplifies a dynamic learning environment to solve complex tasks from a holistic experience (i.e. feelings (affective), thoughts (cognitive)

and actions (physical)) during six information- seeking stages, namely: initiation, selection, exploration, formulation, collection, and presentation (Kuhlthau, 1991, 2013).

This model, as depicted in Figure 1.1, has been associated with constructivist learning, guided inquiry, information needs, and, more recently, the third space. The focus on feelings, thoughts, actions and the various stages associated with the ISP model, more specifically the information barriers that occur during the transition between Stage 3 (Exploration) and Stage 4 (Formulation) when students perform tasks, has been noted as important to investigate for information behaviour studies (Case & Given, 2016; Kuhlthau & Cole, 2012).

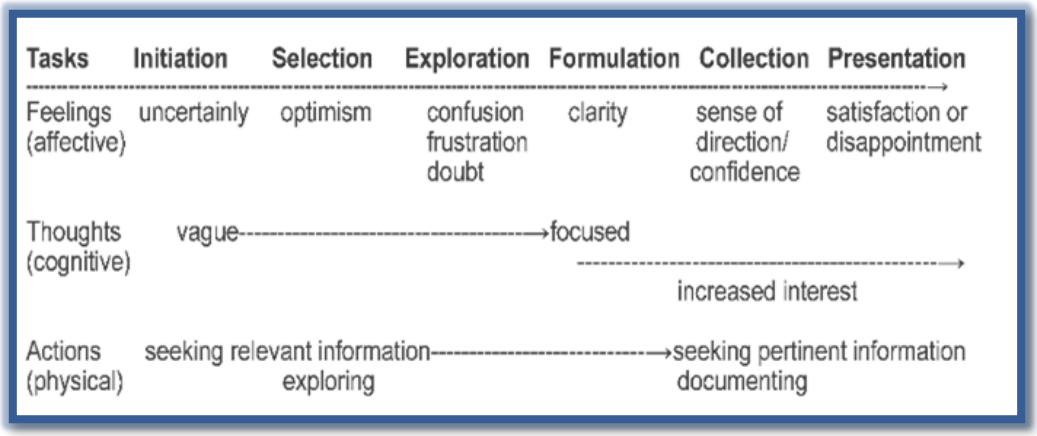


FIGURE 1.1: Kuhlthau's information search process (ISP) model (Kuhlthau 2004: 82)

Mills, Knezek and Khaddage (2014: 326) specify that in the educational context, students' information behaviour should be emphasised so that guided instructions, problem-solving, and intervention programmes can be provided. Against the preceding, Maniotes' (2005) third space in guided inquiry model (see Figure 1.2) indicates the importance of constructing an intersection between a student's first (current experience and knowledge) and second (tertiary curriculum) space to promote a guided learning environment. This was considered important in the background of this study. The prospective of a third space as a theoretical framework to extend physical makerspaces for higher levels of collaboration, social experiences and guidance outside the workplace, school or home (Koh & Abbas, 2015, Slatter & Howard 2013: 279), triggered the researcher's interest.

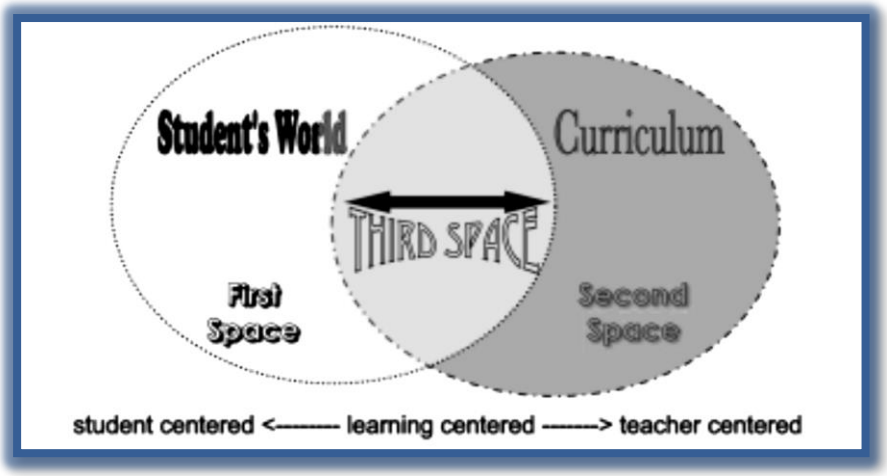


FIGURE 1.2: Maniotes' third space in guided inquiry model (Kuhlthau, Maniotes & Caspari, 2015: 26).

Maniotes' (2005) third space in guided inquiry model also acknowledges other researchers' models of information-seeking behaviour and theoretical frameworks such as Dervin's (1983) sense-making model, Wilson's (1999) model of information seeking, Savolainen's (1995) everyday life information-seeking model, Ellis's (1989) work on different information-seeking activities, and Taylor's levels of information need (1968) and information use environments (1991). Little explicit evidence of makerspaces being associated with third space has been noted in the information behaviour literature (Slatter & Howard, 2013). This prompted the exploration of the potential link between academic makerspaces as a creative space through a third space framework.

1.3 PROBLEM STATEMENT AND SUB-QUESTIONS

Against the preceding introduction and background, it seems as if makerspaces hold the potential for academic institutions and libraries to be approached as a creative space facilitating a third space for intervention in design projects. This can include support from academic staff and the wider academic context, and may be applied to creative spaces not specifically labelled as makerspaces.

Problem statement: For effective support of information needs, an understanding of information behaviour is required. As a result, the exploratory study will investigate the information behaviour of architecture students, specifically their information activities and

interactions, during the design stages of a project. For example, information seeking (as depicted in Figure 1.1) although there are many phases in design projects (such as defining a problem, brainstorming, research, idea generation, design, prototype, evaluate and communication (Olson, 2011)). The design stage is of interest for architecture students as this stage reveals the transformation from the realm of ideas to physical form (Idi & Khaidzir, 2015).

Main research question: Which information activities and information interactions feature in the information behaviour of architecture students during the design stages of a project?

Sub-questions to be answered from the literature:

- What has been reported on the information behaviour of architecture students?
- What has been reported on information behaviour and creativity?
- What has been reported on information behaviour and makerspaces?
- Which characteristics of makerspaces can be allied to spaces of creativity?

Sub-questions to be answered empirically:

- Which information activities and interactions of architecture students are revealed during the design stages of a project?
- How do architecture students draw on their personal experiences and resources during design projects?
- How does their architecture curriculum influence their information behaviour during the design stages of a project?
- On which resources do they draw to inspire creativity?
- How do the physical spaces (i.e. the space of creativity) help them in finding solutions and being creative?
- What role can the library play in supporting architecture students during the design stages of their projects in spaces of creativity?

1.4 PURPOSE, OBJECTIVES AND VALUE OF THE STUDY

The researcher's intention was to explore students' information behaviour, attitudes and interactions when using a makerspace as a third space for tasks of creativity within an academic institution. More specifically, the researcher focused on a third space as portrayed in the work of Maniotes (2005) and guided inquiry as portrayed by Kuhlthau, Maniotes and Caspari (2007, 2012, 2015). The wider goal of the study was to explore which information activities feature in the information behaviour of third-year architecture students during creative tasks in academic spaces. The findings will be used to advise tertiary institutions and libraries on how academic spaces of creativity can kindle information activities such as independent exploration, critical thinking and use of information resources and information literacy skills; how tertiary institutions and libraries can facilitate an inventive, creative and dynamic academic learning space; and how architecture students can benefit from these spaces. The purpose is also to comment on the relevance of third space, as a theoretical framework, to support an information behaviour lens, and to comment on the potential of guided inquiry to aid architecture students in converting their theoretical knowledge into practical applications during creative endeavours.

1.5 DEMARCATION

Demarcation in research provides a line, boundary, or other conceptual separation between specific areas, groups and categories (Barab & Squire, 2016). For the purposes of this study, topical, geographical and contextual demarcation will be discussed.

- **Topical demarcation:** The utilisation of spaces of creativity such as makerspaces in an academic learning and information context; specifically, from an information behaviour and information activity perspective.
- **Geographical demarcation:** South Africa.
- **Contextual demarcation:** Academic context; specifically, in the building science discipline, which is related to architecture. Other related art and design disciplines (which might display similar information behaviour) were excluded for the purposes of this study.

1.6 LIMITATIONS

Academic library makerspaces focusing on library and information science education, especially in South Africa, are still in an exploratory phase, given that the field of "making" and makerspaces only emerged around 2005. As a result, the makerspace literature regarding academic institutions, and library and information services, with a specific focus on information behaviour and information literacy, is still limited. Moreover, makerspaces are places of rapid development and so the investigation of this research problem and measurement of change or stability within the designed experiment may be overtaken by events. Lastly, the students who were to participate in the research covered a range of ages, backgrounds, and disciplines, but it was expected that only a small number of students with experience of makerspaces would participate.

1.7 CLARIFICATION OF TERMS

1.7.1 Creativity

"Creativity is a natural gift and part of the wholeness *(gestalt)* of every individual" (Goodman & Dingli, 2013: 54). Alomar (2003: 4) notes "the act of 'making' or 'doing' which we call 'creative'; the products: a poem, a play, a painting, a piece of music, or sketches for buildings of structures under contemplation, the product of imagination; this is what refer to as 'creation'". Naiman (2014: n.p.), founder of Creativity at Work, explains that "creativity is characterised by the ability to perceive the world in new ways, to find hidden patterns, to make connections between seemingly unrelated phenomena, and to generate solutions". For the purpose of this study, creativity is defined as the "act of turning new and imaginative ideas into reality" by "re-examining assumptions and re-interpreting facts, ideas and past experiences" (Goodman & Dingli, 2013: 54; Naiman, 2014: n.p.).

1.7.2 Information behaviour

Information behaviour can be defined as the "human behaviour dealing with generation, communication, use and other activities concerned with information, such as information-seeking behaviour and interactive IR" (Ingwersen & Järvelin, 2005: 384). Likewise, Fisher and Julien (2009: 317) write that information behaviour focuses on individuals' information needs; specifically how they seek, manage, give and use information, actively and/or passively, in

their various roles in their daily lives. Bates (2010: 2381) notes that information behaviour can be explained as people's interaction with information. Information behaviour can be considered as any activities in which students interact with information such as information seeking, information searching, information retrieval (IR), information use and giving, information transfer and exchange, communication of information, and the acknowledgment or discard of information needs (Case, 2007; Fisher & Julien, 2009; Pettigrew, Fidel & Bruce, 2001; Savolainen, 2007; Wilson, 1997, 1999). For purposes of this study, the following operational definition by Wilson (1999: 249) is accepted, namely: information behaviour is "those activities a person may engage in when identifying his or her own needs for information, searching for such information in any way and using or transferring that information".

1.7.3 Information literacy

Julien and Barker (2009: 12) explain that the term "information literacy" refers to "the set of skills required to identify information sources, access information, evaluate it, and use it effectively, efficiently, and ethically". Kuhlthau, Maniotes and Caspari (2015: 68) define information literacy as "the ability to locate, evaluate, and use information wisely in a wide range of situations". For purposes of this study the following operational definition is accepted from the Association of College Research Libraries (ACRL) (2000: 2), namely: "information literacy has been generally defined as an understanding and set of abilities enabling individuals to recognize when information is needed, and to have the capacity to locate, evaluate, and use effectively the needed information" (Chen & Lin, 2011: 401). Makerspaces have been noted as interconnected information resource and service spaces (Fourie & Meyer, 2015), signifying a potential connection between the information resources available throughout academic institutions and libraries, and information literacy skills training usually offered.

1.7.4 Guided inquiry

Guided inquiry can prepare students for learning and living in the 21st century by guiding them in the process of discovery and learning from an assortment of information resources and services (Kuhlthau, Maniotes & Caspari, 2015: 3). Kuhlthau (2010: 23) notes that guided inquiry present the grounds for a constructivist approach to learning, which is an active,

continuing process of learning and constructing knowledge for a deeper understanding (Kuhlthau, Maniotes & Caspari, 2015: 15).

Linked to the concept of guided inquiry is guided inquiry learning, and as this study focuses on academic institutions, learning and education, it is important also to note guided inquiry learning. Kuhlthau, Maniotes and Caspari (2015: 4) explain that guided inquiry learning highlights personally related questions that encourage students to learn further and construct distinctive methods of sharing what they have learned: "guided inquiry raises the bar even further to move students to deeper learning by incorporating the research process explicitly into their work" (Kuhlthau, Maniotes & Caspari, 2015: 4). So guided inquiry is an approach to learning (known as guided inquiry learning) which encourages students to question and explore by finding and using an assortment of information resources and services to formulate new ideas or to increase their understanding of a particular area (Kuhlthau, Maniotes & Caspari, 2015: 4). For the purpose of this study the definition of Kuhlthau, Maniotes and Caspari (2015: 3) is used, namely: guided inquiry "is a way of teaching and learning that changes the culture of a school into that of a collaborative Inquiry Community". For purposes of this study, the definition is applied to a university as an institution of higher education.

1.7.5 Makerspace

A makerspace is "a place where individuals meet to access materials, tools, and technologies that allow for hands-on exploration" Fisher (2012: n.p.). Similarly, Kelly (2013: 2) defines a makerspace as a "community-oriented space where people gather to create, make, and learn using a variety of tools". For the purpose of this study a makerspace is defined as a "learning environment rich with opportunities that serve as gathering points where communities of new and experienced makers connect to work on real and personally meaningful projects, informed by helpful mentors and expertise, using new technologies and traditional tools" (Maker Media, 2013:1).

1.7.6 Third space

Kuhlthau and Cole (2012: 1) note that a third space can be defined as "an intersection zone between the school curriculum and the student's knowledge and ways of knowing, creating a dynamic conception of the learning space that involves the student's outside-the-classroom

knowledge". Kuhlthau, Maniotes and Caspari (2007: 32) explain that a third space provides a particular kind of adaptable learning space where "students can construct new worldviews rather than having to take on the teacher's perspective or those mandated by the curriculum or textbooks". For purposes of this study, third space serves as a theoretical framework to inform the information activities and interactions that occur among architecture students during design projects in creative spaces.

1.8 LITERATURE OVERVIEW

Makerspaces as a promising ground for facilitating dynamic learning and teaching spaces have been flourishing worldwide (Abram, 2013; Fisher, 2012; Peppler & Bender, 2013). Makerspaces are associated with instilling in students the skills and values that are embedded in resourcefulness, problem-solving, creativity, critical thinking, and technological and information literacy. There are many reports on the use of makerspaces to support studies in the STEM (science, technology, engineering and mathematics) disciplines (Abram, 2013; Barniskis, 2014; Burke, 2015; Hira, Joslyn & Hynes, 2014; Peppler & Bender, 2013). Makerspace and its related concepts, technologies and values are a trending topic of discussion in the library community, from public libraries to academic libraries (Burke, 2014, 2015; Koh & Abbas, 2015; Pryor, 2014). However, little has been published about information behaviour and the effectiveness of makerspaces as grounds for enabling information literacy programmes, or on the competencies and roles of Library and Information professionals to provide library and information services and resources in academic library makerspaces.

Studying the third space literature, one comes to the realisation that the concept of third space has been incorporated into various disciplines of practice, for example, leisure studies (Hollinshead, 1998; Purnell, 2015), urban environmental design (Soja, 1996; Tahmaseb-McConatha, 2015), tourism landscape (Fagence, 2014), literacy learning (Cook, 2005; Pane, 2007), learning and educational practices (Kuhlthau, Maniotes & Caspari, 2007, 2012, 2015; McDonough, 2014; Skattebol & Arthur, 2014), and library and information science (Chan & Spodick, 2014; Elmborg, 2011).

For the purpose of this study, the model of Maniotes (2005) third space guided inquiry, and Kuhlthau's (1991, 2004) six stage ISP model, guided inquiry, constructivism and zone of intervention, provide the theoretical basis for gaining a better understanding of individuals'

information-seeking behaviour in makerspaces as exemplary of spaces of creativity (Mills, Knezek & Khaddage, 2014: 326). Kuhlthau, Maniotes and Caspari's books (2007, 2012, 2015), which are based on Maniotes' (2005) third space in guided inquiry model suggest that educational social interaction and intellectual discourse in the students' third space can interconnect a student's experience (first space) and knowledge with curriculum (second space) to create a dynamic learning environment. Kuhlthau's (2007, 2010) work on guided inquiry notes the significance of the zone of intervention, which was modelled on Vygotsky's zone of proximal development (1978), to offer the desired interventions at critical points in the information-seeking processes of students to encourage personal learning and knowledge creation (Mills, Knezek & Khaddage, 2014: 324).

So the third space concept applied within makerspaces can produce zones of collaboration, learning and development to advance the underlying idea of intervention, in the form of guided inquiry, to create a dynamic and constructive teaching environment where fruitful information interactions among students can occur. This is true of students of architecture or in the case of this study, third-year students situated within the building science discipline.

1.9 RESEARCH DESIGN AND METHODOLOGY

1.9.1 Research methodology

This study employed a mixed methods research approach, which integrated elements of qualitative and quantitative research approaches, to explore the research question and sub-questions (Creswell, 2014: 3; Pickard, 2013: 18). A mixed methods approach benefited this study by providing a multi-method matrix for examining multiple approaches to data collection and analysis. The matrix captured numeric and narrative results when the information behaviour research was conducted (Creswell & Clark, 2011: 4). A more comprehensive discussion of the methodological approaches, collection methods and data analysis procedures is found in Chapter 3.

1.9.2 Research method

This is a case study of a leading South African university and department in the professional, research and applied sciences streams. According to Yin (2013: 16), a case study refers to the "empirical inquiry that investigates a contemporary phenomenon within its real-life context;

when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used". A case study research design provided a holistic view for this study and offered in-depth insight pertaining to the research questions (Pickard, 2013: 102).

1.9.3 Study population and sample

A purposive sampling method, which is a non-probability sampling method, was used. A specific group of 60 participants (third-year architecture students) in a specific context (the building science discipline) at a designated university in South Africa with an architecture department was invited to participate – specifically, students registered for a third year model in architectural design (Module Anonymous[3]). An interview with the acting head of department[4] and the associated lecturer for the module was also conducted.

1.9.4 Methods for data collection

Quantitative data was collected from all participants through self-administered online (web-based) profiling questionnaires. Qualitative data was collected from individual self-administered semi-structured interviews. The quantitative data from the questionnaires were statistically analysed using Microsoft Excel, while qualitative data from the individual interviews were analysed thematically after the audio recordings of interviews were transcribed using Dragon NaturallySpeaking 13 software.

1.9.4.1 *Profiling questionnaire*

A self-administered semi-structured online questionnaire, in the form of a Google Form, was used to obtain background information on the research participants, their information needs when using various physical spaces aligned with the characteristics of a makerspace (hence the term "pseudo-makerspace" in the title), their information-seeking behaviour, and their

[3]The actual module code and name was taken out and replaced with Module Anonymous to ensure anonymity of the participants and associated institution. In addition, the name of the institution and associated department will be replaced with a leading South African university and department of architecture when the information documents form part of the mini-dissertation to ensure anonymity. This is in accordance with the ethical clearance received from the institution.

[4] The acting head of department participated in the study on behalf of the head of department.

need for support from the library and library staff (Pickard, 2013: 209; Struwig & Stead, 2001: 41).

1.9.4.2 *Individual interviews*

Self-administered semi-structured individual interviews were used to investigate students' information activities and interactions, to obtain descriptions of the project design stages followed during creative tasks, the role of the physical spaces in solution finding and creativity, the use of information resources to inspire creativity, and other issues drawn from the literature reviews and inspired by third space as a theoretical framework. Overall, the researcher wanted to gain insights into the perceptions of the architecture students on the role of the various physical spaces provided in their department (which form a pseudo-makerspace) in solution finding and creativity, and their opinion of the role of library and information science professionals in providing information and information support in creative spaces.

1.9.5 Reliability and validity

Kumar (2011: 165) notes that the significance of any research rests on the correctness, quality, accuracy and credibility of its findings. Reliability refers to the degree of consistency and stability of measurement (Creswell, 2014: 149; Kumar, 2011: 181), while validity refers to the degree to which the empirical measurement adequately indicates the scientific soundness and appropriateness of the research design under consideration (Kumar, 2011: 166; Pickard, 2013: 136). While the researcher conducted the study, she was constantly apprehensive about how she can maintain the reliability and validity of her findings. For example, pilot-testing the research instruments to gain feedback to refine the final instruments for improved reliability and validity; guaranteeing confidentiality by not requesting respondents' names or other forms of identification; and lastly, providing a description of the research purposes to the participants to show the applicability and practical implications of the study (Cooper & Schindler, 2013: 225).

1.10 ETHICAL CLEARANCE

Ethical clearance for the researcher to carry out her study was obtained by a written application to the Faculty Committee for Research Ethics and Integrity, the dean of the faculty

where the research was conducted, the head of the department of architecture and the lecturer where the study took place, and the Research Committee of the Department of Information Science (University of Pretoria) (as the representatives of the institution that will grant the degree). The application included the questionnaire, three interview schedules, informed consent form, a letter of invitation and a signed research declaration (see Appendices A to G).

1.11 MINI-DISSERTATION STRUCTURE

The study is structured as follows:

- **Chapter 1 - Introduction:** This chapter offers an introduction to the dissertation with an overview and plan of the study that covers the background to the study; the problem statement, including the main question and its associated sub-questions; the research methodology; purpose, demarcation and limitations of the study; the clarification of key concepts; a brief literature review; and concludes with the dissertation structure.
- **Chapter 2 - Literature analysis:** This chapter offers an analysis of key issues relevant to the research problem. It reports on makerspaces and information behaviour studies related to makerspaces, on creativity and information behaviour studies related to creativity, explores makerspaces as spaces of creativity, discusses architecture and information behaviour studies related to architecture, and discusses the model selected for the theoretical framework for this study (i.e. Maniotes' (2005) third space in guided inquiry model).
- **Chapter 3 - Research methodology:** This chapter presents the research design and methodology applied in this study. It discusses the case study research design and gives details on the mixed methods data collection approach, instruments for data collection and data analysis such as the self-administered semi-structured individual interviews and semi-structured web-based questionnaire, and the steps taken to increase the validity and reliability of data, and adherence to ethical research conduct.
- **Chapter 4 - Data analysis and reporting research findings:** This chapter presents the analysis of the quantitative and qualitative data collected, and data triangulation and

application of the theoretical framework for this study (i.e. Maniotes' (2005) third space in guided inquiry model) to fit into the context of architectural education.

- **Chapter 5 - Findings, recommendations, suggestions for further research and conclusion:** This chapter offers a summary of findings and recommendations from the study in relation to the main research question and its sub-questions. It reaches an overall conclusion from the findings and presents the recommendations for theory and practice, as well as for further research.

1.12 CONCLUSION

Chapter 1 functioned as the introduction and background of the study, in particular stating the outline of the research problem with its associated research question and sub-questions. It briefly discussed the research design and methods that will be followed. This includes a case study research design using a mixed methods approach for collecting data by means of interviews, questionnaires and observation. The study's purpose, demarcation, limitations and key concepts were also presented. It concludes by explaining how the dissertation is structured.

CHAPTER 2: LITERATURE ANALYSIS

2.1 INTRODUCTION

This chapter offers the literature analysis for the study. The literature review should not merely aid in providing the research standpoint for the present study, but formulate a foundation for the empirical component of the study. This chapter discusses the significance of performing a literature review, the scope of the literature searches and search strategies, makerspaces and information behaviour studies related to makerspaces, creativity and information behaviour studies related to creativity, exploring makerspaces characterised as spaces of creativity, architecture and information behaviour studies related to architecture, and lastly, the relevance of applying the third space framework as an information behaviour lens for architecture.

2.2 THE SIGNIFICANCE OF PERFORMING A LITERATURE REVIEW

A literature review can be defined as "a written document that presents a logically argued case founded on a comprehensive understanding of the current state of knowledge about a topic of study" (Machi & McEvoy, 2016: 5). They note that the literature review process is a structured and systematic method to study a selected topic (*ibid*). Two approaches can be taken to a literature review, namely: *a simple literature review* (i.e. the significance of this approach is to argue a position about the current state of knowledge on a topic) and *a complex literature review* (i.e. the significance of this approach is to review the literature to discover a research problem for further study) (Machi & McEvoy 2016: 2). Pickard (2013: 27-28), Machi and McEvoy (2016: 2), Mouton (2011: 87), and Leedy and Ormrod (2014: 1) have noted the following significances of performing a literature review:

- Permits the researcher to outline and define her/his main arguments and search objectives when performing the study;
- Supports the exploration of the most current and respected theories, models and frameworks about the research topic;
- Helps the researcher to identify keywords, concepts, phrases and topic objectives when performing the study;

- Assists in determining the most broadly acknowledged empirical findings in the field of the study;
- Encourages the researcher to examine the methodologies used in previous studies to eliminate making similar mistakes, therefore, decreasing efforts and time during the collection of data;
- Supports the researcher to elude plagiarism and evaluate previous studies conducted; and
- Decreases duplication, by the researcher studying all previous research on the topic, and so sets the theoretical framework in which the current research is located.

2.3 LITERATURE SEARCHING AND SELECTION CRITERIA

Literature searches were conducted in the following databases, covering the information, engineering, social and computer science disciplines, namely: Library and Information Science Abstracts (LISA) (Proquest), Library and Information Science Source, Emerald, ERIC (Proquest), ISI Web of Science, EBSCOhost, and ScienceDirect. For the purpose of this literature review, the emphasis was purely on the term “makerspace” in association with information behaviour, creativity and architecture. Searches were conducted over an extended period (November 2015 to October 2016) to ensure that all applicable literature was retrieved. The researcher divided the literature searches into two segments to assist in the selection and evaluation of the literature according to its applicability to the two main topics: makerspaces and architecture.

1. A total of 22 full-text articles were retrieved through searching the makerspace literature, using the term “makerspace” in association with “creativity”, “spaces of creativity”, “information (behaviour OR behavior)”. The concept “information behaviour” yielded little or no applicable literature, and so the researcher used the associated terms of information behaviour, noted by Savolainen (2007), namely: information needs, seeking, searching, retrieving, sharing and use.
2. A total of 23 full-text articles were retrieved through searching the architecture literature, using the term “architecture” in association with “architecture student*”, “architecture education”, “architecture (learn* OR teach* OR pedagog*)”, “creativity”, “spaces of creativity”, “information (behaviour OR behavior)”.

The search results were filtered through the following specifications: time period from 2005 till 2016 (the starting date was 2005 as the theoretical framework (third space concept of Maniotes) originated in that year); literature published in English (researcher most accustomed with this language); key search terms must be in the title field[5] (except for the terms associated with information behaviour as an umbrella term due to retrieving none or limited amounts of applicable literature); availability of the full-text (depended on the accessibility of the document – subscription to databases); and document types such as articles, books, book chapters and conference papers. A total of 72 documents were retrieved during the two segments of searches in the six databases. These documents were manually examined and evaluated for their relevance and applicability to the two main topics, makerspaces (linked to spaces of creativity) and architecture. Documents were excluded if they mentioned the concept only once (e.g. makerspace was mentioned as an example in the document) or if the topic of the document was irrelevant (e.g. information architecture, information system architecture, network architecture). After removing duplicates and documents deemed irrelevant, only 45 documents remained for the literature review.

2.4 MAKERSPACES: SPACES FOR CREATORS, TINKERERS AND DIYERS

"Everyone is a Maker. Everything we do is an act of creation, and our use of tools to transform our environment is what distinguishes us the most from other species (usually for positive effect, one would hope!)" (Maker Media, 2013: 23).

Although the physical space used by participants in this study for their design projects was not formally labelled a makerspace, it shared many characteristics noted in the literature analysed here. The reference to "pseudo-makerspace" in the title of this dissertation suggests that the various physical spaces provided in target group's department establish a space for creativity.

[5] Please note that for the concept "information behaviour", the researcher used the terms related to information behaviour as an umbrella term, as noted by Savolainen (2007), in any search field within a document, due to retrieving none or limited amounts of applicable literature.

2.4.1 Background to the concept of makerspaces

In the shifting landscape of higher education, "creativity, design, and engineering are making their way to the forefront of educational considerations as tools such as 3D printers, robotics, and 3D modelling applications become accessible to more students" (Johnson, Adams Becker, Cummins, Estrada, Freeman & Hall, 2016: 42). This prompts the following question in the *New Media Consortium (NMC) Horizon Report: 2016 Higher Education Edition* (Johnson *et al*., 2016: 42): "how to renovate or repurpose classrooms and labs to address the needs of the future is being answered through the concept of makerspaces."

The evolving phenomenon of makerspaces (known as the maker movement) has been noted in many places, for example, storefronts, art galleries, street spaces, schools, atriums, museums, church basements, summer camps, homes, community centres, and public and academic libraries (Burke, 2014, 2015; Davee, 2012; Koh & Abbas, 2015; Peppler & Bender, 2013; Rivas, 2014). The maker movement, which is a grassroots movement of the backyard, of garage and kitchen tinkerers, designers, crafters, and hackers, has developed intensively in recent years (Vossoughi & Bevan, 2014). The foundation of the maker movement was the achievement of the Maker Faire, which was launched in 2006 in San Mateo, California, and has subsequently proliferated itself into various making festivals, conferences, activities, spaces, studies and Do-It-Yourself (DIY) programmes (Fisher, 2012; Johnson *et al*., 2016; Vossoughi & Bevan, 2014). "The contours of the modern makerspace movement began to take shape in the mid-1990s, with the formation of tech-focused non-profit associations such as the Geek Group in Michigan and c-base in Berlin, Germany" (Enis, 2015: 24).

Bevan, Gutwill, Petrich and Wilkinson (2015: 99) point out that in June 2014, the White House introduced its first Maker Faire, which included several agencies, as well as the Mott Afterschool Network, the U.S. Department of Education and companies such as Intel, Autodesk and General Electric. Initially, makerspaces were referred to as hackerspaces, which were collective spaces where computer programmers would gather to work and share knowledge (Abram, 2013; Kelly, 2013; Slatter & Howard, 2013). However, Lotts (2015b: 409) notes that the history of making spaces, also recognised as "in-between spaces" (Jónsdóttir, Gísladóttir & Guðjónsdóttir, 2015; Verbaan & Cox, 2014), originated in New York as early as 1873 (Barniskis, 2014).

"Makerspaces come in all shapes and sizes, but they all serve as a gathering point for tools, projects, mentors, and expertise. A collection of tools does not define a makerspace. Rather, we define it by what it enables: making" (Maker Media, 2013: 1). Throughout the makerspace literature, numerous terms allied to makerspaces occur, such as makerhoods, medialabs, makelabs, hacklabs, learning labs, fab labs, idea labs, creativity labs, makery, tech workshops, hackerspaces, creative spaces, creative laboratories, content-creation spaces, tinkering spaces, drop-in spaces, and co-working spaces (Abram, 2013; Kelly, 2013; Koh & Abbas, 2015; Slatter & Howard, 2013; Vossoughi & Bevan, 2014). It is evident that makerspaces can offer a diversity of making practices and approaches in various contexts, for instance, makerspaces in *academic context* (Abram, 2013; Koh & Abbas, 2015; Stager, 2013); *community spaces* (Graves, 2014; Klipper, 2014); *library and information resources and services* (Bowler, 2014; Burke, 2015; Slatter & Howard, 2013); *literacy learning* (Loertscher, Preddy & Derry, 2013; Lotts, 2015b; Moorefield-Lang, 2015a); *digital media* (Abram, 2013; Benton, Mullins, Shelley & Dempsey, 2013; Moorefield-Lang, 2014); *mobile/pop-up spaces* (Gierdowski & Reis, 2015; Litts, 2015; Preddy, 2013); *online/virtual spaces* (Craddock, 2015; Loertscher, 2015; Moorefield-Lang, 2015c); *floating spaces* (Dorkfort, 2016; Lumb, 2016; Makerboat, 2014); *STEM disciplines (Science, Technology, Engineering, and Mathematics)* (Hall, 2014; Houston, 2013; Martin, 2010); and *lastly, arts and crafts disciplines* (Barniskis, 2014; Daley & Child, 2015; Peppler & Bender, 2013).

Numerous benefits have been noted throughout the makerspace literature regarding the use of makerspaces as an innovative educational approach. These benefits include: providing central spaces for community members to gain expertise; facilitating knowledge creation and providing equal opportunity to access materials, information and knowledge; providing access to new and emerging technologies; fostering a culture of maker education to nurture tinkering, curiosity and iterative learning; building character traits collectively such as creativity, curiosity, open-mindedness, persistence, critical thinking, social responsibility, and teamwork; and lastly, establishing a self-directed learning environment where natural collaboration can occur (Johnson *et al*., 2016; Kurti, Kurti & Fleming, 2014b; Maker Media, 2013; Slatter & Howard, 2013). But what really makes a makerspace special is its ability to produce opportunities in shaping the habits, attitudes and personalities of its makers, and collecting their ideas, interests and dreams to deliver a space that is unique to its makers'

needs. An understanding regarding the makers' information behaviour (specifically their information interactions and activities) in makerspaces may provide an opportunity to support the design and development of these spaces according to the makers' needs. This can also apply to creative spaces not specifically labelled as makerspaces.

2.4.2 Makerspaces explored through an information behaviour lens

The maker movement has given rise to educational spaces enabling everyday-life collaboration, integration across various disciplines (e.g. STEAM-rich disciplines), different teaching opportunities (information literacy), and guided and reiterative learning (Kurti, Kurti & Fleming, 2014a, 2014b, 2014c). The movement has cultivated "a new school of educational thought which strives to deliver constructivist, project-based learning curriculum and instructional units" (Waters, 2014: n.p.). From the latter, some significant concepts stood out to the researcher indicating a possible correlation between makerspaces and information behaviour, namely: guided (inquiry-based) and iterative learning, information literacy training and constructionism.

Numerous studies and models on information behaviour and information seeking, use and retrieval have been published and reviewed (e.g. Bates, 1989; Case, 2012; Dervin, 1983; Ellis, 1989; Ford, 2015; Hepworth & Walton, 2009; Kuhlthau, 2004; Wilson, 1999) in various contexts ranging from *medicine* (Tong, Raynor & Aslani, 2014), *music* (Medaille, 2010), *education* (Kuhlthau, 2004), *law practitioners* (Khan, Bhatti & Khan, 2011), *social scientists* (Meho, & Tibbo, 2003), *architects* (Makri & Warwick, 2010) to *engineers* (du Preez & Meyer, 2016). But few information behaviour studies have been conducted in the context of makerspaces. The following sub-sections explore makerspace literature through using the associated terms of information behaviour, as noted by Savolainen (2007), namely: information needs, seeking, searching, retrieving, sharing and use.

2.4.2.1 *Need for information and information resources in makerspaces*

The nature of makerspaces implies a spectrum of potential information needs, for example, tools, technologies, expertise, and information resources and services (Abram, 2013; Koh & Abbas, 2015). Limited studies have noted the actually information needs and information resources required in makerspaces for students, facilitators and space makers (Kelly, 2013;

Koh & Abbas, 2015). Lamb (2015) identified the need for a dedicated resource space to provide background knowledge to students required for design, production and exploration. Twelve information resources and tools were identified: curiosity resources, design resources, planning resources, pattern resources, game design resources, creation resources, print communication resources, multimedia communication resources, simulation resources, magazine resources, how-to resources, and special event resources (Lamb, 2015). Fourie and Meyer (2015) noted similarly that makerspaces (specifically in the library context) should not just focus on needs related to tools, but should produce an interconnected information resources space. Abram (2013) and Moorefield-Lang (2015a) reveal that as technology progress and users' needs evolve, so too do the roles and responsibilities of libraries change to fulfil the needs of their users; most notably, information literacy training is needed. Moorefield-Lang (2015a: 30) explains that makerspaces are spaces where information can be absorbed, requested, created and imagined, but the skills required to evaluate, locate and use information depend on the ability of "an individual to know when information is needed". Moorefield-Lang's (2015a) study highlights the importance of information literacy training in makerspaces to aid makers in gaining the skills to know what and when information is needed (Lenton & Dineen, 2016). Emphasis should also be placed on other significant types of literacy training required as part of the makers' 21st-century skills, namely: digital literacy (Carruthers, 2014; Koh & Abbas, 2015) and media and visual literacy (Bowler, 2014; Canino-Fluit, 2014).

Other information needs noted throughout the makerspace literature were the information needs of the creators, facilitators and educationists, for example, information regarding spatial selection, layout and design (Choy & Goh; 2016), tools, software, equipment and funding opportunities (Abram, 2013), and skills and competencies needed by facilitators and educationists (Koh & Abbas, 2015).

2.4.2.2 *Information seeking, searching and retrieval in makerspaces*

Although a number of makerspace studies have revealed the information-seeking and retrieval behaviour of their makers (Abram, 2013; Chua, 2014; Moorefield-Lang, 2015a), none of the 13 selected articles for this section reported on the search process of makers in retrieving information. According to Fourie and Meyer (2015: 523), academic makerspaces should be approached "as collaboration spaces, and learning spaces aligned with information

seeking and extended knowledge, and sharing spaces for creating and disseminating new knowledge and experiences, e.g. on "how-you-did-it", "how-you-created" and where to from the "moment-of-creation" – entrepreneurship". Chua (2014: 175) emphasises the significance of nurturing information literacy skills and guidance in makerspaces to aid makers in successfully seeking and retrieving information. Some predominant information-seeking activities noted throughout the makerspace literature are the seeking of information regarding new ideas or inspiration (Borman, 2016; Petrich, Wilkinson & Bevan, 2013), finding answers, solving problems (Bevan, *et al*., 2015) through various academic and personal experience (Gustafson, 2013), search engines (Google) (Abram, 2013) and information resources (library collection, staff, peers, and print and electronic reference materials) for guidance and assistance (Lamb, 2015).

2.4.2.3 *Information sharing and use in makerspaces*

Britton (2012: 20) points out that "the beauty of the Maker movement" is the fact that makerspaces facilitate shared spaces that encourage a culture of sharing "resources, knowledge, and 'stuff'". Fullerton (2016: 26) notes that the makerspace ethos offers the ideal environment for establishing a creative fan-fiction writing group to promote guidance during the creative writing process, promote reading and stimulate the sharing of ideas. More specifically, the sharing and use of information in makerspaces could be for a variety of reasons such as collaboration on projects (Jiang, Beavers, Cady & McCoy, 2015: 14), transferring knowledge and expertise (Abram, 2013; Kelly, 2013), idea generation (Steele, 2015), sharing new reflections and understandings on learned skills (Canino-Fluit, 2014), and sharing various information resources (e.g. tools, technologies, books) (Moeller, Bastiansen, Gates & Subramaniam, 2015; Peppler & Bender, 2013). Moreover, information sharing and use can be accomplished through individual or collective engagements (Moorefield-Lang, 2015a), online resources (Peppler & Bender, 2013), communication or conversations (Lamb, 2015). Ultimately, the sharing philosophy of makerspaces is what makes these spaces so magical (Hatch, 2014: 17), as "sharing what you have made and what you know about making with others is the method by which a maker's feeling of wholeness is achieved" (Hatch, 2014: 1).

2.5 CREATIVITY: THE 'MUST-HAVE' 21ST CENTURY SKILL

"Everyone is born with a natural streak of creativity. Children are the best proof of this. You can see natural curiosity – a key mindset of creativity – in play in just about everything they do" (Hall, 2013: n.p.).

2.5.1 Background to the concept of creativity

Davee (2012) points out that the 21st century "needs people who can creatively make". Various studies in the academic context and with regard to library services and information literacy highlighted the importance of creativity (Chang & Hsu, 2015; Hensley, 2004; Plemmons, 2014). Glăveanu (2010: 79) explains that creativity has been hypothesised and applied throughout various domains of studies, such as *psychological and behavioural science* (Auger & Woodman, 2016; Pelaprat & Cole, 2011); *educational science* (Ergen & Akyol, 2012; Likar, Cankar & Zupan, 2015); *building science* (Dayaratne, 2013; Onsman, 2016); *health science* (Bang, 2015; Smoyak, 2015); *library and information science* (Lotts, 2015a; Onuoha, Anyanwu, Ossai-onah & Amaechi, 2015); *fine arts and science* (Lavranos, Kostagiolas, Martzoukou & Papadatos, 2015; Medaille, 2010); and *economic and management sciences* (Dean, Griffith & Calantone, 2016; Karim & Sarfraz, 2016).

The concept of creativity dates back as far as the Book of Genesis (Pope, 2005: 5). The idea of creativity literally originated as an act of God "bringing the universe into being, the ultimate act of creation – 'let there be light'!" (Martin, 2010: 1). Popova (2013: n.p.) states that "'creativity' is one of those grab-bag terms, like 'happiness' and 'love,' that can mean so many things it runs the risk of meaning nothing at all". Great minds have endeavoured to capture, define, study and record the nature of creativity. For instance, *Albert Einstein* noted that a vital feature in creative thought was combinatory play, suggesting that creativity is combinatorial – a connection between various building blocks (i.e. memory, knowledge and information) (Popova, 2013; Taylor, 2012); *Steve Jobs* described creativity as connecting one's personal library of experiences and ideas to synthesise new products (Popova, 2013: n.p.); *Graham Wallas* said that creativity is the art of thought and questioning (known as creativity question), positing a creative process consisting of four stages (i.e. preparation, incubation, illumination, and verification) (Popova, 2013: n.p.); *Walt Disney* said that "there were actually three different Walts: the dreamer, the realist, and the spoiler", implying that creativity is

finding the balance between your vision (dreamer), action (realist) and logic (spoiler) (Elmansy, 2014: n.p.); and lastly, *T.S. Eliot* wrote that creativity is the incubation of fragmented thoughts into beautiful ideas (Popova, 2013: n.p.).

The greatest minds in history have been divinely inspired and mesmerised by the phenomenon of creativity, as "there is little that shapes the human experience as profoundly and pervasively as creativity. Creativity drives progress in every human endeavour, from the arts to the sciences, business, and technology" (Paul & Kaufman, 2014: 3). Gaut (2010: 1034) notes that if one asks someone what their initial thought is about the term creativity, words such as expression (stimulated by a physical, emotional or mental phenomena) (Extremera & Fernández-Berrocal, 2006; Ostwald, Bernal, Cron & Godwin, 2009), imagination, children, art (Van Gogh) or music (Mozart) (Reuter, 2015) will most probably emerge. "Creativity is of immediate interest to just about everyone: Am I creative? How creative am I? Can I become more creative?" (Pope, 2005: 1).

Various authors have stated that creativity is multidimensional (Lucas, 2016; Runco & Pritzker, 1999; Sternberg, 2005; Williams, Ostwald & Askland, 2010), consisting of various components (also known as the 4Ps of creativity) such as the creative individual (personal factors), creative product (design, service and system factors), creative process (cognitive factors) and creative environment (physical factors or context). Vogel (2014: 124) added a fifth component: creative philosophy (motivational factors or ideology). Williams, Ostwald and Askland (2010: 3) explain that to understand the concept of creativity during creative activities, creative endeavours and creative success, especially for educational purposes, a holistic approach is required. So an understanding of information behaviour, which involves a holistic approach focusing on the affective, cognitive, and physical components (Anderson, 2011; Case & Given, 2016; Kuhlthau, 1991, 1994; Hepworth & Walton, 2013), might inform studies of creative assessment frameworks, design of creative spaces and development on creative teaching and learning practices (McCormick, 2014; Prince, 2012; Vogel, 2014).

2.5.2 Creativity explored through an information behaviour lens

Case and Given (2016: 363) explain that not all information-seeking activities focus on finding information regarding a problem, but can be for creative purposes. Studies regarding creativity in information behaviour mainly focus on information seeking (Hemming, 2008,

2009; Lavranos, *et al*., 2015; Medaille, 2010; Visick, Hendrickson & Bowman, 2006; Zach, 2005) driven by inspiration, motivation (intrinsic and extrinsic) or to reach goals (Lavranos, Kostagiolas & Martzoukou, 2016; Makri & Warwick, 2010; Medaille, 2010). As noted in section 2.4.2, several models of information behaviour and information seeking are available, however, these models do not distinctively focus on creativity, thus inspiring the perfect opportunity for exploring creativity through an information behaviour lens. The following literature explores creativity and information behaviour.

Torun, Tekçe and Esin (2011: 750) note that research into creativity in design education has been flourishing in the past decade. Throughout the education literature, skills associated with creativity are noted, such as critical thinking, imagination, holistic thinking, information literacy, problem-solving and active learning (Kostagiolas, Lavranos, Martzoukou & Papadatos 2015; Medaille, 2010; Torun, Tekçe & Esin, 2011). According to Torun, Tekçe and Esin (2011: 749), creativity in design education is predominantly discussed as a cognitive process and examined in the psychological context. Torun, Tekçe and Esin (2011) aimed at developing a learner-centred pedagogical framework by examining the social characteristics of creativity using a learner-centred teaching philosophy and network-based learning environment. They found that by using a learner-centred approach in a design studio, "students are no longer passive receivers of knowledge; instead, they are active participants in learning and co-constructors of knowledge" (Torun, Tekçe & Esin, 2011: 750). Students interact and engage more in this learning space, and share information and experiences.

Medaille (2010) investigated the information behaviour of theatre artists. An exploratory study was conducted using online questionnaires and individual interviews to collect data from 80 theatre artists regarding the role of information seeking and gathering during the creative process. The findings revealed six main reasons for theatre artists to seek for information, namely: "understanding a work's historical, cultural, and critical background; finding sources of inspiration; learning about contemporary or historical theatre productions, artists, and events; learning technical or process information; finding performance materials; and furthering career goals" (Medaille, 2010: 343). The author concluded that theatre arts saw the ISP as very important for their creative endeavours (Medaille, 2010: 345).

Kostagiolas *et al*. (2015) explored the possibility of combining Wilson's (1999) macro-model of information behaviour with Webster's (2002) creative thinking in music model to "study the role of personality traits on music information-seeking behaviour and their impact on musical creativity, focusing on creative activities" (Kostagiolas, *et al*., 2015: 12). Musical creativity consists of three main creative activities: composition, performance and improvisation, and listening and analysis (Kostagiolas, *et al*., 2015: 5). The study made use of a questionnaire, which was completed by 174 out of 200 musicians, a response rate of 87%. Key findings from the questionnaire included:

- Motives for seeking information included work-related tasks, educational or training purposes, to increase musical performance, collection development or gathering information regarding a piece of music (Kostagiolas, *et al*., 2015: 18);
- Types of information needed for musical creativity included: musical publications, music software, multimedia applications, composer, the theory of music and various other information resources regarding music (e.g. news, seminars, conferences and electronic files) (Kostagiolas, *et al*., 2015: 19);
- Information resources used during the search process included: public library, personal collection, music store, music institutions, music databases, search engines (Google), friends or colleagues and electronic journals (Kostagiolas, *et al*., 2015: 20); and
- Obstacles to online information seeking included: cost, lack of time, information in foreign languages, lack of trust in online resources, overload of information, and a lack of digital and information literacy (Kostagiolas, *et al*., 2015: 21).

The study concluded that different personality dimensions can be affected by the type of information resource used, obstacle encountered and motives during the seeking of information (Kostagiolas, *et al*., 2015: 13). In addition, results indicated that personality traits can influence how individuals perceive the importance of information for creativity. Lastly, the authors point out that the musicians' personality characteristics influenced their information needs (Kostagiolas, *et al*., 2015: 22).

Other information-seeking behaviour noted throughout the selected literature included information gathering, encountering (browsing and searching), use, sharing (communication), visualisation and avoidance (Ebrahimy, Hekmat & Jowkar, 2015; Lavranos, Kostagiolas & Martzoukou, 2016; Makri & Warwick, 2010; Medaille, 2010).

2.6 CHARACTERISTICS OF MAKERSPACES AS SPACES OF CREATIVITY

"The makers movement in education helps to develop in students the full capacity, creativity and confidence to become 'agents of change in their personal lives and in their community'" (Dougherty, 2013: 3).

The creative and imaginative role that educational makerspaces play in academic settings have been mentioned by several authors such as Bowler (2014), Bowler and Champagne (2016), Britton (2012), Fullerton (2016), Kurti, Kurti and Fleming (2014a), Lamb (2015), Peppler and Bender (2013), and Slatter and Howard (2013). According to Kurti, Kurti and Fleming (2014a: 10), "playfulness is an extremely important tool in the engagement of learning": this is noteworthy because makerspaces have been termed intellectual playgrounds to foster creativity (Davee, Regalla & Chang, 2015; Plemmons, 2014; Small, Laura & Meredith, 2014). The significance of spaces supporting creativity, particularly to encourage curiosity, deep learning, questioning, critical thinking and creativity itself, have been noted by various authors (Benton *et al*., 2013; Martin, 2010; Range & Schmidt, 2014).

Martin (2010: 23) explains that the notion of having a unique space to be creative is not a new concept. It originated during the Renaissance, where writers and artists had their own personal retreats or studios as creative spaces to work, while designers and engineers had workshops to inspire creations and ideas (Martin, 2010: 23). Throughout history medical students have observed operations being performed in operating theatres, which become a space for visual awareness and learning (Martin, 2010: 23).

Against the preceding, the characteristics intrinsic to makerspace, as an exemplar of a creative space, might be a golden opportunity to inform the development of spaces of creativity in the academic context. Throughout the literature, seven characteristics associated with makerspaces have been noted, namely: known by various terms; relevant to different contexts; deliver access to a spectrum of tools, knowledge and skills; establish a space and

culture that is physically, socially and emotionally safe; establish an open environment for freedom of expression, opinion and ideas; establish a constructivist learning environment for guided and hands-on learning; and lastly, provide a collective space to nurture character traits significant to creativity (Bowler, 2014; Britton, 2012; Davee, Regalla & Chang, 2015; Meyer & Fourie, 2016). The following sub-sections will address the characteristics of makerspaces.

2.6.1 Known by various terms

Martin (2010: 23) explains that present-day examples of creative spaces are architect offices, rehearsal rooms, science labs, design studios, and more recently acknowledged as makerspaces, fun labs or fab labs. Several makerspace labels include the words "creation" or "creative". They also go by labels such as co-working spaces, content-creation spaces, creative spaces, creativity labs, drop-in spaces, fab labs, hacklabs, idea labs, learning labs, makelabs, makerhoods, makery, medialabs, tech workshops, and tinkering spaces (Davee, Regalla & Chang, 2015; De Boer, 2015; Koh & Abbas, 2015). Consequently, Barniskis (2014), Hatch (2014) and Jensen (2013) have validated makerspaces as spaces of creativity.

2.6.2 Relevant to different contexts

According to Bohm (1998: 17), "as we are social creatures, some forms of creativity are seen as having more value than others, but these value judgements are dependent on both the context and the dominant values of the society or section of society". Martin (2010: 29) explains that creativity applied in various contexts can produce various outcomes, for example, creativity in the context of teaching and learning (academic context) focuses on the conditions needed to teach and learn more creatively; creativity in the context of work focuses on the creative abilities of an individual to produce innovate outcomes (Kulemeka, 2012; Martin, 2010; Peck, 2012; Povilanskas & Armaitienė, 2014). The context in which creativity is placed is significant. The use and construction of makerspaces has been noted in diverse contexts ranging from academia to leisure (Abram, 2013; Bevan, *et al.*, 2015), showing the flexibility of the term (Houston, 2013: 26). In educational makerspaces, information and information support can enable curricula that inspire exploration and creation of new ideas, posting opportunities to build community, and nurturing an assertiveness of creativity (Davee, Regalla & Chang, 2015). In conclusion, the flexibility of makerspaces provide the ability to generate "multiple options, encourage cross-pollination of varied creative pursuits,

and foster ways to share and learn skills within a supportive, diverse, and vibrant" (Davee, Regalla & Chang, 2015: 6).

2.6.3 Deliver access to a spectrum of tools, knowledge and skills

Creative spaces occur in various contexts, and individuals have different needs, thus requiring a spectrum of equipment, tools, materials and a wide variety of information resources (from books to internet access) to stimulate inner reflection for inspiration. Houston (2013: 26) points out that makerspaces are seen as central community resource centres, where a range of facilities, tools, and expertise are provided for inspiring new and innovative ideas. For makerspaces, equitable access to technologies, materials, and fabrication instruction, which may not be usually obtainable, is important, as is the freedom to make (Gustafson, 2013; Slatter & Howard, 2013). So makerspaces can be hubs of collaboration where sharing of information, resources and ideas produces creative tinkering and thinking (Gustafson, 2013; Slatter & Howard, 2013). Lastly, makerspaces' "drive toward interdisciplinary collaboration in industry, which requires informational and physical connectivity" (Foertsch, 2013: 5). As a result, constructing a bridge between theoretical knowledge and practical application during creative endeavours by providing an interconnected information resources space (Fourie & Meyer, 2015).

2.6.4 Establish a space and culture that is physically, socially and emotionally safe

Bowler (2014: 60) explains that throughout the several stages of a design project, trial and error, figuring out, workaround, frustration and reiteration of activities occur in makerspaces. Makerspaces are envisioned as a safe space that nurtures a positive environment for expressions of ideas and opinions, and inspires creation, questioning, experimentation, innovation and constructivist learning (Bowler & Champagne, 2016; Graves, 2014). Ojeda-Zapata (2016: n.p.) mentions that makerspace "facilities exist as 'safe spaces' for teens to 'hang out, mess around and geek out'". Davee, Regalla and Chang (2015: 6) point out that makerspaces, as creative spaces, must provide a safe space that encapsulates the physical, social and emotional safety of makers.

2.6.5 Establish an open environment for freedom of expression, opinions and ideas

Several authors have noted the importance of creativity in academic contexts and with regard to library services and information literacy (Chang & Hsu, 2015; Hensley, 2004; Plemmons, 2014). A number of makerspace studies note the importance of playing in makerspace to inspire individuals to go beyond the precincts of academic constraints (Burke, 2015; Canino-Fluit, 2014; Lamb, 2015; Abram & Dysart, 2014), thus providing individuals the freedom to express themselves creatively through the creation of innovative designs (Hira, Joslyn & Hynes, 2014; Kurti, Kurti & Fleming, 2014c), and freedom to express their opinions, thoughts, emotions and feelings in a group related to fulfilment, self-content and accomplishment (Meyer & Fourie, 2016; Lavranos, *et al*., 2015).

2.6.6 Establishes a constructivist learning environment for guided and hands-on learning

According to Kurti, Kurti and Fleming (2014c: 8), makerspaces support the application of constructivist learning principles, fabricating an environment supportive of hands-on exploration and learning. Constructionism is a learning approach that builds on what students already know and actively involve them in learning. The lecturer observes and acts as a guide for inquiry, while the learning process is driven by students (Kurti, Kurti & Fleming, 2014c: 8). As a result, students have to dynamically participate and work together to overcome problems experienced during their tasks and if needed the lecturer will intervene to provide guidance (Kurti, Kurti & Fleming, 2014a).

2.6.7 Provide a collective space to nurture character traits significant to creativity

Making has been noted as synonymous with creativity, inventive, spontaneous, open, communal, collaborative and passionate exploration of personal ideas (Makerboat, 2014; Makeschools Higher Education Alliance, 2015). Therefore, as noted in section 2.6.1 (known by various terms), makerspaces are greatly related to creativity, play, imagination, curiosity, adaptability, open-mindedness, persistence, critical thinking, exploration, and collaboration (Gustafson, 2013; Maker Media, 2013; Plemmons, 2014). Makerspaces, as a space of creativity, should support the improvement and fostering of such characteristics by delivering

access to a spectrum of tools, knowledge and skills, establishing spaces (encapsulating physically, socially and emotionally safety) for sharing opinions and ideas, and for the freedom to fail (trial and error) (Gustafson, 2013; Meyer & Fourie, 2016). However, more significantly, the process of creative collaboration (co-design or co-creation) must be supported (Graves, 2014; Gustafson, 2013).

2.7 ARCHITECTURE THROUGH AN INFORMATION BEHAVIOUR LENS

"*Information is of great importance when planning, designing and reviewing the construction of buildings or other structures*" (Makri & Warwick, 2010: 1475).

2.7.1 A retrospective view: information behaviour and architecture

"Information behavior is a relatively new but growing research field. A recent review found 615 studies were published between 2009 and 2013" (Campbell, 2016: n.p.). Shaaban, Lockley and Elkadi (2001: 43) highlight that "information is a critical element for architects to accomplish their tasks". Nevertheless, Makri and Warwick (2010: 1745) explicate that even though the importance of information for architectural design has been noted by various authors (Campbell, 2016; Shaaban, Lockley & Elkadi, 2001), there has been relatively little research on how architects search for, interpret, and use information in their design projects. The two most recent information behaviour studies regarding architecture are by Campbell (2016), and Makri and Warwick (2010) (reviewed in Table 2.1). In the 1970s and 1980s several information behaviour studies were conducted in relation to architecture. Even though these studies are dated and the information landscape (only paper-based sources) was significantly different from the present, a retrospective view could provide significant insight and value (Makri & Warwick, 2010: 1746). A retrospective view of these studies follows.

Goodey and Matthew's (1971) study was situated in the United Kingdom and focused on how architects handle and use information in practice. A survey and interviews were used to collect data. The main findings indicated that only 57% of the architect offices used research literature as a core source of information. Further, "although this study was conducted several decades ago, several participants in our study suggested that when undertaking design projects, architects rely less on research sources such as journals and more on practical ones, such as design-focused books or Web sites" (Makri & Warwick, 2010: 1747). Findings

about information context and flow showed that "each architect has a favourite set of references which are used over and over again" (Goodey & Matthew, 1971: 18).

Mackinder (1983) noted that the private collections of architects made it easier and quicker to re-find information. Further, Mackinder (1983: 103) explained that separately from monographs, trade publications are also individually printed sources architects frequently collected. It was found that the ideal source of information for architects is visual and brief, showing that architects display a notable lack of interest in documents containing much text or text only (Mackinder, 1983: 103).

A study by Snow (1975) examined the information needs and wants of architects, by means of a telephone survey (included a follow-up questionnaire and interviews). Snow (1975: 116) noted that the greatest need or want for information was related to solving complex design problems, where fast solutions were desired. These solutions typically required technical or product information, which required the architects to "keep up-to-date and learn about new techniques" (Snow, 1975: 121). Snow concluded by stating that "information retrieval should be viewed as an essential part of the decision-making process, i.e., the design/build process in architecture" (Snow, 1975: 121).

Powell and Nichols's (1982) study focused on the information needs of architects and engineers, their access to information, and its interpretation and use for daily design projects. The study used interviews to collect data (Powell & Nichols, 1982). The main findings were that architects and engineers largely relied on their past experience to deal with known design problems, and would consult information sources only if the design problem was both new and essential (Powell & Nichols, 1982: 309).

The preceding studies revealed the spectrum of architects' information needs and wants, and their information use and retrieval behaviour, which was exclusively directed towards paper-based sources. Elliott (2002: 194) proposed that "one environment should allow architects to do both", meaning a space catering for both paper-based and electronic information activities. Makri and Warwick (2010: 1747) note that the findings by Bennett (2006) (combining "traditional library services" with the design projects of architecture students to motivate information seeking) and Elliott (2002) (image search tools used for information retrieval can inspire creativity) stimulated their interest in designing electronic information

tools for architecture students to inspire and nurture creativity. The study by Makri and Warwick (2010) is one of the most recent studies combining information behaviour with architecture (see Table 2.1), thus providing a contemporary view for the current study.

2.7.2 A contemporary view: information behaviour and architecture

"*The concept of information as inspiration is gaining popularity and changing academic architecture*" *(Campbell, 2016: n.p.).*

Numerous authors (Campbell, 2016; Danaci, 2015; Jutraž & Zupančič, 2014) have recognised architecture as an interdisciplinary field drawing inspiration from the arts, the social sciences, engineering, mathematics and science (climatology), especially with regard to architectural education (including design studios) (Kowaltowski, Bianchi & De Paiva, 2010; Musa, 2013; Torun, Tekçe & Esin, 2011). According to Danaci (2015: 1310), "the concept of creativity is very important for the architectural profession, and architecture is also sometimes used instead of creativity as meaning". Creativity can thus be seen as an inherent characteristic of architects' information work (Makri & Warwick, 2010: 1750). In correspondence, Danaci (2015), and Makri and Warwick (2010) confirm that students' architectural projects frequently involve creativity for inspiration, and information-seeking and information-use activities.

From the latter, connections between architecture, creativity and information behaviour (information activities – seeking and use) are clear (Bennett, 2006; Campbell, 2016; Makri & Warwick, 2010). To apply an information behaviour lens in architecture studies, the following literature explores the information activities and interactions of architecture students.

For the purpose of this study, only two articles, pertaining to architecture and information behaviour, were available. A brief overview regarding architecture and creativity is presented in Table 2.1. The literature is arranged alphabetically by author's surname. Table 2.1 portrays the context of the study, research objectives, research methodology, information behaviour lens, creativity and key findings.

Some key findings of the studies by Campbell (2016), and Makri and Warwick (2010) (discussed in Table 2.1) indicate that although architects used various internet sources to

inspire creativity, they are just add-ons to printed material. Information activities noted throughout the two studies were:

- **Information encountering and exploring** (serendipitously or unexpectedly finding especially through image searching – provided students with a feeling of inspiration or idea generation);
- **Information searching** (primarily done on Google**);**
- **Information browsing and extracting** (whether textual or video to identify material of interest);
- **Information visualising** (used Google Maps);
- **Information selection** (students had to select search queries and keys to retrieve information);
- **Information use** included information recording and editing (students preferred the use of personal books, internet resources, and conversations with peers for creative inspiration, as well as various types of images such as architectural plans, details and photographs);
- **Information communication** (very important in regards to communicating design and solutions);
- **Information sharing** (among peers, expertise, consultation. Done primarily through social networking sites such as Facebook, YouTube and blogs); and
- **Information seeking** (done to keep up with trends and inspiration).

The study by Makri and Warwick (2010) indicated the use of three specific information behaviour models to inform their study, namely: Ellis's (1989) behavioural model, Kuhlthau's (1991) ISP model and Vakkari's (2001) theory of task-based information retrieval.

ARCHITECTURE AND INFORMATION BEHAVIOUR LITERATURE

Authors	Context of study	Research objectives[6]	Research methodology	Key findings from the study through an information behaviour lens
Campbell (2016)	Examined the information-seeking behaviour and perceptions of library services of architecture faculty across the United States.	The objective was to determine the information-seeking behaviour patterns of the architecture faculty and to define the factors influencing information use.	A quantitative approach using an online survey. Response rate 16% (99/606). Survey consisted of 15 open-ended questions. Faculty were asked to rank information sources they used for teaching, research and creativity in their discipline.	The following key findings were noted by Campbell (2016): Information use: Personal books, internet resources, and conversations with peers were ranked as the information source most used for creative inspiration. Images (architectural plans, details and photographs) were indicated as highly used. Information seeking: Mainly used for keeping up with trends and for inspiration. Attitude towards libraries: Lowest ranked information sources. A certain scepticism about the role of library personnel as organisers and selectors of information sources was indicated. Information sharing: Primarily through social networking sites (Facebook, YouTube and blogs). Information needs: Varied in sources and material needed (e.g. online internet resources and scholarly journals). Overall, the concept of "obscure sources" for inspiration was noted as a key information need for inspiration and creativity. In addition, the internet is an add-on resource for printed materials.
Makri & Warwick (2010)	Examined the electronic information behaviour of three postgraduate architectural design	**Main research question:** "Which electronic information-seeking and use behaviors are particularly pertinent to	A qualitative approach using naturalistic observations, and probing and opportunistic	The following key findings were noted by Makri and Warwick (2010): Students had to take on a self-selected, naturalistic information tasks associated with one of their design projects.

[6] The research question and sub-questions were not stated in all of the studies, so the researcher provided the research objectives when these were not stated.

	and six urban design students in the faculty of the built environment at a large London university.	architects when working on design projects?" **Sub-questions:** - "What is the importance of images and video for architectural design projects?" - "How does the creative nature of architectural design projects influence architects' information-seeking and use behaviors?"	questions (think-aloud).	Key information activities and interactions noted in the study included: information encountering, exploring, browsing, visualising (multimedia materials), selection (search query and keys), use (recording and editing) and communication (distributing and sharing). Overall, inspiration and creativity were noted as the main drivers behind information work in the architecture domain. Therefore electronic resources designed at supporting information seeking, interpretation and use must support creativity for design. The participatory design process might aid in this regards.

ARCHITECTURE AND CREATIVITY LITERATURE

Authors	Context of study	Research objectives	Research methodology	Key findings in terms of creativity	Studies of creativity benefiting from an information behaviour lens
Danaci, 2015	Architectural education in higher education.	The aim of the study was to examine the transition between theoretical and practical emphasis by means of practical application of theory in architectural education.	Historical research method using a literature review.	Various variables intrinsic to creativity were mentioned such as cognitive, personal and environmental. The cognitive (development) variable was noted as the most significant ability, as knowledge and technical skills are needed for architectural design. A trial and error approach to architectural education was suggested to facilitate the transfer of learned knowledge to practical application.	Learning through trial and error, thus providing knowledge at the right time for students to produce creative actions, instead, of just passively consuming knowledge (Bowler, 2014). In addition, the concept of third space, grounded on guided inquiry-based learning, as envisioned by Kuhlthau, Maniotes and Caspari (2007, 2012, 2015), could offer a meaningful crossing from theoretical knowledge to practical application.

Casakin & Kreitler (2010)	Architectural design and engineering design education in higher education.	The aims of the study were to measure motivation for creativity in architectural design and engineering design students, founded on the cognitive orientation theory, which describes motivation as a function of a set of belief types, themes, and groupings identified as relevant for the development of creativity.	Comparative research of 52 architecture students and 60 engineering students. The study administered questionnaires.	Architectural design students' motivations for creativity were their inner world, inner-directedness, and a development of the self. Engineering design students' motivations for creativity were receptivity to the environment and demands from oneself.	Interventions to improve architectural and engineering design education are needed, thus studies regarding zones of intervention and guided inquiry from Kuhlthau's (2007, 2010) work could be of value.
Kinga, Paul & Şefan (2015)	Architectural education in higher education.	The goal was to identify associations between self-measured creativity (creative self-efficacy, role-identity and behaviour), Hexaco Personality factors and motivational orientations.	A quantitative approach using three different questionnaires. The sample involved 182 students from the Technical University of Cluj-Napoca.	Key findings indicated that there is a positive association between intrinsic motivation (enjoyment and challenge) and creativity. Additionally, individuals who value more being creative are more oriented toward recognition than participants with a lower level of creative personal identity.	Evaluate the effects between personality factors (emotions, feelings) and creative performance (cognitive and physical) in a specific architectural design task. Thus, Kuhlthau's ISP model could provide a holistic approach (emotions, cognitive and physical aspects) to inform architectural design task (Kuhlthau, 1991).
Kowaltowski, Bianchi & De Paiva (2010)	Architecture and Urban Design Course of the State University of Campinas - Unicamp, in Brazil.	The aim of the study was to examine methods that could enrich the creative process and their application in architecture courses (specifically in design studios) around the world.	Explorative research using an online structured interview. The interview was completed by 28 design instructors of architecture schools around the world, 43 design	Creativity enhancement tools revealed to improve the creative process were: Analogy metaphor: Increases students' design repertoire. Biomimicry: inspiration through natural phenomenon. Brainstorming: Helps the spontaneous generation of ideas in groups.	The key component in architectural education is to give students tools to stimulate the search for creative solutions to problems. Information literacy will be a significant factor as this entails the capacity for students to successfully locate, evaluate, and use information in creative

			instructors participated in the study and 28 faculty members.	Attribute list method: Provides a clear vision of a design problem by means of visually noting the positive and negative points of the solution in a list. Mental maps: Sensing-making of design problems through the graphical exposition of ideas. TRIZ matrix: Not well known. Investigation needed.	solutions (Kuhlthau, Maniotes & Caspari, 2015).
Mahdavinejad, Shahrigharahkoshan & Ghasempourabadi (2012)	Architectural education in higher education.	**Research questions:** "What are the effects of site analysis on creativity during the design process? What are the effects of site analysis on functionality during the design process?"	Quasi-experimental research using the class of design studio III - the students of bachelor of architecture in Tehran.	The site analysis step affects the creativity of architectural design meaningfully. In addition, creativity based on their process and practical conclusions can be divided into four categories, thus creativity based on the *creative person* (motivation, emotion), *knowing* (cognitive), doing (actions) and *environment* (context). Thus, a holistic approach is needed.	Evaluate the influence of site analysis in the creativity of the students and their design process, thus if creativity requires a holistic approach, information behaviour studies' holistic approach could provide some insight (Anderson, 2011; Case & Given, 2016).
Raviz, Abad & Nikpour (2015)	Creation of Architecture School in Rafsanjan city.	The aim of the research was to investigate the impact of the physical components on creativity.	A quantitative approach using a questionnaire. The sample of the study involved a number of experts in the field of architecture (No specific numbers were specified).	The study indicated that physical features do influence creativity in architectural education, thus by improving the physical components such as spatial organisation form, functional characteristics, environmental characteristics, and psychology, can provide a space where creativity flourish.	Physical features influence creativity, especially, in terms of perception of spaces, communicative spaces, open spaces, green spaces and spaces of movement. Thus various spaces can influence creativity (creative space). Meyer and Fourie (2016) note that Kuhlthau's work can inform information behaviour studies in creative spaces.

Table 2.1: Review of architecture literature in relation to information behaviour and creativity

2.7.3 Third space in guided inquiry model: theoretical framework for information behaviour studies in architecture

According to Verbaan and Cox (2014: 2), third space theory has been predominantly promoted by Bhabha (1994) with regard to its potential for literary, geographical, historical, political and cultural studies. Third space institutes a "site of interaction, contestation, tension and transformation between two cultural systems" (Chulach & Gagnon, 2015: 3). Numerous fields of practice have acknowledged the value of integrating and exploring the third space ("in-between space") produced between two or more discourses or conceptualisations (Elmborg, 2011: 345), for instance, urban environmental design (i.e. green space) (Soja, 1996; Tahmaseb-McConatha, 2015), linguistic studies (Fitts, 2009; Lee, 2009), leisure studies (Hollinshead, 1998; Purnell, 2015; Tahmaseb-McConatha, 2015), literacy learning (Levy, 2008; Pane, 2007; Wilson, 2000), tourism landscapes (Fagence, 2014), and library and information science (Chan & Spodick, 2014; Elmborg, 2011; Kuhlthau, Maniotes & Caspari, 2007, 2012, 2015). The value of exploring third space in learning and educational practices has also been widely noted (Jónsdóttir, Gísladóttir & Guðjónsdóttir, 2015; Maniotes, 2005; McDonough, 2014; Skattebol & Arthur, 2014).

For this study, Maniotes' (2005) third space in guided inquiry model is used as an information behaviour lens to inform a study with architecture students who use a special physical space for their creative design projects (i.e. a pseudo-makerspace). The model was developed from Maniotes' (2005) doctoral thesis in 2005, entitled: *The transformative power of literary third spac*e. She published various articles such as "Teaching in the zone: formative assessments for critical thinking" (Maniotes, 2010); "Making the shift" (Maniotes & Kuhlthau, 2014); and "Guided Inquiry Design in Action: Middle School" (Maniotes, Harrington & Lambusta, 2015), to advance her model. The idea of third space has been advanced by Kuhlthau, Maniotes and Caspari (2007, 2012) with regard to guided inquiry and inquiry learning as viewed from an educational or information literacy perspective. According to Kuhlthau, Maniotes and Caspari (2015: 118), "a flexible model for the information age school incorporates a constructivist approach to learning with an environment for creating third space in which the curriculum meets the students' world in dynamic, interactive, deep learning".

In addition to the definition given in Chapter 1, section 1.7.6, third space can be defined as an intersection zone between the students' personal knowledge system (first space) and their class curricula (second space) that creates a dynamic, hybrid learning space (third space) for hands-on-learning (Kuhlthau & Cole, 2012; Maniotes, 2005). Throughout the literature various terms related to the concept of third space were noted, namely: deep learning, dynamic learning, inquiry learning, independent learning, in-between learning space, learning-centred environment, organic environment or space, hybrid space and safe space (Kuhlthau, Maniotes & Caspari, 2007, 2012, 2015). Kuhlthau, Maniotes and Caspari (2015: 145) argue that third space interactions promote inspiration and curiosity throughout the inquiry process, and lifelong learning once a project is completed.

Guided inquiry is grounded in the philosophy of constructivist learning and Kuhlthau's (1999) ISP model . It is a dynamic process of learning from a variety of information sources (Kuhlthau, Maniotes & Caspari, 2015: 53). Kuhlthau (1989: 2) elucidates that "the working definition of the 'information search process' is that it is a complex learning process involving thoughts, actions, and feelings that take place over an extended period of time, that involves developing a topic from information in a variety of sources, and that culminates in a presentation of the individual's new perspective of the topic".

The constructive process of guided inquiry establishes a zone of intervention, which was moulded on Vygotsky's zone of proximal development (1978). Kuhlthau (1994: 62) explains that "this concept provides a way for understanding intervention into the constructive process of another person". Therefore, lecturers and librarians can identify when a student requires assistance and as a result guidance can be provided to connect a student's world (first space) with his or her tertiary curriculum (second space) producing a dynamic learning and teaching space called the third space (Kuhlthau, Maniotes & Caspari, 2007, 2012, 2015; Maniotes, 2005).

It is vital for educationalists to know how to encourage students to use their experiences from everyday life and their cultural knowledge to improve the curriculum content (Kuhlthau, Maniotes and Caspari, 2015: 145). Kuhlthau (2010: 2) points out that the main challenge for educators is to create a third space which enables students to creatively and innovatively

make their own connections within the inquiry process of learning, implying the possibility of using the third space concept within makerspace.

Kurti, Kurti and Fleming (2014a: 20) state that makerspaces in education are built on the groundwork of constructionism, which is the philosophy of hands-on learning through building things (Kurti, Kurti & Fleming, 2014a: 20), thus providing the link to guided inquiry. Various makerspace writings (Gustafson, 2013; Hall, 2014; Lotts, 2015a) indicate that these creative spaces, like third spaces, can provide the "intersection of formal and informal learning" (Loertscher, Preddy & Derry, 2013: 48). Makerspace literature has noted the significance "for students to have creative freedom in this [creative] space, but even with artistic flexibility, guidance is needed" (Preddy, 2013: 42), thus indicating that there are occasions when intervention is needed through information support, information literacy, collaboration or instructional programmes (Fourie & Meyer, 2015; Kuhlthau, 2010; Stager, 2013).

In summary, this research study gains great insight from using Maniotes' (2005) third space guided inquiry model as a theoretical framework, for the following reasons:

- The third space concept and the theory associated with it can bridge the gap between students' theoretical knowledge (curricula knowledge) and practical application (personal knowledge) to generate creative outcomes. It can provide insights for lecturers about how curriculum-based projects or tests can be constructed to support students' personal knowledge in complex learning environments;
- The third space concept in correlation with guided inquiry and Kuhlthau's (1991) ISP can be used to promote collective idea generation and sharing during architectural design projects in space of creativity; and
- Information and information support needed during the architectural design projects promotes the underlying idea of intervention and guidance of the students' information seeking, use and needs (Gutiérrez, 2008; Harris & Simons, 2006; Kuhlthau, 2010).

2.8 CONCLUSION

This chapter covered the following makerspace, architecture and creativity literature: introducing makerspaces: spaces for creators, tinkerers and DIYers (plus makerspaces being defined and explored through an information behaviour lens); introducing creativity: the "must-have" 21st century skill (plus creativity being defined and explored through an information behaviour lens); makerspaces characterised as spaces of creativity; and architecture through an information behaviour lens (in retrospective and contemporary). Various makerspace and architecture studies have noted the importance of creativity in the academic context. However, few of these studies are conducted from an information behaviour lens (Bowler, 2014; Burke, 2015; Fourie & Meyer, 2015; Campbell, 2016; Makri & Warwick, 2010). As a result, there is no universal framework or model informing studies on makerspaces, as creative spaces, in architectural education from an information behaviour lens.

This chapter concluded by proposing the use of Maniotes' (2005) third space and guided inquiry model as a theoretical framework, in addition to Kuhlthau's (1991) ISP model, constructionism theory and zones of intervention, to inform the information activities and interactions that occur among architecture students during design projects. The next chapter reports on the research methodology and research design selected for the empirical component of this study.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

Research methodology can be defined as the general approach or strategy of systematic inquiry the researcher takes in carrying out the research project, which to some extent forms the fundamental assumptions to a research design, data collection and analysis (Creswell, 2014: 11; Leedy & Ormrod, 2014: 7; Pickard, 2013: 324). This chapter provides a discussion of the research methodology used for this study. The research design including the research paradigm, research approach, research method, research population, sampling, data collection techniques, data analysis, ethical considerations, and the significance of ensuring reliability and validity are discussed in this chapter.

3.2 REITERATION OF THE RESEARCH STATEMENT GUIDING THE STUDY

This study is intended to show the importance of understanding the information behaviour of architecture students (specifically their information activities and information interactions) and the support that libraries and academic departments may offer to students completing design projects involving creativity. The purpose of this study, as stated in Chapter 1, was to explore a group of third-year architecture students' information activities and interactions when using a dedicated academic space of creativity (pseudo-makerspace). Third space as portrayed by Maniotes (2005) and Kuhlthau, Maniotes and Caspari (2015) was used as a research framework. The study was guided by the following research question and its accompanying sub-questions, as outlined in Chapter 1, section 1.3, namely:

Main research question: Which information activities and information interactions feature in the information behaviour of architecture students during the design stages of a project?

The following sub-questions should be answered by the empirical component of the study:

- Which information activities and interactions of architecture students are revealed during the design stages of a project?
- How do architecture students draw on their personal experiences and resources during design projects?

- How does their architecture curriculum influence their information behaviour during the design stages of a project?
- On which resources do they draw to inspire creativity?
- How do the physical spaces (i.e. the space of creativity) help them in finding solutions and being creative?
- What role can the library play in supporting architecture students during the design stages of their projects in spaces of creativity?

3.3 RESEARCH DESIGN

"*Research design, which I refer to as the plan or proposal to conduct research involves the intersection of philosophy, strategies of inquiry and specific methods*" (Creswell, 2014: 16).

According to Cooper and Schindler (2013: 82), a research design is "the blueprint for fulfilling research objectives and answering questions". Denzin and Lincoln (1994: 14) define a research design as "a flexible set of guidelines that connect theoretical paradigms to strategies of inquiry and methods for collecting empirical material". For the purpose of this study, research design refers to a logical plan with processes and strategies that cover the decisions on the research method, methods of data collection, study population and data analysis (Creswell, 2014: 3; Leedy & Ormrod, 2014: 76; Pickard, 2013: 52; Yin, 2014: 240). The purpose of a research design is to specify the approach to follow when addressing a research problem: the research approach, research method(s), method(s) of data collection and analysis, the population and sample selection processes, the procedures to ensure the validity and reliability of the research results, and adhering to the requirements for ethical research conduct; and lastly, to align the research design with the theoretical framework accepted for the study (Creswell, 2014: 3). The research design fits in with the chosen research philosophy, also referred to as research paradigm.

3.3.1 Research paradigm

All research is grounded in a fundamental philosophical assumption about what institutes valid research and which research methods are suitable for the progression of knowledge in a particular study. Three main philosophical assumptions are noted by Pickard (2013: 7), namely the positivist, postpositivist and interpretive paradigms. According to Terre Blanche,

Durrheim and Painter (2006: 6), research paradigms "are all-encompassing systems of interrelated practice and thinking that define for researchers the nature of their enquiry along dimensions of ontology, epistemology, and methodology". Creswell (2014: 6) notes a fourth philosophical assumption, namely the pragmatist paradigm. The pragmatist paradigm was selected for this study. It provides the philosophical basis to "open the door to multiple methods, different worldviews, and different assumptions, as well as different forms of data collection and analysis" (Creswell, 2014: 11).

3.3.2 Research approach: mixed methods

Three key research approaches are acknowledged throughout the literature on research design, namely: the quantitative approach, the qualitative approach and the mixed methods approach (Creswell, 2014; Leedy & Ormrod, 2014; Pickard, 2013). Each of these methods has different aims, advantages and disadvantages, which are discussed next.

3.3.2.1 *Quantitative research approach*

- **Definition:** The precise "measurement of something", such as participants' behaviour, opinions, attitudes or knowledge (Cooper & Schindler, 2013: 146).
- **Aims:** To answer questions (e.g. whom, how much, when, how often and how), to test theories and realities of social facts by investigating the relationship among variables (Cooper & Schindler, 2013: 146; Creswell, 2014: 4; Pickard, 2013: 18).
- **Advantages:** Permits the researcher to make general and possible predictions; valuable for studying large numbers of participants; less time-consuming when the data is processed using a software program; and offers the research precise, statistical and numeral findings (Creswell, 2014: 4; Leedy & Ormrod, 2014: 139).
- **Disadvantages:** Impersonal due to focusing more on statistical significance than on human significance; manual data analysis could be time-consuming; and may not accurately describe the phenomena occurring within a particular context due to the method being too abstract and general for the complex situation (Creswell, 2015: 5; Leedy & Ormrod, 2014: 139).

3.3.2.2 *Qualitative research approach*

- **Definition:** Cooper and Schindler (2013: 144) define the qualitative research approach as "the interpretive methods that seek to describe, decode, translate, and otherwise come to terms with the meaning, not the frequency, of certain phenomena; a fundamental approach of exploration".
- **Aims:** To accomplish an in-depth understanding and interpretation of a complex situation or human problem that occurs in a natural setting that ascribes to the social construction of reality (Creswell, 2014: 4; Leedy & Ormrod, 2014: 141).
- **Advantages:** Assists in describing a complex phenomenon; provide the individual's personal experiences, thoughts and feelings; valuable for studying a limited number of participants; and provides rich information regarding contextual and background factors (Johnson & Onwuegbuzie, 2004: 17; Pickard, 2013: 14).
- **Disadvantages:** Provides only soft data (difficult to generate quantitative calculations); may be subjective due to researcher's personal peculiarities and biases; and time-consuming when collecting and analysing data (Creswell, 2015: 5; Leedy & Ormrod, 2014: 139; Pickard, 2013: 14).

3.3.2.3 *Mixed methods approach*

- **Definition:** Johnson and Onwuegbuzie (2004: 17) define mixed methods research as "the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study". A mixed methods research approach involves philosophical assumptions (i.e. multiple ways of seeing), which move past the paradigm conflicts by posting a practical and logical alternate usage of qualitative and quantitative research approaches (Creswell & Clark, 2011: 4; Gorman & Clayton, 2005: 12; Johnson & Onwuegbuzie, 2004: 17).
- **Aims:** To integrate elements of both qualitative and quantitative research approaches to offer enhanced solutions and findings (Creswell, 2014: 3; 2015: 5).
- **Advantages:** A mixture of graphs, narratives, pictures and statistics add rich information to the research findings; balances the disadvantages and advantages of

both qualitative and quantitative research approaches; provides a stronger basis for data triangulations (Creswell, 2015: 6; Malina, Nørreklit & Selto, 2011: 59).

- **Disadvantages:** Can be very resource intensive and time-consuming; the complexity of evaluations is high; response rate could be low; and the research runs the risk of conflicting findings from the quantitative and qualitative data (Leeuw & Vaessen, 2009: 38; Malina, Nørreklit & Selto, 2011: 59).

Both qualitative and quantitative research methods hold various disadvantages. The researcher felt that the biases inherent in any single method could be neutralised or cancelled by using a mixed methods approach. Consequently, the researcher adopted a mixed methods approach consisting of quantitative research (descriptive analysis) combined with qualitative research (thematic analysis).

3.3.3 Research method: case study

"*Research methods are selected because they will provide the data you require to produce a complete piece of research*" (Pickard, 2013: 97).

Various research methods are noted in the literature, such as action research, case studies, ethnography, experimental research, survey research and historical research, which the researcher can use to engage in an empirical investigation (Leedy & Ormrod, 2014; Pickard, 2013; Struwig & Stead, 2001). Pickard (2013: 97) notes that the choice of method depends on a number of factors such as the purpose of the study, the audience, and resource and time constraints.

Quantitative research can include methods such as surveys (paper-based or web-based questionnaires), correlational research (testing the relationship between two variables), causal-comparative research (testing the cause and effect relationship between two variables) and experimental research (research guided by a specific hypothesis) (Creswell, 2014; Pickard, 2013; Struwig & Stead, 2001). Qualitative research can include methods such as content analysis (e.g. document analysis), phenomenological research, a case study, grounded theory research, and ethnography (Leedy & Ormrod, 2014; Pickard, 2013; Struwig & Stead, 2001). A mixed methods research approach can include different designs such as exploratory sequel mixed methods design (i.e. researcher expands on or develops the findings

of one method with another method), concurrent mixed methods design (i.e. researcher combines quantitative and qualitative data in order to deliver a full analysis of the research problem), and transformative mixed methods design (i.e. researcher address the same overarching research problem by taking diverse sequential or a concurrent approach) (Creswell, 2014: 14-15; Pickard, 2013: 18).

According to Yin (2013: 16), a case study refers to the "empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used". Three key types of case studies are noted in the literature, namely: intrinsic case study (i.e. gain a better understanding of the case); instrumental case study (i.e. investigate a specific phenomenon/theory and the case itself); and collective case study (i.e. descriptive study that investigates a collection of cases) (Pickard, 2013: 102; Stake, 1994: 237). For the purposes of this study, an instrumental case study research method was used to provide a holistic view of the issues of the research problem pertaining to the research site.

Table 3.1 provides a review of literature considered to inform the choice of a case study research method. The literature is arranged alphabetically by author's surname. Studies mentioned in Table 3.1 were conducted in either academic or public libraries. Table 3.1 also reflects the context of the study, target group, research methodology, research method, participants, and sampling and data collection method. Table 3.1 shows that using a case study research method has often proved useful for libraries and makerspaces.

Authors	Context of study	Target group	Research methodology	Research method	Participants	Data collection method
Burke (2014)	Investigate Makerspaces situated in public and academic libraries in 30 US states and seven other countries	Information professionals working within makerspaces situated in public and academic libraries across the US	Quantitative approach	Survey research	One hundred and forty-three librarians responded to the web-based questionnaire	Web-based questionnaire as a form in Google drive
Koh & Abbas (2015)	Leading learning labs and makerspaces in public libraries and museums in the US	Information professionals working in learning labs and makerspaces situated in public libraries and museums across the US	Mixed method **Phase 1:** Qualitative approach **Phase 2:** Quantitative approach	Two phases, not specifically labelled as a mixed method research project: **Phase 1:** Content analysis **Phase 2:** Survey research	**Phase 1:** Nine individuals were selected by purposive sampling **Phase 2:** Large-scale survey for all information professionals working in learning spaces across the US	**Phase 1:** In-depth individual interviews were done via phone, Skype, or Google Hangout **Phase 2:** Online questionnaire
Moorefield-Lang (2015a)	Public and academic libraries across the US	Information professionals working in makerspaces situated in public and academic libraries across the US	Qualitative approach	Content analysis	Twenty-four makerspace user agreements from public and academic libraries in the US were selected by purposive sampling	Online searches were conducted to find user agreements
Moorefield-Lang (2014)	Six case studies of makerspaces in various school and public libraries across the US	The case studies focus on libraries at three levels: school, public, and higher education, with two case studies from each type	Qualitative approach	Case study	Six individuals were selected by convenience sampling	Individual interviews were conducted via Skype online chat service, Google Hangout, or phone

O 'Connell (2015)	Tufts University's Center for Engineering Education and Outreach and Tisch Library in Medford, US	Tufts University's Medford campus student community	Qualitative study	Case study	The group consisted out of cataloguing and metadata services librarian, a member of the library's administrative staff, a research librarian, a biomedical engineering student, and a software engineer from Tufts technology services	In-depth individual interviews were done
Slatter & Howard (2013)	Makerspaces in Australian public libraries	Information professionals working in public library makerspaces across Australia	Qualitative approach	Case study	Three participants each from different states across Australia through purposive sampling	Semi-structured, qualitative interviews were conducted
Turnera, Welch & Reynolds (2013)	Evolution of learning spaces in academic libraries in the first decade of the twenty-first century	Information professionals working in academic library learning spaces	Qualitative approach	Historical research	All academic library learning space literature from the period 2000-2010	Literature review was conducted

TABLE 3.1: Review of selected literature on the research design for academic and public library makerspaces

3.3.4 Data collection methods

According to Struwig and Stead (2001: 40), data collection methods denote the practices used in collecting data and the techniques to process and analyse the data. Struwig and Stead (2001: 80) explain that data collection can occur in two fundamental types, namely: primary data collection (i.e. new data) and secondary data collection (i.e. existing and current research data) (Connaway & Powell, 2010; Creswell, 2014; Kumar, 2011).

Data collection methods can include the following: interviews (individual or focus groups), observation (experimental recordings, systematic field or participant observation), videotaping of participants, testing (psychological or psychometric), document analysis (text, discourse or narrative analysis), and questionnaires (paper-based or web-based) (Leedy & Ormrod, 2014; Mouton, 2001; Pickard, 2013; Struwig & Stead, 2001). In this study, data was collected through questionnaires and individual interviews. Initially, the researcher wanted to include site visits (observation), but decided against it as individuals might change their behaviour when they become aware of being observed (this change could be negative or positive) (Connaway & Powell, 2010; Leedy & Ormrod, 2014). More specifically, Minichiello (2011) explains that individuals can become secretive about their creative thoughts from fear of someone else capitalising on their unique idea first. The researcher decided against observation as participants might feel that their privacy is invaded.

3.3.4.1 *Profile questionnaire as a data collection instrument*

A questionnaire involves a set of open and/or closed questions in a structured form, which can be "delivered to the participant via personal (intercept, phone) or non-personal (computer-delivered, mail-delivered) means" (Cooper & Schindler 2013: 664; Struwig & Stead, 2001: 41). Brace (2013: 12) explains that a questionnaire can be seen as a medium of communication between the researcher and the participant. Questionnaires can be paper-based or web-based and contain two types of questions, namely: open-ended and close-ended questions (Brace, 2013; Kumar, 2011).

i. **Open-ended questions** produce longer, richer and more revealing words, comments and phrases (Pickard, 2013: 218). These questions are ideal for promoting intellectual involvement and generating critical thinking (Brace, 2013: 34).

ii. **Closed-ended questions** produce a straightforward yes or no answer or an exact short factual question (Pickard, 2013: 218). These questions are ideal for generating a fast paced interaction between researcher and participant and can be used with Likert scales, with the participant selecting the most appropriate option (Kumar, 2011: 151).

For this study a self-administered paper-based questionnaire was used to obtain profile information on the participants (see Appendix B). The following advantages were considered when choosing a questionnaire for data collection: large amounts of information can be collected in a short time; can be cost effective to use; relatively easy to analyse; offers a format that is often familiar to the participants; and lastly, information is collected in a standardised way and is therefore easy to analyse (Pickard, 2013: 209; Kumar, 2011: 148).

According to Cooper and Schindler (2013), and Leedy and Ormrod (2014), the following disadvantages can be associated with questionnaires: they are difficult to construct since categories must be well thought out; emotions such as anxiety may arise among some participants when required to use unfamiliar software to complete the questionnaire; participants might read differently into each question and respond according to their personal interpretation, therefore there is a level of bias that is not acknowledged; and lastly, participants may perceive open-ended questions as time-consuming.

For purposes of this study, the advantages of questionnaires prevailed over the disadvantages to collect profile data from participants; there was also less chance of misinterpretation.

3.3.4.2 *Interviews as a data collection method*

In addition to a questionnaire to collect profile data, three semi-structured interview schedules were used for three different groups of participants, namely: (1) the acting head of department[7], (2) lecturer of the Module Anonymous, and (3) the third-year architecture students. According to Kumar (2011: 339), an interview schedule "is a written list of questions, open-ended or closed, prepared for use by an interviewer in a person-to-person interaction (this may be face-to-face, by telephone or by other electronic media)". The acting head of

[7] The individual interview schedule was originally developed for the head of department. However, due to the head of department being new to the department and having limited time available, she suggested I ask the acting head to take part in the study. As a result, the acting head of department participated on behalf of the head of department.

department was interviewed first followed by the lecturer of the module in mid-September 2016. Lastly, the third-year architecture students, registered for the Module Anonymous, who indicated on their informed consent form (Appendix C) willingness to take part were interviewed in October 2016. An interview schedule (Appendix F: Interview schedule for third-year architecture students) was used to collect data on participants' personal views and experiences during the design stages of a project with specific reference to the use of a dedicated space of creativity, their information activities and information interactions. The interview schedule for the acting head of department is in Appendix D and for the lecturer in Appendix E.

An individual interview was chosen for data collection in light of these advantages mentioned by Given (2015: 50), Creswell and Clark (2011: 308), Leedy and Ormrod (2014: 155):

- Offers more in-depth data which is not possible to acquire using a questionnaire;
- Provides the interviewer with the option of clarifying the questions, thus safeguarding against unclear and confusing questions;
- Offers the interviewer the opportunity to capture verbal and non-verbal cues;
- Provides more flexibility than questionnaires, because the interviewer can adjust to the situation, probe for response and get as much in-depth information as possible; and
- Can collect data on personal views and experiences of participants from their own perspectives and in their own words, consequently gaining rich information.

Leedy and Ormrod (2014) and Kumar (2011) note the following disadvantages of face-to-face interviews: they can be highly labour-intensive when follow-ups are required, thus time-consuming; the size of the sample is limited to the size of the interviewing staff and the number of qualified respondents; the interviewer may need training; some interviewees may be unwilling to talk to an unacquainted individual (i.e. researcher), so trust between the interviewer and interviewee may have to be established first; and lastly, interviewees may not always be available or accessible.

From the advantages and disadvantages of interviews as a data collection technique, it is noticeable that the advantages exceed the disadvantages. The advantages of using focus group interviews as an alternative to individual interviews (Creswell & Clark, 2011; Given,

2015) was considered, but these were not used since students might not want to share how they pursue creativity and information seeking in front of their peers for fear of someone else replicating their ideas (Minichiello, 2011).

3.3.4.3 *Summary of advantages and disadvantages of the selected data collection methods*

Various authors (Brace, 2013; Creswell & Clark, 2011; Given, 2015; Kumar, 2011; Kvale, 2008; Pickard, 2013) note the advantages and disadvantages of using questionnaires and interviews to collect data. Table 3.2 provides an overview and comparison of the advantages and disadvantages discussed in the preceding two sections (3.3.4.1 and 3.3.4.2):

What are the advantages?	What are the disadvantages?
QUESTIONNAIRES (Brace, 2013; Pickard, 2013; Kumar, 2011)	
Large amounts of information in a short timeframe	Possibility of a low response rate
Can be analysed more scientifically and objectively	Difficult to construct questions
Cost effective to cover a large sample area	Participants may not understand the questions
Format is accustomed to most of the participants	Participants may not have the skills to use the software needed to complete the questions
Easy to administer	Participants may perceive some of the open-ended questions to be time-consuming
INDIVIDUAL INTERVIEWS (Creswell & Clark, 2011; Given, 2015; Kvale, 2008)	
Offers more in-depth data (rich data)	Time-consuming to transcribe and analyse
Interviewer gets the option to clarify the participant's response	Interviewee unwilling to talk openly about sensitive matters to interviewer
Can capture verbal and non-verbal cues	The interviewer may need training
More flexible than questionnaires	Highly labour-intensive and costly
Relationship development amid interviewer and interviewee	Limited sample size

TABLE 3.2: Overview and comparison of advantages and disadvantages of the selected data collection methods

3.3.5 Study population and sample

"*The ideal participant is thoughtful, articulate, rational, and, above all, co-operative*" (Jason & Sara Hammer, cited in Cooper & Schindler 2013: 337).

According to Cooper and Schindler (2013: 665), "a sample is a group of cases, participants, events, or records consisting of a portion of the target population, carefully selected to represent that population". Sampling refers to the process of selecting some elements from a population to embody that population (Cooper & Schindler, 2013: 665). Sampling is done to represent a certain population's characteristics, whether it is homogenous or heterogeneous, to gather information and draw valid inferences from the selected sample rather than the whole census (population) (Imdadullah, 2015; Struwig & Stead, 2004). Some characteristics of the sampling method are that it eliminates costs, reduces time and minimises sampling errors (Imdadullah, 2015; Singh, 2010). Table 3.3 offers a comparison between the advantages and disadvantages of sampling. The sampling method used is determined by the objectives of the research study.

Advantages	Disadvantages
(Imdadullah, 2015; Singh, 2010)	
Eliminates costs of studying the whole census	Inadequate sample selected
More time effective	Inexperienced manpower
Reliable when using a scientific sampling technique to minimise sampling errors	High possibility of bias
Practical method for executing various surveys	Physical impossibility or difficulty to get the perfect representative sample

TABLE 3.3: Comparisons of advantages and disadvantages of sampling

According to Cooper and Schindler (2013), Creswell (2015), and Struwig and Stead (2004), there are two main sampling methods, namely:

i. **Probability sampling:** Refers to the possibility that each element in the target population could be selected and usually the chance of selecting one element is equal to the chance of selecting any other element (Cooper & Schindler, 2013; Struwig & Stead, 2004). Examples of this sampling method: simple random, systematic sampling,

stratified sampling, cluster sampling and multi-stage sampling (Creswell, 2015; Leedy & Ormrod, 2014; Pickard, 2013).

ii. **Non-probability sampling**: Refers to elements that are selected based on the judgment of the researcher. Generalisations are usually possible from this method although not by using statistical techniques (Cooper & Schindler, 2013; Struwig & Stead, 2004). Examples of this sampling method: convenience sampling, purposive sampling and quota sampling) (Creswell, 2015, Pickard, 2013).

For the purpose of this study, a purposive sampling method was used. A specific group of 60 participants (third-year architecture students) within a department of architecture at a designated university in South Africa was invited to participate – specifically, students registered for a third year module in architectural design (Module Anonymous).

3.3.6 Pilot study

"[A] pilot test [is] a trial collection of data to detect weaknesses in design and instrumentation and provide proxy data for selection of a probability sample" (Cooper & Schindler, 2013: 662). Crossman (2016) explains that before the main study is conducted a feasibility study (pilot study) can be done to reveal errors (e.g. question sequencing, instructions or skip directions), refine the research questions, estimate the resources required, time needed and whether the research method taken is workable and realistic (Cooper & Schindler, 2013).

A pilot study was conducted in mid-September 2016 with two postgraduate architecture students at the designated department. The two postgraduate students were asked to complete a questionnaire and take part in the individual interviews to detect any difficulties in understanding the questions, and to note the time taken to complete the data collection. The data from the pilot study was not mixed with the data from the actual study due to the participants being post-graduate students.

3.4 RELIABILITY AND VALIDITY

"The value of any research rests on the appropriateness, quality, accuracy and credibility of its research findings" (Kumar, 2011: 165).

As researchers develop and conduct a research study, the researcher should constantly be apprehensive of how he or she can maintain the reliability and validity of the research findings. Reliability refers to the degree of consistency and stability of measurement (Creswell, 2014:149; Kumar, 2011:181), while validity refers to the degree to which the empirical measurement is reflected adequately to indicate the scientific soundness and appropriateness of the research design under consideration (Kumar, 2011:166; Pickard, 2013: 136). Leedy and Ormrod (2014: 91) explain that the reliability and validity of measurement instruments affect the following:

- The degree to which a researcher can learn something about the phenomenon under exploration;
- The probability that the researcher will acquire statistical importance in the data analysis; and
- The degree to which the research can draw meaningful conclusions from the data.

3.4.1 Ensuring reliability of instruments

Leedy and Ormrod (2014: 93) and Struwig and Stead (2001: 131-132) suggest four possible ways to increase the reliability of instruments, namely:

- **Inter-rater reliability:** The degree of agreement to which two or more entities (i.e. raters) evaluate the product or performance and give matching conclusions;
- **Test-retest reliability:** The degree to which a single instrument is administered over two or more intervals to the same participants over a period of time and yields the same outcomes;
- **Equivalent forms / parallel-forms reliability:** The degree to which two dissimilar accounts of similar instruments yield similar outcomes; and
- **Internal consistency / split-half reliability:** The degree to which all the items within a particular instrument reproduces the same attributes to yield similar outcomes.

Kumar (2011: 182) notes that reliability may be influenced by the following factors, namely: the ambiguous wording of questions, variations in physical setting, the respondent's and interviewee's moods, the nature of interaction among the participants, and lastly, the regression effect of the instrument.

3.4.2 Ensuring validity of instruments

According to Struwig and Stead (2001: 139-140), Leedy and Ormrod (2014: 91) and Kumar (2011:179-180), there are four ways of establishing the validity of measurement instruments, namely:

- **Face and content validity:** The judgement of an instrument measuring what it is proposed to measure;
- **Predictive validity:** The judgement of an instrument by the extent to which it can estimate an outcome;
- **Concurrent validity:** The judgement of an instrument by how well it can compare with an additional assessment being done simultaneously; and
- **Construct validity:** This is determined by establishing the influence of each construct to the total variance perceived in a phenomenon.

In this study, the value of the research findings is safeguarded by addressing the concerns of both reliability and validity in the subsequent ways:

- Triangulation was applied, which refers to a process by which a researcher verifies a finding by using different sources of data and different methods of data collection to support the research questions (Leedy & Ormrod, 2014: 104). This study used data triangulation from third-year architecture students, lecturers and the acting head of department. Participants' views and experiences noted in the questionnaire and interview data were compared with findings from the literature. The objective was to improve the confidence and credibility of the research findings (Leedy & Ormrod, 2014; Pickard, 2013);
- Most of the questions in the questionnaire and interviews were developed bearing in mind Maniotes' (2005) third space in guided inquiry model (part of the theoretical framework for the present study) and are aligned with findings from the literature review reported in Chapter 2;
- The research instruments were pilot-tested with the purpose of improving the reliability and validity (explained in section 3.3.6);
- The questions in the questionnaire and interviews were formulated concisely to avoid ambiguity;

- A description of the research purpose and objectives was communicated to participants to clarify the applicability and practicality of the study for educational purposes, and for support by tertiary institutions and libraries regarding academic spaces of creativity; and
- All the participants were assured that confidentiality would be maintained. Although participants were required to sign a form of informed consent, they were not asked for their names (to maintain anonymity), so they could freely and openly respond to the questions without any fear of being identified.

3.5 ETHICAL CLEARANCE

"*Research ethics involve requirements on daily work, the protection of dignity of subjects and the publication of the information in the research*" (Fouka & Marianna, 2011:3).

Formal permission to conduct this study was received from the Faculty Committee for Research Ethics and Integrity, the dean of the faculty where the research was conducted, the head of department of architecture and the lecturer where the study took place, and the Research Committee of the Department of Information Science (as the representatives of the institution that will grant the degree).

A requirement was that the architecture department, tertiary institution and participants of the study will not be mentioned by name in any reports on this study; it will be referred to only as a leading South African university and department of architecture. The documents mentioned are included as appendices:

- **Appendix A:** Letter of invitation;
- **Appendix B:** Profile questionnaire for third-year architecture students;
- **Appendix C:** Informed consent form;
- **Appendix D:** Interview schedule for head of department;
- **Appendix E:** Interview schedule for lecturer of module anonymous;
- **Appendix F:** Interview schedule for third-year architecture students; and
- **Appendix G:** Research declaration.

Fouka and Marianna (2011) explain that for a study to be considered ethical, the respect to anonymity and confidentiality, the right to privacy, beneficence (do not harm), and the informed consent of participants must be acknowledged when conducting research. The researcher viewed a number of similar case studies to assist her in considering all ethical issues. For example, Slatter and Howard (2013: 282) obtained full ethical clearance for their study (Makerspaces situated in public libraries in Australia) from the QUT Ethics Committee, which is the Office of Research Ethics and Integrity (OREI) in Australia (OREI, 2015). Moreover, any ethical concerns regarding the integrity of their research were safeguarded through the *QUT Code of Conduct for Research Framework*, which included general ethical codes of behaviour such as showing respect towards the subjects participating in the study, properly acknowledging the role of others in the research, ensuring the liability of the research results communicated to others, certifying the honesty and integrity of the researcher, and lastly, certifying good stewardship of public resources used to conduct the research (OREI, 2015; Slatter & Howard, 2013).

The researcher adhered to the following ethical considerations:

- Safeguarding all confidential information by performing the study in a private and safe space, and not asking any personal questions in the profiling questionnaire and interviews;
- Not using any names of the participants in her dissertation or any other publication and not disclosing or using any information against the participants, now or in the future;
- Presenting participants with the letter of permission granted by all the relevant Research Ethics Committees of the institution where the study was completed;
- Explaining the informed consent form to all the participants before it was signed; and
- Using pseudonyms for each of the participants to protect their identities (Goodall, Newman & Ward, 2014; Wilson, 2016).

Further, various steps were taken to ensure the data collected was secured by addressing the concerns of both reliability and validity to improve the confidence and credibility of the research findings presented.

3.6 DATA ANALYSIS

"*Data analysis methods enable you to organise and bring meaning to large amounts of data*" (Struwig & Stead, 2001: 169).

In this study, the descriptive quantitative data from the self-administered semi-structured questionnaire (Appendix B) were analysed using Microsoft Excel spreadsheets. This analysis tool enabled the researcher to conditionally format data to indicate variations, build a variety of charts and easily generate formulations.

The qualitative data from the individual semi-structured interviews (Appendices D to F) were analysed using thematic analysis. Thematic analysis is the grouping of information (through coding) into themes that emerge as being important to the description of the phenomenon (Fereday & Muir-Cochrane, 2008: 82). For the purpose of this study a smartphone audio recorder (Huawei P6 Smart Voice Recorder) was used, with signed permission from the participants (Appendix C), to capture the interviews. Thereafter, the audio recordings were transcribed to text files using Dragon NaturallySpeaking 13, a Windows-based speech-to-text software. The text-files were later analysed through the application of thematic analysis as a theme-recognition technique.

Ryan and Bernard's guidelines (cited in Guest, MacQueen & Namey, 2011: 66) on thematic analysis were followed to identify, analyse and report emerging patterns (themes) from the data, namely:

- **Repetition:** If a concept iterates throughout a record, it is likely to be a theme;
- **Indigenous categories/typologies:** Local terms that sound unfamiliar or are used in unique ways known to the researcher's theoretical framework may indicate themes;
- **Metaphors and analogies:** Themes may arise from the linguistic expressions of participants in making sense or comprehending a given topic;
- **Transitions:** Participants shifting from the topical content may point toward themes.
- **Constant comparison/similarities and differences:** Themes may arise through systematically comparing segments of text to note similarities and variances;
- **Linguistic connectors:** Themes may arise when focusing on places in the text where a participant's method of reasoning is revealed. For example, identifying phrases or

words such as “if’, “because”, “since”, or any other words implying casual relation; and

- **Silence/missing data:** Absence of a theme can occur, especially in the case where important information is left out by the participants.

In this study, data analysis and interpretation focused on validating overarching themes supported by extracts from the raw data. Findings and analysis are presented in Chapter 4.

3.7 CONCLUSION

In this chapter, an outline of the research design, research paradigm, research approach, research methods, data collection methods, and study population and sample for this study were discussed. The chapter furthermore provided details regarding the pilot study, ensuring the reliability and validity of findings, addressing ethical concerns, and data analysis methods used for qualitative and quantitative data. The succeeding chapter reports on the findings of the questionnaire and individual interviews.

CHAPTER 4: DATA ANALYSIS AND REPORTING RESEARCH FINDINGS

4.1 INTRODUCTION

In this chapter the findings from the data collected during the empirical component of the study are presented. The empirical study was conducted during the period from September 2016 to October 2016. This chapter consists of the empirical component's research statement reiterated, participant profile, data collection methods, setting the context for the findings, quantitative analysis of the profile questionnaire, qualitative analysis of the three individual interviews (i.e. acting head of department, lecturer and third-year architecture students), triangulation, and the relevance of Maniotes' (2005) third space guided inquiry model as a theoretical framework.

4.2 RESEARCH QUESTION AND EMPIRICAL SUB-QUESTIONS REITERATED

The purpose of this study, as stated in Chapter 1, was to explore a group of third-year architecture students' information activities and interactions when using a dedicated academic space of creativity (pseudo-makerspace) during design projects. The study was guided by the following research question:

Which information activities and information interactions feature in the information behaviour of architecture students during the design stages of a project?

Sub-questions addressed by the empirical component:

- Which information activities and interactions of architecture students are revealed during the design stages of a project?
- How do architecture students draw on their personal experiences and resources during design projects?
- How does their architecture curriculum influence their information behaviour during the design stages of a project?
- On which resources do they draw to inspire creativity?
- How do the physical spaces (i.e. the space of creativity) help them in finding solutions and being creative?

- What role can the library play in supporting architecture students during the design stages of their projects in spaces of creativity?

4.3 SETTING THE SCENE FOR THE EMPIRICAL STUDY

This section provides an outline of how the empirical component of this study was conducted, with specific references to the invitation process for the three participating groups from a leading South African university and department of architecture, the participant profile and a summary of data collection methods used.

As stated in Chapter 3, permission to conduct this study was received from the Faculty Committee for Research Ethics and Integrity, the dean of the faculty where the research was conducted, the head of department and the lecturer of Module Anonymous where the study took place, and the Research Committee of the Department of Information Science, University of Pretoria (as the representatives of the institution that will grant the degree). A Researcher Declaration (Appendix G) was signed by the researcher to indicate adherence to all ethical considerations noted in Chapter 3 in section 3.5.

4.3.1 Invitation of participants

The study used a purposive (third-year architecture students busy with an architectural design project and used the physical spaces provided) and convenience (easy access to the sample group and physical spaces) sampling method, as discussed in Chapter 3. Apart from the 60 third-year architecture students registered for a third-year module in architectural design (titled as Module Anonymous), the head of department and lecturer were invited to take part in the study. The acting head of department participated on behalf of the head of department.

4.3.1.1 *Profile questionnaire for third-year architecture students*

An online profile questionnaire was used to gain descriptive quantitative findings from the third-year architecture students. The questionnaire provided insights into their background, self-assessed creative abilities and their use of informal and formal information resources during design projects. The web-link to the questionnaire (Appendix B) (consisting of seven questions, an invitation letter and informed consent form) was distributed through e-mail on 17 October 2016. Once the profile questionnaire was completed, participants were asked to

indicate whether they were willing to continue the study by taking part in an individual interview, or they could discontinue and exit the study. By 23 October only 10 fully completed questionnaires were returned via Google Forms to the researcher, giving at that stage a very low response rate of 17% (10/60). Subsequently, a reminder e-mail, and an announcement on the institution's learning management system, were sent out to the third-year architecture students on 24 October 2016. In total 25 third-year architecture students' responded to the questionnaire by 31 October 2016, but two respondents entered the study and then exited directly, resulting in an overall final response rate of 38% (23/60) for the online questionnaire.

A question in the profile questionnaire asked whether participants were willing to take part in the second component of the study, namely an individual interview. Of the 23 third-year architecture students only 19 indicated their willingness to take part in the individual interview. The acting head of department and lecturer of Module Anonymous indicated their willingness to take part in the individual interviews.

A low response rate is not uncommon. For example, a study by Campbell (2016) noted a response rate of 16% to an online survey of the information-seeking habits of architecture faculties across the United States. The Royal Institute of British Architects (RIBA) (2012) reported a response rate of 10% to an online questionnaire exploring average salary levels among architecture students. Chen (2013) accepted a response rate of 31% to an online questionnaire investigating "the role of research in landscape architecture practice". An exploratory study by Kowaltowski, Bianchi and De Paiva (2010), reported a response rate of 33% for their individual interviews examining the various methods to inspire creativity in architectural design education.

The low response rate to this research study could be for several reasons such as participants not having internet access, limited internet access or slow internet speed (especially for students participating off-campus), the time of the year when the study was conducted (third-year students were presenting their final-year projects before November examinations began), participants might have been uninterested in taking part in the study due to the topic of the study and student unrest across South Africa at the time.

4.3.1.2 *Individual interviews for three groups of participants according to different interview schedules*

The individual interviews provided qualitative findings to gain insight and rich information. Three interview schedules (Appendix D to F) were used to collect data from the students, acting head of department and lecturer. All participants signed the informed consent form (Appendix A).

1) The individual interview schedule originally developed for the head of department (Appendix D) consisted of eight questions. A meeting was scheduled with the acting head of department at her convenience, and a copy of the invitation letter (Appendix A) and interview schedule were attached in the e-mail.
2) The individual interview schedule for the lecturer of the Module Anonymous consisted of nine questions (Appendix E). A meeting was scheduled at her convenience, and a copy of the invitation letter (Appendix A) and interview schedule were attached in the e-mail.
3) The individual interview schedule (Appendix F) of the third-year architecture students consisted of 12 questions. Participants were given the option to select their preferred method of participation in the individual interview. The following options were provided: online (Google Form), by video Skype or face-to-face. If a participant indicated that they preferred video Skype or a face-to-face interview, the participant was requested to provide contact details so that the researcher could schedule a meeting to conduct the interview. The individual interviews were conducted from 17 October 2016 to 31 October 2016. A printed copy of the informed consent form and interview schedule was provided to participants in the face-to-face session. Electronic copies were sent by e-mail to participants taking part via video Skype to be signed. Appendix F shows the interview schedule of the third-year architecture students.

4.3.2 Participant profile

This section provides the demographics of the prospective and actual participants in the study for each data collection method used. In total 60 third-year architecture students were invited to participate while only 25 actually participated (as indicated in Table 4.1). Although 25 third-year architecture students' participated, two respondents entered the study and then exited directly, resulting in an overall final response rate of 38% (23/60) for the online questionnaire.

Participant groups	Prospective number of participants	Actual number of participants	Number of responses for questionnaire	Number of responses for individual interview
Acting head of department	1	1	Not applicable	1
Lecturer of the module	1	1	Not applicable	1
Third-year architecture students	60	25	23	19

TABLE 4.1: Outline of potential participants versus actual participants

4.3.3 Summary of data collection methods

Chapter 3 provided a comprehensive explanation of the selection of the research design and data collection instruments used for the study. The data collection instruments, as noted in section 3.3.6, were pilot-tested in mid-September 2016 with two postgraduate architecture students before being administered. In this section a summary (see Table 4.2) is provided of the data collection methods, the number of participants, time period and software used to administer the data collection instruments.

SUMMARY OF DATA COLLECTION METHODS		
Method	Profile questionnaire	Individual interviews *(three different individual interview schedules for each of the sample groups)*
Administration mode	Online (web-based)	- Online (web-based) - Face-to-face - Skype video
Software	Google Forms (cloud-based application)	- Online individual interview: Google Form - Face-to-face session: Huawei P6 Smart Voice Recording software - Skype video session: Skype web application - Transcribing software: Dragon NaturallySpeaking 13 software
Sample groups	Third-year architecture students	1) Acting head of department 2) Lecturer of Module Anonymous 3) Third-year architecture students
Number of questions	Seven semi-structured questions	1) Head of department interview schedule: eight questions

		2) Lecturer of Module Anonymous interview schedule: nine questions 3) Third-year architecture students interview schedule: 12 questions
Time to complete	± 5-10 minutes	± 30 to 45 minutes
Actual number of participants	23 out of 60 participants: 38%	1) Acting head of department: 1 2) Lecturer of Module Anonymous: 1 3) Third-year architecture students: 32% (19/60)
Time period	2016/10/17 to 2016/10/31	1) Acting head of department: 2016/10/27 2) Lecturer of Module Anonymous: 2016/10/06 3) Third-year architecture students: 2016/10/17 to 2016/10/31
Informed consent	The consent form was signed online and participants had the option of discontinuing and exiting the study, which redirected them to a "Thank you for your time and participation" page. See Appendix C to view informed consent form.	1) Acting head of department **face-to-face** interview: printed copy of consent form administered was signed before the interview began. 2) Lecturer of Module Anonymous **face-to-face** interview: printed copy of consent form administered was signed before the interview began. 3) Third-year architecture students interview: - Online individual interview: consent form signed online and participants had the option of not answering all the questions, as well as discontinuing and exiting the study, which redirected them to a "Thank you for your time and participation" page. - Face-to-face session: printed copy of consent form administered was signed before the interview began. - Skype video: electronic copy of consent form e-mailed to the participant was signed and returned to researcher before the interview began.

Table 4.2: Summary of data collection methods and administration modes used in study

4.4 PROFILE QUESTIONNAIRE: DESCRIPTIVE QUANTITATIVE FINDINGS FROM THE THIRD-YEAR ARCHITECTURE STUDENTS

This section reports on the analysis of the descriptive quantitative findings collected from the third-year architecture students' profile questionnaire (see Appendix B). The profile questionnaire was administered online to participants before the individual interview was conducted. The questionnaire provided a profile sketch of the students by questioning three main topics, which were also used as subsections, namely: background, creativity, and information resources used and preferred. The subsections reporting on the findings follow the same order as the questionnaire. The questionnaire consisted of seven semi-structured questions ranging from multiple choice to Likert scale questions. Open-ended questions were also included. All participants were registered third-year architecture students, thus all 23 questionnaires could be fully used for analysis. The descriptive quantitative findings supported the contextualisation of the participants.

4.4.1 Background

This subsection reports on the analysis of question 1, 2 and 3 of the questionnaire (Appendix B). For this study, no personal information was requested in regard to gender, name and surname, age and race to increase the anonymity of the participants and to adhere to ethical considerations (as mentioned in section 3.5). Hence pseudonyms were used to present the findings from the students in the graphs of the study (e.g. Graph 4.1).

4.4.1.1 *Confirmation of status as registered third-year architecture student*

Participants had to confirm that they were third-year architecture students for their questionnaire to be accepted as valid for this study, as the sample selection of the study was specifically focused on third-year architecture students registered for a third year module in architectural design (Module Anonymous). All 23 participants confirmed that they were third-year architecture students, thus resulting in 23 valid questionnaire submissions for the study. This is shown in section 4.3.2, Table 4.1 (Outline of potential participants versus actual participants) and section 4.3.3, Table 4.2 (Summary of data collection methods and administration modes used in the study).

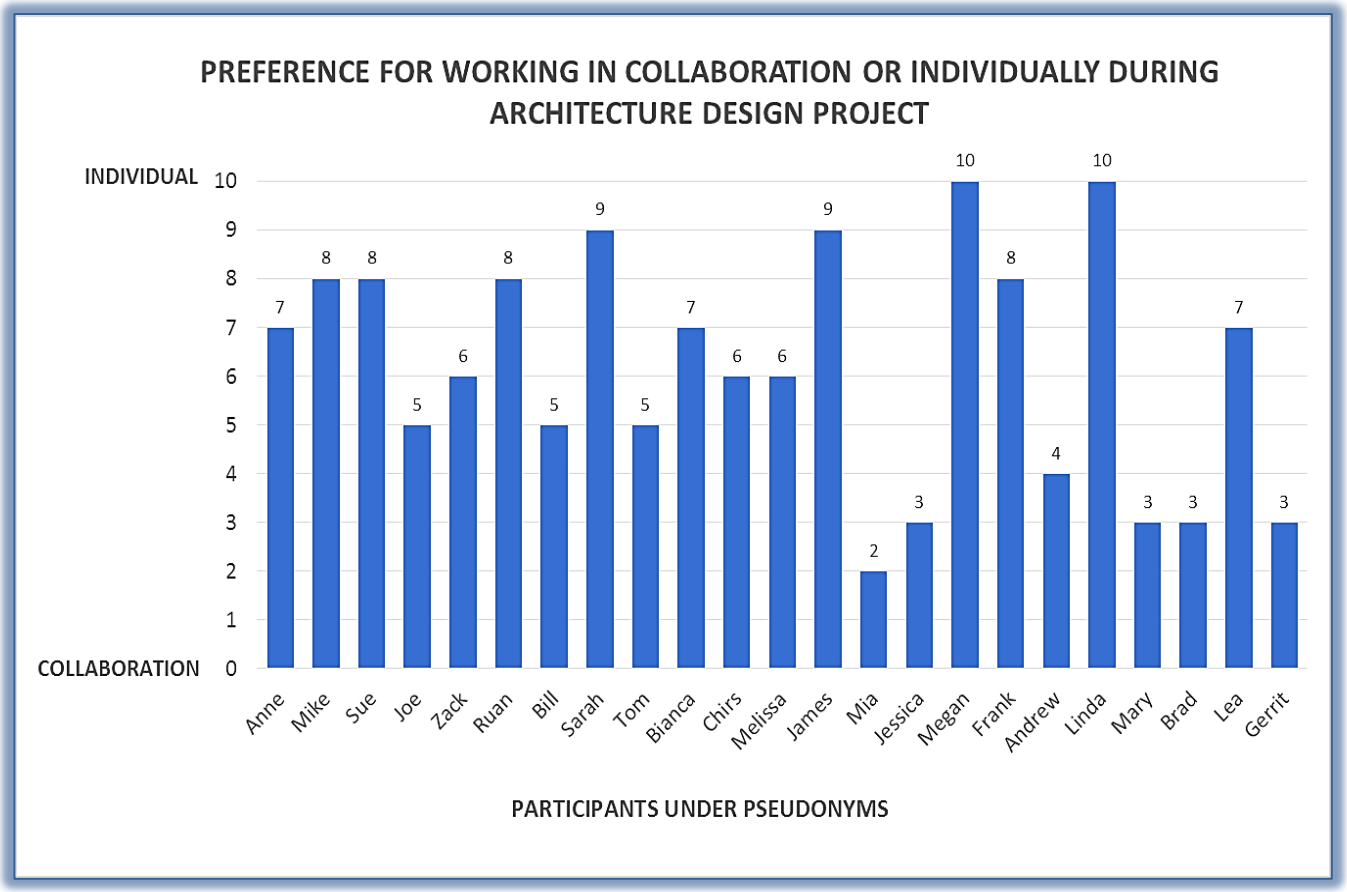
4.4.1.2 *Industry work experience*

Question 2 (Appendix B) on industry work experience was a yes/no question. Only 7/23 (30%) participants reported industry work experience, for example internships at architecture firms, performing freelance work in computer-aided design (CAD) and drafting, or being part of the quantity surveying and site analysis team in projects.

This question was of great significance as participants who had such experience might have had a different approach, rationale and understanding regarding the design stages behind design projects from gaining a preview of how architecture practices function. This was confirmed in the verbatim extracts in section 4.5.3.1c.

4.4.1.3 *Preference for collaboration or working individually on an architecture design project?*

In question 3 (Appendix B) participants were asked to indicate their preference in regard to working in collaboration or individually when working on an architecture design project. Question 3 used a 10-piont Likert scale where 1 indicated the highest preference for collaboration and 10 the highest preference for individual work. Graph 4.1 illustrates the participants' preferences.



Graph 4.1: Preference for working in collaboration or individually during architecture design projects

A plurality of the participants, 11/23 (48%), preferred working individually (selecting 7, 8, 9 or 10 on the Likert scale) during architecture design projects. Other significant findings included:

- None of the participants specified an extremely high preference for collaboration, thus selecting 1 on the Likert scale. The closest was 5/23 (22%) participants selecting 2 and 3 on the Likert scale;
- 4/23 (17%) participants indicated a moderate preference for collaboration, thus selecting 4 or 5 on the Likert scale;
- 6/23 (26%) participants indicated a moderate preference for working individually, thus selecting 6 or 7 on the Likert scale;
- 6/23 (26%) participants stated that they had a high preference for working individually, thus selecting 8 or 9 on the Likert scale; and
- 2/23 (7%) participants specified an extremely high preference for working individually, thus selecting 10 on the Likert scale.

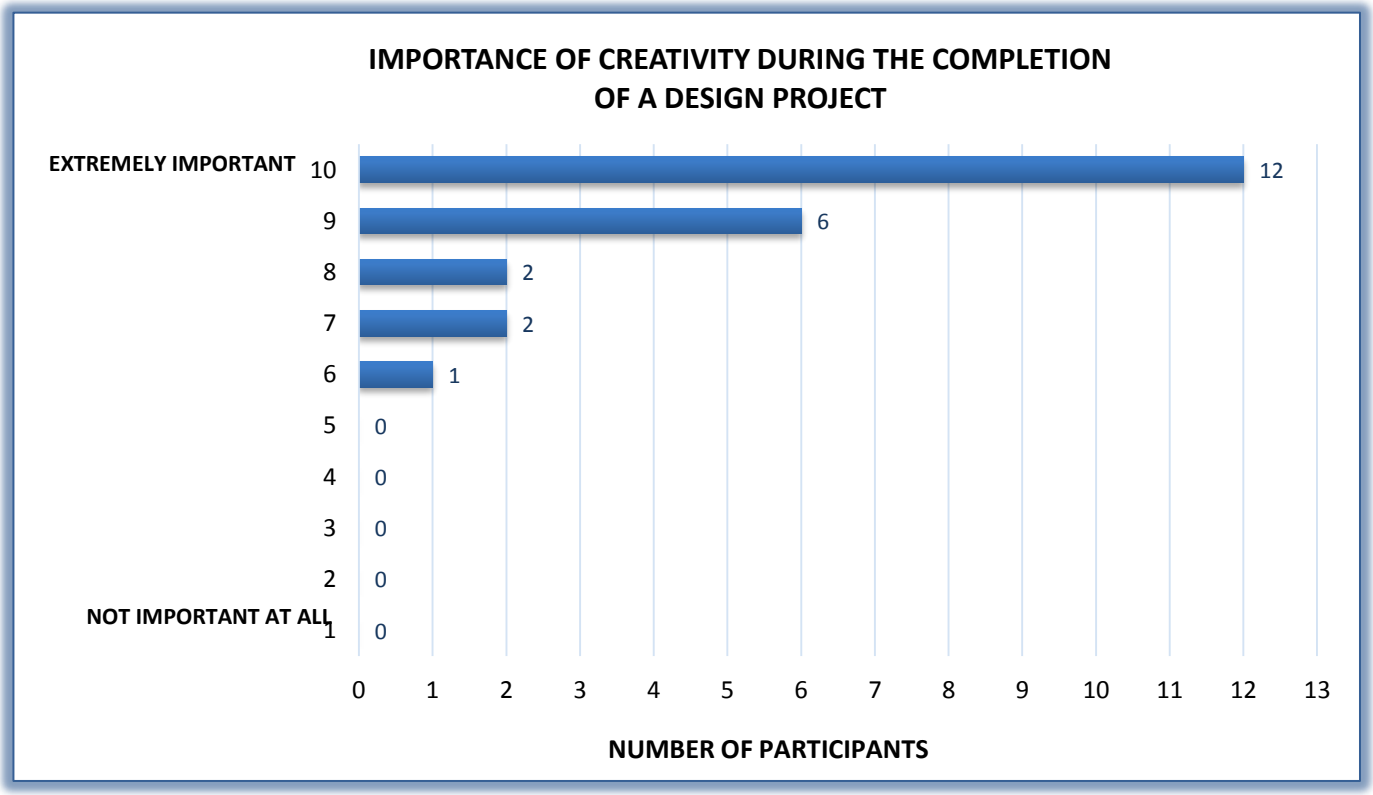
The significance of working collaboratively in groups during architectural design projects will be discussed further in section 4.5.1.1b (individual interviews with the acting head of department) and section 4.5.2.1d (individual interviews with the lecturer).

4.4.2 Creativity

Questions 4 and 5 focused on the participants' opinion of the importance of creativity and their self-reported levels of confidence in their creative abilities during design projects. The significance of creativity in creative spaces (section 2.6.1) and information behaviour (section 2.5.2) studies was discussed in Chapter 2.

4.4.2.1 *Importance of creativity during design project.*

In question 4 (Appendix B) participants had to indicate on a 10-point Likert scale how important creativity is during the completion of a design project, where 1 indicated not important at all and 10 extremely important. The ratings of the participants are depicted in Graph 4.2.



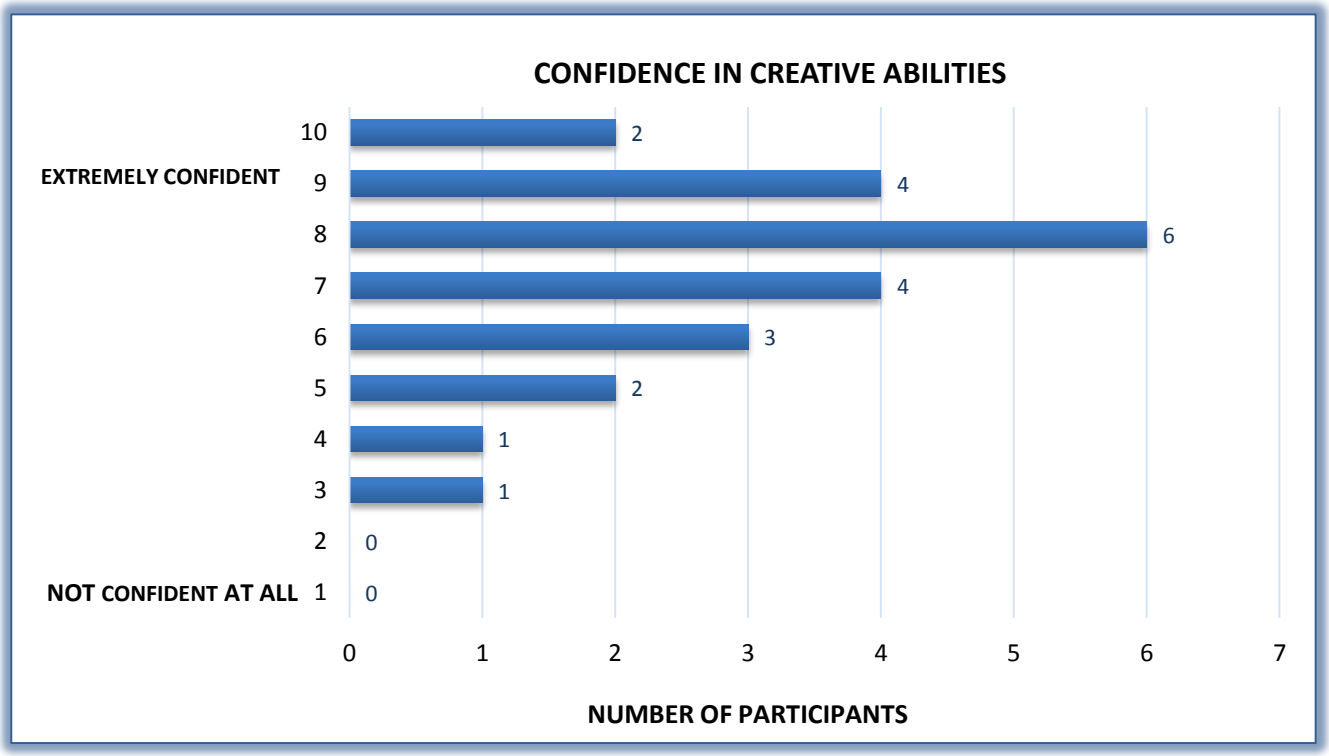
Graph 4.2: Importance of creativity during the completion of a design project

A majority of participants, 12/23 (52%), indicated that creativity is extremely important (selecting 10 on the Likert scale) during the completion of design projects. Further, 6/23 (26%) participants selected 9 on the Likert scale, whereas 4/23 (17%) participants indicated either 8 or 7 on the Likert scale. The lowest rating on the Likert scale was a 6 by 1/23 (4%) participant, indicating the importance of creativity as moderate. In aggregate this shows that 100% considered it from moderately to extremely important (i.e. selecting a 6, 7, 8, 9 or 10 on the Likert scale).

The importance of creativity in completing a design project is thus well acknowledged. Further descriptions of the reasons why the integration of creativity is important during projects are discussed in section 4.5.3.4 (Individual interviews with third-year architecture students).

4.4.2.2 *Self-reported confidence in creative abilities*

Question 5 (Appendix B) specifically focused on how confident a participant was in his or her creative abilities. A 10-point Likert scale was used to measure the participants' self-rating of their confidence; 1 indicated not confident at all and 10 indicated extremely confident, as shown in Graph 4.3.



Graph 4.3: Confidence in creative abilities

A large majority of the participants, 16/23 (70%), indicated that they were highly confident in their creative abilities (selecting 7, 8, 9 or 10 on the Likert scale). Other significant findings included:

- None of the participants reported no confidence in their creative abilities (i.e. selecting 1 or 2 on the Likert scale);
- 2/23 (9%) participant reported very low confidence in their creative abilities (i.e. selecting 3 or 4 on the Likert scale);
- 5/23 (22%) participants indicated that they had a moderate degree of confidence in their creative abilities (i.e. selecting 5 or 6 on the Likert scale);
- 4/23 (17%) participants indicated that they had a fairly high degree of confidence in their creative abilities (i.e. selecting 7 on the Likert scale);
- 10/23 (44%) participants stated that they had a high degree of confidence in their creative abilities (i.e. selecting 8 or 9 on the Likert scale); and
- 2/23 (9%) participants specified that they had an extremely high degree of confidence in their creative abilities (i.e. selecting 10 on the Likert scale).

Overall, participants were confident in their creative abilities with 52% selecting a 6 or higher on the Likert scale. Elaboration on the type of resources from which they draw inspiration is presented in section 4.5.3.4a (Individual interviews of third-year architecture students). This should be considered with the findings from the interview with the lecturer for Module Anonymous (section 4.5.2.1).

4.4.3 Information resources

Questions 6 and 7 addressed the significance of various types of scholarly information resources in different contexts to inspire and motivate creativity (as noted in section 2.6.2 of Chapter 2). The term “scholarly information” was used in association with formal and informal sources to indicate that the sources noted must be academic.

4.4.3.1 *Use of formal sources and sources of scholarly information for your architecture design projects*

Question 6 (Appendix B) assessed the use of formal sources of information. A 4-piont Likert scale (never, seldom, often and very frequently) was used to rate use of the following formal information sources: libraries, databases to which libraries subscribe, Google Scholar, journal articles, conference papers, books, design standard or technical instruction manuals and multimedia. More detail on the findings is presented in Table 4.3.

Formal sources of information (N=23)	Never	Seldom	Often	Very frequently
Libraries	1	7	12	3
	(4.3%)	(30.4%)	(52.2%)	(13%)
Databases to which libraries subscribe	2	13	6	2
	(8.7%)	(56.5%)	(26.1%)	(8.7%)
Google Scholar	2	10	9	2
	(8.7%)	(43.5%)	(39.1%)	(8.7%)
Journal articles	0	5	10	8
	(0%)	(21.7%)	(43.5%)	(34.8%)
Conference papers	7	13	3	0
	(30.4%)	(56.5%)	(13%)	(0%)
Books	0	2	12	9
	(0%)	(8.7%)	(52.2%)	(39.1%)
Design standard/ technical instruction manuals	0	2	15	6
	(0%)	(8.7%)	(65.2%)	(26.1%)
Multimedia	4	6	7	6
	(17.4%)	(26.1%)	(30.4%)	(26.1%)

Table 4.3: Formal sources of information used for architecture design projects

Findings from analysis of Table 4.3:

- The formal information sources most frequently used were books (9/23; 39.1%), journal articles (8/23; 34.8%), design standard or technical instruction manuals (6/23; 26.1%) and multimedia sources (audio/image, CD-ROM/DVD) (6/23; 26.1%). These are followed by fairly frequently used sources (i.e. selecting "frequently" on the Likert scale) such as libraries (3/23; 13%), Google Scholar (2/23; 8.7%) and databases to which libraries subscribe (2/23; 8.7%). Conference papers were not used by any of the participants.
- The formal information sources used most often are design standards or technical instruction manuals (15/23; 65.2%), libraries (12/23; 52.2%) and books (12/23; 52.2%). Following these are information sources used fairly often (i.e. selecting "often" on the Likert scale), namely: journal articles (10/23; 43.5%), Google Scholar (9/23; 39.1%), multimedia (7/23; 30.4%) and databases to which libraries subscribe (6/23; 26.1%). Conference papers again were the least often used information source (3/23; 13%).
- The formal information sources used most seldom included conference papers (13/23; 56.5%), databases to which libraries subscribe (13/23; 56.5%) and Google Scholar (10/23; 43.5%). These were followed by the information sources used fairly seldom (i.e. selecting "seldom" on the Likert scale), namely: libraries (7/23; 30.4%), multimedia (6/23; 26.1%) and journal articles (5/23; 21.7%). Books and design standard or technical instruction manuals were the least seldom used (2/23; 8.7%).
- As for information sources never used, 7/23 (30.4%) participants have never used conference papers, 4/23 (17.4%) reported never using multimedia and 2/23 (8.7%) reported never using Google Scholar. 2/23 (8.7%) reported never using databases to which their libraries subscribe, 1/23 (4.3%) have never used any libraries. Journal articles, books and design standard or technical instruction manuals were never mentioned as information resources never used.

Additional formal information sources mentioned by the participants included: blogs (Pinterest and Archdaily), architectural magazines, dissertations (other master students) and projects of previous years. None mentioned doctoral theses.

4.4.3.2 *Use of informal sources and sources of scholarly information for your architecture design projects*

Question 7 (Appendix B) collected data regarding the use of informal sources of information. As with question 6, a 4-piont Likert scale (never, seldom, often and very frequently) was used to rate the use of the following informal information sources: people you know, people you do not know, search engines and social networking sites. Details regarding the findings are presented in Table 4.4.

Informal sources of information (N=23)	Never	Seldom	Often	Very frequently
People you know	0	0	10	13
	(0%)	(0%)	(43.5%)	(56.5%)
People you do not know	5	11	6	1
	(21.7%)	(47.8%)	(26.1%)	(4.3%)
Search engines	0	1	6	16
	(0%)	(4.3%)	(26.1%)	(69.6%)
Social networking sites	1	3	5	14
	(4.3%)	(13%)	(21.7%)	(60.9%)

Table 4.4: Informal sources of information used for architecture design projects

Here follows the analysis of Table 4.4:

- The informal information source most often reported as used *very frequently* was search engines (16/23; 69.6%). This was followed by 14/23 (60.9%) participants using social networking sites very frequently, and 13/23 (56.5%) reporting that they very frequently use people they know. Only one participant (1/23; 4.3%) reported very frequently using people he or she did not know (assuming this refers to not knowing a person personally) as an information source;

- Participants also reported on information sources they used *often*, but not necessary very frequently. 10/23 (43.5%) reported that they often use people known to them as an informal information source. This was followed by 6/10 (26.1%) reporting that they use search engines or people they do not know as informal information sources. Social networking sites received the lowest response as an information source often used by participants (5/23; 21.7%);
- The informal information source most *seldom* used was "people you do not know" (11/23; 47.8%). This was followed by 3/23 (13%) participants reporting that they seldom use social networking sites and only one participant indicated seldom use of search engines. "People you know" were never used by any of the participants; and
- Lastly, participants reported on information sources they *never* used. 5/23 (21.7%) participants reported that they have never used "people you do not know", 1/23 (4.3%) reporting on never using social networking sites (1/23; 4.3%). "People you know" and search engines were never mentioned as information resources never used.

Additional informal information sources highlighted by the participants included: architecture websites, and personal friends and family. The latter two count as people known.

Overall, question 6 and 7 indicated that a comprehensive range of formal and informal information sources are used by the participants for their architecture design projects. In aggregate the highest preference was for books as formal information sources, and search engines as informal information source.

4.5 INDIVIDUAL INTERVIEWS: QUALITATIVE FINDINGS

This section reports on the analysis of the qualitative findings collected through three different interview schedules with three different groups of participants: the acting head of department (Appendix D), lecturer of the Module Anonymous (Appendix E), and the third-year architecture students (Appendix F). The aim of qualitative research is to investigate the rationale, opinions and interpretations of the participants. In addition, the qualitative research approach provided the researcher with a deeper comprehension of the information activities and interactions of the students. This included their question-asking behaviour

during design projects stages, spaces (physical and virtual) that support creativity, and the role of information and information support to complete architecture projects successfully. The evaluation of the qualitative findings in combination with the quantitative findings (profile questionnaire) and literature review (Chapter 2) offer the researcher a comprehensive stance to formulate recommendations and further research suggestions. (The triangulation of findings is addressed in section 4.6).

The participant composition for the individual interviews is portrayed in Table 4.1. The number of participants and questions, administration mode, and time period of the interviews are indicated in Table 4.2. An informed consent form (see Appendix C) was given to the participants to obtain permission to record their interviews. The researcher used Huawei P6 Smart Voice Recording software with handwritten notes to record the interviews. Dragon NaturallySpeaking 13 software was used to transcribe the voice files and thereafter the transcripts were manually checked by the researcher. Only paralanguage, specifically filler words, such as “uh”, “um”, “er” and “ah” were removed from the transcripts. No other edits were made to the verbatim extracts of the participants.

A thematic analysis method, as discussed in section 3.6, was used to analyse the interview responses. The questions from each of the interview schedules were translated into main themes. Under the main themes, sub-themes were identified for each of the sub-questions. The findings are discussed in sections 4.5.1 to 4.5.3. Each participant received a pseudonym to protect his or her identity. Various information behaviour studies have used pseudonyms to protect the identity of their participants, such as Goodall, Newman and Ward (2014), McCaughan and McKenna (2007), Reddy and Jansen (2008), and Wilson (2016). Pseudonyms were randomly selected as the gender of the participants was unknown.

4.5.1 Interview with the acting head of department

Eight questions were asked to the acting head of department (see Appendix D for the interview schedule). The questions were divided into three main themes, namely: architecture design projects, the role of creativity during design projects, and spaces of support. Findings are discussed according to these themes as main headings, with sub-headings to reflect in-depth analysis of each theme. Interview responses from the acting head of department are reported under the pseudonym Beth. The acting head of department

requested that her interview not be recorded and thus the researcher made handwritten notes to record the interview[8]. To ensure that the researcher captured the essence of every answer given, and so that nothing was omitted or the handwritten notes misinterpreted, the transcribed interview was e-mailed to the acting head of department to be reviewed. Various studies have made use of participant reviews to improve the accuracy, validity and reliability of notes and interpretations (Burnard, Gill, Stewart, Treasure & Chadwick, 2008; Hagens, Dobrow & Chafe, 2009; Thomas, 2016).

4.5.1.1 *Architecture design projects*

Questions 1.1 to 1.3 asked the acting head of department about the department's expectations of students, the importance of group work, and the use of information and information resources to completed architecture design projects.

a. Expectations of students' artistic, technical, practical and theoretical knowledge and skills

In response to Question 1.1, the acting head of department (pseudonym Beth) explained how students' artistic, technical, practical and theoretical knowledge and skills should culminate in architecture design projects. All of these skills combined are important for the design of a project; however, the type of skills and knowledge used by students depend on the type of design project they must complete. Further, Beth noted that when the projects are evaluated at the end, it would be expected from the students to find a balance between the skills and knowledge so that they can operate in any environment or situation.

b. Importance of group work from the departmental approach

In response to Question 1.2, Beth discussed the importance of group work during architecture projects from a departmental approach. She said group work provides a room for interaction. Students have to know one another. In addition, group work is perfect for discussions, and doing exercises. In group work, each individual's end product can complement each other. As a result, they can designate different tasks to different individuals with different skills. Beth concluded by emphasising that group work is perfect for learning how to strategize and

[8] No direct quotations were used due to the acting head of department requesting that her interview not be recorded, thus the researcher had to interpret the handwritten notes herself during the thematic analysis.

summarise a variety of information, ideas, solution, etc. For the purpose of the study, group work will cultivate active learning and co-constructors of knowledge among participants during creative tasks.

c. Use of information and information resources to complete a design project

Question 1.3 covered the use of information and information resources in the completion of a design project. Beth explained that in general, when students use information, it is expected of them to strategize the information and this is what matters. Otherwise, no result could be the outcome of all the information being channelled due to not knowing what to do with it. Students should know what to do with the information. The actual putting to use is thus important.

4.5.1.2 *Role of creativity during design projects*

Questions 2.1 and 2.2 (see Appendix D) asked for Beth's opinion on how creativity should feature during design projects, and how the use of information and information resources can trigger creativity.

a. Creativity features in design projects for the Module Anonymous

In response to Question 2.1, Beth talked about the creative interpretation of information and that using the information to self-evaluate the project is important. In addition to information, self-criticism is of very high significance for students to evaluate themselves, thus being able to position their work.

b. Use of information and information resources to trigger a creative thought or idea

In response to Question 2.2, Beth discussed the role that information use and information resources play in triggering a creative thought or idea. She noted that people are usually searching for information related to their profession, but for architects inspiration can be found outside their profession. For example, the movement of biomimicry, where one can be inspired by nature or noting a problem and finding solutions in nature. For her there are two important starting points: 1) Define what information you need and then salvaging it, and 2) Define the problem and then salvaging the information.

4.5.1.3 *Spaces of support*

Questions 3.1 to 3.3 addressed the spaces of support provided by the academic department, the vision for such spaces in the near future, and how information, information resources and information support should feature in such spaces.

a. Spaces of support (physical or virtual) provided by the academic department

Question 3.1 focused on the physical and virtual spaces of support provided by the department. Beth pointed out that not all spaces of support required are provided for the third-year students; however, instructions are provided to students on where they could find other spaces. For example, some workshops are no longer presented at the department and the computer lab is used only for specific training. Lastly, Beth notes the design studio is an important space for the students to work in.

b. Vision for work spaces in the near future

In responding to question 3.2, Beth noted that the ideal for work spaces in the near further would be to combine the physical and virtual. Although she elaborated on this, the feedback is not incorporated here due to the length restrictions of this study.

c. Information, information resources and information support feature in work spaces

Question 3.1 focused on how the information, information resources and information support feature in the work spaces provided by the department to the students. Beth explained that:

- Firstly, everything cannot be done simultaneously at once. A separate session should be organised that is dedicated to the use of specific information so that students would know the purpose of each type of information resource. Sessions on the use of various information resources should be repeated. For example, specific submissions require specific information. Submission of components of the final design project forms a re-iterative process throughout the various stages of a project. Hence, Beth placed emphasis on the importance of students to have a good understanding of what information sources and services are provided and what they should do with the information.

- Secondly, the successful integration and synergy of various information, and information resources and services are required to produce a creative final design project.

4.5.2 Interview with the lecturer of Module Anonymous

Nine questions were asked of the lecturer responsible for Module Anonymous (see Appendix E). The questions were divided into three main themes, namely: Module Anonymous curriculum, the role of creativity during design projects, and spaces of support. Interview responses from the lecturer of Module Anonymous are reported on under the pseudonym Meredith.

4.5.2.1 *Module Anonymous curriculum*

The module curriculum was covered in questions 1.1 to 1.5. It included a description of Module Anonymous, vision for Module Anonymous, expectations of students, the impotence of group work during design projects, and the use of information and information resources in Module Anonymous.

a. Description of Module Anonymous

In response to question 1.1, Meredith gave feedback on the module and documentation available on the module's curriculum. She elaborated on a spectrum of issues including design activities, interactions, resources of information, personal experiences, curriculum to influence and explore architecture design, sources noted to stimulate creativity, the physical and virtual space, and solutions to challenges they experience.

The module stretches over a year, and involves five and a half studio sessions as well as two lectures per week. Several assignments are set to inspire a wide range of design experiences from the diction of ideas, through design manifestation and development, to detail and technical tenacities, design description, communication and objective self-appraisal. Each year the curriculum is adapted to fit the current contemporary design themes (e.g. political and social themes).

The objective of the curriculum is to introduce advanced design challenges relating to scale and complexity, focusing on the urban context. These design challenges assess the designer's

(i.e. student's) aptitude to respond to both the physical and metaphysical (i.e. speculative or abstract thought) context in which architecture is positioned.

The curriculum presents "a sort of horizontal pedagogical underpinning" from first to third-year. At first year level students are exposed to a wide range of design realms. This is gradually extended to more focused designs and "how to design complex programmes within a specific contextual setting in third year". The module is constructed on the notion that architecture is physiological, political and philosophical, rather than a scientific practice.

b. Vision for Module Anonymous

For question 1.2, Meredith explained that the overall vision of the module is to explore different identities, investigate different kinds of narratives (e.g. Homi Bhabha and Achille Mbembe postcolonial text), as a source of creative expression, and to investigate different design lenses so that students can primarily find their own voice in the third-year studio.

c. Expectations of students' artistic, technical, practical and theoretical knowledge and skills

Question 1.3 explored Meredith's expectations of students' artistic, technical, practical and theoretical knowledge and skills, and how these should be integrated into Module Anonymous. Meredith pointed out that students' personal experiences such as personal politics or normative position, also known as invisible design aspects, establish the groundwork of their design manifesto within different contexts and modes of design.

It is expected of third-year architecture students, in their end-of-year integrated examination, to incorporate a range of knowledge and skills (i.e. theoretical, practical, technical and artistic) accumulated throughout their three years of study into their final project, for example:

- Theoretical knowledge and skills development are supported by subjects titled Design and History. The Design and History subjects expose students to a range of skills and knowledge such as more holistic thinking skills in terms of the theoretical premise; problem-solving skills to handle theoretical ramifications and frameworks issues; and selection skills for evaluating the most suitable lens (e.g. identities) to frame a theoretical premise. The History subject fosters searching and retrieval skills and knowledge to investigate the spatial and physical aspects in a specific context (e.g. city);

- Practical and technical knowledge and skills development are supported by a subject titled Construction. The Construction subject nurtures various practical and technical knowledge and skills such as design interrogation skills; construction drawing skills based on student's normative position; and question-asking skills (e.g. how do I build this?, what materials will I use? etc.) to move designs from the speculative realm to the realistic realm; and
- Artistic knowledge and skills development are supported by a subject focusing on sustainable systems. Creative thinking is encouraged to ensure that the environmental systems designed in a project are sustainable on numerous levels.

d. Importance of group work in Module Anonymous

With regard to the importance of group work (question 1.4), Meredith explained that the third-year students' design studio is a noteworthy physical space to aid students in group work and discovering their own voices during projects. In addition, she noted that during group work a specific complex urban setting (e.g. city), also referred to as a design laboratory, is provided to contextualise their design projects.

e. Use of information and information resources in Module Anonymous

Question 1.5 asked Meredith for information on the use of information and information resources in Module Anonymous. She mentioned two main types of information resources used by the students during the design activities and phases of their projects, namely (she labelled the types "soft" and "hard information):

i. **Soft information:** this encompasses information from *reading sources*, for example, printed books and peer-reviewed journal articles are noted as a preference of hers.
ii. **Hard information:** this encompasses information collected from the *city* (i.e. invisible information) through *LG diagrams, and physical* and *digital models*, and information collected from the *site analysis* through a wide spectrum of tools. This can include *physical end even anthropological interviews*[9] with people on the site, and spatial information from the hard factual environmental aspects.

[9] Anthropological interviews are the "qualitative process of exploring in depth the whys and hows of human culture, behaviour, and expression" (Agency for Healthcare Research and Quality (AHRQ, 2013: 1).

iii. "Information is not just people as a sort of an infrastructure but across a range of information technologies". For that reason, there "is an incredibility wide range of information platforms that they tap into". Against the latter, apart from the soft and hard information, it seems as if also a third type of information can be used and captured in technology or tools, or even objects. Thus, signifying where librarians can play a key role in literacy training to develop the skills needed for the use of various types of information resources.

4.5.2.2 *Role of creativity during design projects*

Question 2.1 and 2.2 asked Meredith to explain how creativity features in design projects such as those for Module Anonymous, and the role of information use and information resources to trigger creativity.

a. Creativity feature in design projects for Module Anonymous

Meredith answered question 2.1 by emphasising that "creativity is a core ingredient of the course/module". Creativity features in design projects in a couple of different ways and stages of the project, namely:

i. **Start of a project:** Mapping the site sets the premises and this can be done straightforwardly or creatively. For example, a straightforward pedestrian mapping or mapping the story of the trolley-pushers in the city. Furthermore, communicating the mapping creatively is very important.
ii. **Development of a design program:** Responding creatively to mapping by translating it creatively into a design program and then deciding on how this should be planned (i.e. straightforward stereotypical sort or outside-the-box process).
iii. **Actual design (end product):** Creative expression regarding spatial and formal exploration from the start of a project till completion is very important and rewarding (i.e. with good marks).

b. Use of information and information resources to trigger a creative thought or idea

Question 2.2 focused on the role of information use and information resources to trigger creative thoughts or ideas. Meredith pointed out that information and information resources

to inspire creativity are "a very important underpinning to all the work you do", as "information gives the integrity to design decisions".

4.5.2.3 *Spaces of support*

Question 3.1 and 3.2 adressed spaces of support (physical or virtual) currently provided by the department to assist in Module Anonymous (question 3.1), and the usefulness of these spaces in supporting creativity, and whether there were things she would want to add (question 3.2).

Meredith discussed various physical and virtual spaces that are in place to support the completion of design projects, for example:

i. **Physical spaces:** The *design studio* is a space for crowdsourcing and sharing of notions; *design pinup spaces* enable cross-pollination across all years of study; the *atrium space* for design critics (known by students as design crits) provides observers with interesting insights (improve the design project, and gain inspiration and advices to solve complex design problems); the *reading room* provides access to a physical repository of various information resources; the *archives* offer background information on historical meritorious architects. Other physical supporting spaces to represent and communicate designs are a *computer laboratory*, and several tools such as *laser cutting, 3D printing and model-building facilities*. The usefulness of physical spaces to support creativity include: the *design studio* supports the notion of "you learn more from your peers ultimately than you do from your lecturers", thus an important learning device to foster creativity; robust setup of the building fosters conscious or even subconscious engagements with the work on the pinup spaces to stimulate creative ideas; physical scaled mock-up models during crit sessions produce a responsive environment to inspire creativity.
ii. **Virtual spaces:** The *computer laboratory* provides a range of software to move designs from the physical to the virtual spaces; the *electronic learning management system* is used as a communication and teaching tool; *Ted Talks* is used to foster discussion in the design studio; *virtual models* constructed on Revit software vs. *physical model (mock-up model)* provide a different lens for investigating a project. Other virtual supporting spaces to represent and communicate designs are *e-reserves, electronic resources and the internet*. The usefulness of virtual spaces to support creativity include: Institutions providing

support online in a virtual studio format (e.g. Open Architecture) with a range of educational tools to inspire creativity was noted.

In essence, Meredith stressed that, "I do believe there are advantages in the actual physical space to harvest and to build on a creative output more so than the virtual realm". On the other hand, Meredith noted that although she is "sceptical of the utilisation of a virtual studio setup, it has been proved to be used successfully" and that the incorporation of the "virtual world in the physical studio is very important as its exposure to students to work within".

4.5.3 Interviews with the third-year architecture students

Twelve questions were asked to the third-year architecture students (see Appendix F). As noted in Table 4.1, only 19 students (who also fully completed the questionnaire) agreed to take part in the individual interviews. The questions were divided into four main themes, namely: design project overview, project design stages, an information behaviour perspective of the stages in the design process, and creativity.

4.5.3.1 *Design project overview*

Questions 1.1 to 1.3 covered an overview of the design project. Participants were asked about a design project they completed in Module Anonymous during 2016. The following sub-themes were identified from the answers to questions 1.1 to 1.3:

a. Description of design projects completed in Module Anonymous

Question 1.1 requested a description of a design project completed by the participant during 2016 in the Module Anonymous. A diverse range of design projects were described by the participants, namely: implementation of a bicycle transportation hub, riverside restaurant, creation of a future space for journalists where messages and media intended for public consumption is screened and monitored, protective and low-income housing, shelters, processing and consumption facility for high protein crop growing, rehabilitation centre, library addressing media and information technology influences, urban orphanage, language learning and textual trade skills centres, backpackers' hostel, multi-religion meditation centre, and youth mental wellness centre.

Some specific contemporary issues were revealed among the design projects such as *political issues* (message and media screening and monitoring or censorship, protective housing, and shelters), *social and cultural issues* (bicycle transportation hub, restaurant, rehabilitation centre, urban orphanage, multi-religion meditation centre and youth wellness centre), *economic issues* (low-income housing and processing and consumption facility for high protein crop growing), and *educational issues* (language learning and textual trade skills centres, and library).

b. Perception on the importance of creativity

In question 1.2 participants were asked to state their perceptions regarding the importance and integration of creativity into their designs. The responses varied from creativity being important to creativity being extremely important. This is in line with the findings of the questionnaire (section 4.4.2.1). The following verbatim excerpts from the participants' responses reveal their perceptions on the importance of creativity:

- "I personally believe creativity is the only thing designers possess that makes them different from other craftsmen ... though most of the time it [is] quite experimental and needs practical thought to materialise it ... I think integrations assists with that" (Mike).
- "Creativity is extremely important in the field of architecture as it sets your work apart from everyone else" (Ruan).
- "Highly important from start to finish" (Bill).
- "Creativity is essential to rich design. In order to make those important design decisions often something more than rational is required" (Tom).
- "I find it to be extremely important to allow for creativity to be a predominant factor within a design yet there should be practical outlook which many overlooks" (Bianca).
- "Very important, people respond better to 'prettier' things even if the design is not good" (Melissa).
- "Incredibly important, an architect (Architecture/Landscape/Interior) that doesn't speculate, solve problems, find new ways of thinking and provide alternatives - is not an architect. If someone just 'copy and paste' existing solutions (which if you look at the state of our urban society are woefully inadequate in today's world and terribly

contextual) then they were misguided in trying to become an architect and would be better suited as a draftsman" (James).

- "Creativity is vital to carrying out new and unique designs" (Andrew).

The fact that creativity is a distinguishing factor in their line of study or work was noted by several participants:

- "I feel as tough a creative proposal is what distinguishes one intervention from the next" (Sarah).
- "Although I believe that architecture is (at least within the current era) not 100% unique, having a personal and unique approach to your work is essential for its success" (Ruan).
- "If one is not creative in your design process there will be no furthering in the capabilities of architects, and as a result, our field won't create the modern day process or typologies needed for future opportunities" (Jessica).
- "Seriously? What is design without creativity?" (Megan).
- "I think to succeed in any design profession, creativity is the number one tool to have. To creatively think of a space, to creatively solve a design issue, to creatively suggest an alternative of the existing and to creatively communicate your vision. It separates architecture from engineering" (Frank).
- "It is what makes us the individuals we are and defines that one thing we bring to the table" (Andrew).
- "It is the only thing that makes substantial design worthy of being called architecture" (Gerrit).

Some of the participants opted to define creativity by noting the various integrated skills and knowledge needed to cultivate creativity, namely:

- "Creativity is designed. You need to be able to think in a way that integrates theory as well as architectural elements. Your creativity needs to be holistic in order to produce good architecture" (Mia).
- "Creativity allows us to not just design the physical but the experience and emotional quality of a space. A balance between function and creative form is essential for the successful molding of the spaces we create" (Andrew).

- "I guess creativity is synonymous with design so it isn't a question of its importance or integration as I believe it's an inherent part of design, it is design, design is creativity" (Linda).
- "Creativity is integral for integrating and managing beauty, space, sensuality, experience, logic and restrictions. It is a core element that defines planning from architecture" (Brad).

Against the latter, skills and knowledge related to theoretical, practical, technical and artistic aspects were noted by participants as being important in the integration of creative design projects. Hence the expectation (noted by the acting head of department in section 4.5.1.1a and lecturer in section 4.5.2.1c) of integrating their learned knowledge and skills, acquired throughout their three years, in their architecture design projects.

c. Prior learning and experience help in the completion of design projects

In question 1.3 participants were asked to elaborate on how their prior learning (from the start of their studies until the end of their third year) and experiences (industry experience) assisted them in completing their design projects. The responses, regarding the usefulness of prior learning and experience, ranged from it being very useful to it not being very useful at all.

The responses elaborate on the findings reported in section 4.4.1.2 (discussion of findings of the questionnaire). 6/19 (32%) of the participants explicitly noted that their prior learning and/or industry experience was not very useful at all or that they did not have any experience, as follows:

- "Not much. I'm making it up as I go along" (Sue).
- "To be honest, my work experiences thus far have not proven very helpful in terms of my current projects" (Ruan).
- "No industry experience" (Bill).
- "I have not had any experience" (Melissa).
- "Practical experience is invaluable, you need to know what the rules are in order to break them and you need to be able to turn your ideas into believable end products otherwise you are an artist and not an architect" (James).

- "Not applicable" (Andrew).

Participants who stated in question 2 (section 4.4.1.2) of the questionnaire that they had no prior industry experience said the same in the above verbatim extracts.

Participants also elaborated on their prior learning and experience stated in section 4.4.1.2 (discussion of findings for the questionnaire). 13/23 (68%) participants explained that their prior learning and experience has assisted them to:

- "… not just visualizing and understanding the project in vacuum but how it is going to work in the specific context given" (Mike).
- "… start thinking of cost, time and quality, as well as heritage, standards and realistically. Your brain starts to bring the idea to life, where it is possible to build it" (Joe).
- "… manage my time and have a better understanding of what lies ahead after graduation" (Ruan).
- "… gain insight into how people tend to appropriate personal space for sense of belonging and or identity" (Sarah).
- "… understand the practical side of design" (Tom).
- "… apply realistic scenarios within my design" (Bianca).
- "… understand the power of a good material palette easily. I could also represent things more easily and emotively than some of my peers who had no prior experience in that area" (Mia).
- "… greatly improve … my CAD skills" (Megan).
- "… work out the spatial constraints in the project" (Jessica).
- "… boost my confidence in seeing myself as a creative [creator] and a designer … managing time within a project and how to execute the communication of a project" (Frank).
- "… narrative catalyzed the design process allowing me to generate spaces" (Linda).
- "… know the restrictions of structural elements of certain materials I was able to stretch those very restrictions through creative methods learned through access to previous classes and projects as well as visual informal guides such as Pinterest. Knowing how to find the information that I needed is extremely important as someone

with poor memory. I can understand a concept but referencing my principles back to the specifics is essential" (Brad).

- "… realise the difference between realistic and paper architecture concepts" (Gerrit).

The importance of prior learning for the completion of a design project was aptly highlighted by the following verbatim extract from Frank's input, (reinforcing that prior industry experience can influence a participant's design as stated in section 4.4.1.2):

> "I would say my prior learning consists of the completion of 1st and 2nd year: the integration of all our subjects definitely enriches any Module Anonymous project (design theory, history, earth studies, construction, etc.) because you have a holistic outcome in a project. The skills learnt in the first year of Module Anonymous helped to boost my confidence in seeing myself as a creator and a designer, and the second year of Module Anonymous helped with managing time within a project and how to execute the communication of a project. Any learning also broaden your framework of design knowledge".

Against the latter, the range of skills and knowledge learned from first to the third year (prior learning) provided "a sort of horizontal pedagogical", as noted by Meredith in section 4.5.2.1a, to assist students (i.e. the participants) in integrating their theoretical, practical (can include industry experience), technical and artistic skills and knowledge (mentioned in previous sub-theme (b)) to complete their architecture design projects.

4.5.3.2 *Project design stages*

Question 2.1 and 2.2 (see Appendix F) addressed the stages followed to complete a design project, and whether the participants worked individually or collaboratively during the project design stages. The following sub-themes were identified to report findings based on questions 2.1 and 2.2:

a. Description of project stages to complete the design project

In question 2.1 participants were requested to describe the stages they went through to complete the projects stated in 4.5.3.1. Some similarities in the responses were noted in the project stages described to complete their projects. A table (see Table 4.5) with all the project stages in correspondence to the participants who used the project stage was generated. The

project stages populated in Table 4.5 were listed in the order in which the responses were collected.

	PARTICIPANTS																			
PROJECT STAGES	Mike	Sue	Joe	Zack	Ruan	Bill	Sarah	Tom	Bianca	Melissa	James	Mia	Jessica	Megan	Frank	Andrew	Linda	Brad	Gerrit	N/19
Briefing of design programme														■						1
Research	■	■			■					■		■								5
Precedent studies	■						■	■			■	■		■						6
Idea (generation and sharing)									■	■	■									3
Conceptualising/concept	■			■	■				■				■	■	■	■		■	■	10
Sketch/Drawings						■					■						■			3
Concept Marquette						■		■			■	■			■					5
Sketch-up model						■											■			2
Planning									■	■										2
Programme and site selection															■	■		■		3
Site analysis	■	■	■	■			■	■			■			■	■	■		■		11
Macro and microanalysis			■																	1
Informal interviews							■													1
Design		■	■	■								■	■	■					■	7
Construction drawings						■														1
Urban framework			■												■					2
Zoning (Land-use planning/urban planning)		■		■																2
Mapping				■		■														2
Exploration (virtual or physical)															■	■				2

	PARTICIPANTS																			
PROJECT STAGES	Mike	Sue	Joe	Zack	Ruan	Bill	Sarah	Tom	Bianca	Melissa	James	Mia	Jessica	Megan	Frank	Andrew	Linda	Brad	Gerrit	N/19
Extrapolation					■															1
Experimentation	■								■									■		3
Integration								■												1
Implementation									■											1
Construction	■													■		■				3
Digital (computer drawings/3D drawings)					■			■			■						■		■	5
Technical study			■																	1
Detail (sectional plans and evaluation, master plans)	■			■									■		■	■	■			6
Execution										■										1
Evaluation														■						1
Critique													■							1
Finalisation									■							■				2
Presentation	■	■			■			■				■	■					■		7
Feedback		■						■												2
Re-design/adjustments		■						■					■					■		4

Table 4.5: Project stages to complete design projects

From the analysis of Table 4.5, the following findings are significant:

- Design stages mentioned by the highest number of participants are site analysis (11/19; 58%), conceptualising/concept (10/19; 53%) and then design (7/19; 37%) and presentation (7/19; 37%). Consequently, the following design stages are specified: precedent study (6/19; 32%), detail (sectional plans and evaluation, master plans) (6/19; 32%), research (5/19; 26%), concept Marquette (5/19; 26%) and digital (computer drawings/3D drawings) (5/19; 26%). A lower number of participants detailed the use of a re-design stage (4/19; 22%), idea generation stage (3/19; 16%), sketch/drawing stage (3/19; 16%), programme and site selection stage (3/19; 16%), experimentation stage (3/19; 16%), and construction stage (3/19; 16%);
- The following design stages were indicated by only 2/19 (11%) participants: sketch-up model, planning, urban framework, zoning, mapping, exploration, finalisation and feedback; and
- Overall, the lowest number of participants identified the following stages: briefing, macro and micro analysis, informal interviews, extrapolation, integration, implementation, technical study, execution, evaluation, and critique.

From the preceding, it appears the overall project phases followed by the students are (i) site analysis (research, precedent studies), (ii) concept design, (iii) design development, (iv) construction drawings (digital and detail drawing), (v) presentation and (vi) revise.

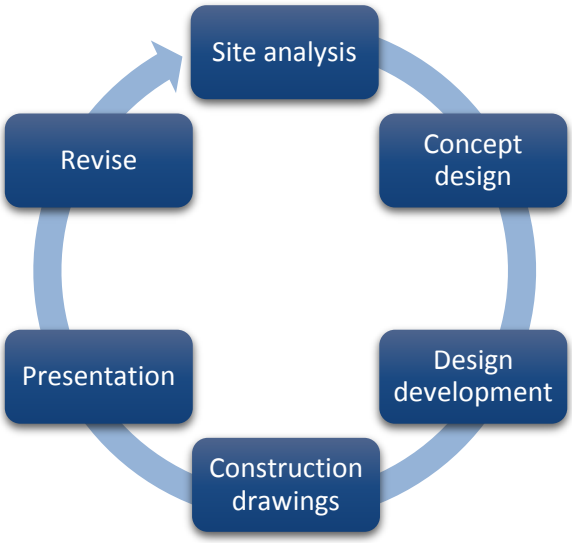


Figure 4.1: Architectural design project stages

b. Work individually or collaborative during the project stages

Participants were asked in question 2.2 to state whether they were working alone during the aforementioned project stages (in Table 4.5) or working with others (in a formal or informal manner). As indicated in section 4.4.1.3 of the questionnaire, 11/23 (48%) participants preferred working individually during design projects. Question 2.2 provided further insight, rationale and understanding regarding participants' preference for working alone or with others. 4/19 (21%) participants distinctively specified that they preferred working alone during the design stages:

- "I prefer to work alone but usually engage with a lecturer once a week for feedback" (Ruan).
- "I was working on the project alone with assistance from lecturers" (Bianca).
- "Working alone but received advice" (Melissa).
- "Alone but always discussing my work with lecturers and my studio mates whose opinions and support is an essential part of architecture school" (James).

Although participants indicated a very strong preference to work alone, they still wanted advice and assistance from the lecturers. Further findings indicated that depending on the design stage, 8/19 (42%) participants chose to work alone and with others, for example:

- "At the first three stages I worked in a group ... then the rest I was alone ... though there's compulsory consultations with lecturers which are helpful" (Mike).
- "In terms of site analysis, I usually have three stages where I start of work alone to investigate the site (i.e. go on websites, YouTube tours or physically visiting the site), then start asking people around me (i.e. how do you experience the site), and then after that I will start discussing my project with my peers and lecturers to ask for advice … It is always better to share information" (Zack).
- "Only worked with a partner for the mapping and had lecturers guiding me in latter stages" (Bill).
- "Both – dependent on the stage" (Tom).
- "I worked alone on this project and the rest of the year with a design partner" (Mia).

- "At the beginning of the project I was working in a group of 14 classmates to develop and design our urban framework. This is mostly done informally with discussions, brainstorming and so. After that I worked individually on my own project, and occasionally had informal discussions with peers and friends about my design. I also had formal sessions with lecturers where they would crit me" (Frank).
- "I worked with a classmate gathering information at times and at other times just sharing ideas and working together" (Andrew).
- "We started off working in groups to determine something of a framework. The continual group discussions kept me informed about my immediate context and so a significant amount of characters within my narrative resided in the designs of my group members, enabling my design to play some sort of role in the entire group" (Linda).

4/19 (21%) participants stated that they preferred working with others during the design stages:

- "Informal working with peers. Formal interim critiques with lecturers. Informal meetings with non-third year lecturers" (Sue).
- "Informally worked with others, mostly for company and safety" (Sarah).
- "Working with others informally asking for advice on what design decisions were being made" (Jessica).
- "Working next to other in the Maclabs and discussing ideas and comparing pin-ups throughout" (Gerrit).

The remaining 2/19 (11%) participants did not specifically indicate whether they preferred working alone or with other, but they said that they required both formal and informal advice from their lecturers, peers and external parties. For example:

- "Yes, external advice as well as peers" (Joe).
- "The constant advice given by studio lecturers gives perspective as to how successful your elements of architecture are integrating while talking to and viewing other

students projects gives perspective as to how far you should be and the expectation of complexity of the overall project" (Bard).

Overall, participants worked with others during the following design stages: site analysis, the start of a project, mapping, urban framework design and development, sharing information, and idea generation and sharing. The main type of formal collaboration distinguished by participants was with their lecturers. Various types of informal collaboration were also noted such as informal discussions with lecturers, peers, friends, external parties, and group discussions and brainstorming sessions.

4.5.3.3 *An information behaviour perspective of the stages in the design process*

Questions 3.1 and 3.2 (see Appendix F) focused on what questions participants ask at the start, during and at the end of a design project, and where and how they searched for information. The following sub-themes were identified to report findings based on questions 3.1 and 3.2.

a. Questions asked at the (i) start, (ii) during and (iii) at the end of a design project

Participants were requested to discuss the questions they ask at the (i) start, (ii) during the stages, and at the (iii) end of a design project, in question 3.1. Table 4.6 provides an overview of some of the questions asked.

In Chapter 1, section 1.2, the researcher noted that for the purpose of this study, the ISP model of Kuhlthau (1991, 2004), more specifically the six stages and holistic experience (i.e. feelings (affective), thoughts (cognitive) and actions (physical)), provide the theoretical basis for understanding individuals' information-seeking behaviour. The aforementioned directed the presentation of Table 4.6.

(i) Start of project	(ii) During project stages	(iii) End of project
• "What's the problem? Who is being affected? How can it be tackled?" (Mike) • "What is done in previous cases?" (Joe) • "How will I set my design and intent apart from my classmates who are perhaps thinking in the same direction at this point?" (Ruan) • "What does the site need from my project?" (Bill) • "How could this design be good for the community? How could it contribute? How would it function? Who would use it?" (Sarah) • What am I designing, for who, where and why?" (Bianca) • "What is happening on the site and around it? What do the people need?" (James) • "Which precedents to look at? History of the site? Scale of context and surrounding approaches to dealing with the context?" (Jessica) • "What socio-political (spatial) statement do I want to make?" (Megan) • "How big of an obstacle are you going to challenge yourself with as well as how did I do my previous projects and what were their failures and successes?" (Brad)	• "What materials am I using? How can I make my building more efficient? How can I make it sustainable?" (Sue) • "How will this design appeal to users (hypothetically speaking)" (Ruan) • How could specific elements help with (i) e.g. How could an open area encourage engagement? A vertical element or secret entrance encourage curiosity?" (Sarah) • How do we integrate two cultures within one design?" (Tom) • "How can I better what I am currently designing?" (Bianca) • "Is this element arbitrary? Am I contradicting myself? How can I clarify my argument?" (James) • "Questions related to your initial design, why are certain spaces where they are?, how will one move through the buildings and into them?, how will the buildings relate to surrounding buildings as well as users?" (Jessica) • "What of media, information and knowledge; what is the link - how can it be spatial?" (Megan) • "I asked the questions of practicality to my creativity, creativity to my practicality as well as overall progress" (Brad)	• "How am I going to finish this presentation? Why am I here? Have I eaten?" (Mike) • "How am I going to pass? How can this be improved? Why did I leave all this work 'til the end'? Why didn't I just study Astrophysics like I originally planned? If I get hit by a car, do I still need to do all this work?" (Sue) • "How could I have done it differently?" (Joe) • "Is it in line with the specified outcomes? Am I achieving what I set out too? Is it good architecture? Who am I designing for, what am I designing for, where am I designing this?"(Sarah) • "How to present our theory as part of the presentation?" (Tom) • "Was this the best outcome and what could I have improved upon. What have I learnt?" (Bianca) • "Was the project successful?, what wasn't given thought that should have?, what did one learn from the project?, how would I have bettered the project?" (Jessica) • "What about your project still needs work, what is more successful than you believe and how can I present the best elements of my project?" (Brad)

Table 4.6: Questions asked at the (i) start, (ii) during and (iii) end of a design project

At the **start** of a project questions related to the following are asked: design problems, who will be affected, previous cases, design uniqueness, site and users' needs, design contribution, history of site, functionality, scale of context, socio-political (spatial) statements, obstacles, and failures and success. See Table 4.6 for elaboration.

During the project stages, questions related to the following are asked: materials, building efficiency, sustainability, design appeal, integration, better design, element arbitrary, contradictions, movement through the building, clarifying arguments, surrounding buildings, practicality, creativity and overall progress.

At the **end** of a project questions related to the following are asked: presentation, improvement, procrastination (waited until the end to complete the project), outcomes, goals, good architecture, success, learnt lessons and completion of the project.

Additional questions asked by participants included: "Do I have enough pins? Is my white shirt clean? Is my work accessible? Will I not collapse due to lack of sleep?" (Mike); "Some small questions like how does scale work again? What's the gradient of a ramp again?" (James).

Overall, the types of questions asked at the (i) start, (ii) during the project stages and at the (iii) end of a design project can be summarised by the following verbatim extract from Andrew's input:

> "At the **start** it's important to understand what your concept and programme is, asking questions such as "What do I want to achieve at the end?", "Who will this programme benefit?", "Will it be sustainable in the long run?", "Does it excite me?". **During** the stages (i) often start to question my intention so I have to look back at what excited me from the beginning and realize why I choose to design this certain space. Questions become more that of: "How is my design going to be resilient?", "How can I achieve this through materiality and quality of light ect..?" Towards the **end** of the project you have to look back and make sure you can justify why you placed certain elements where you did, why the access to the building is where it is, why you used certain materials etc. And when you can answer those questions you start to reveal your thought process and your building comes to life because it has a purpose".

b. Searching for information and answers

Participants were asked in question 3.2 (Appendix F) where and how they searched for information and answers. A word cloud (see Figure 4.2) was generated to illustrate what sources were the most used to search for information and answers. This question is an extension to section 4.4.3 in the questionnaire. Figure 4.2 visually summarises what sources were most popular to use to find information and solutions.

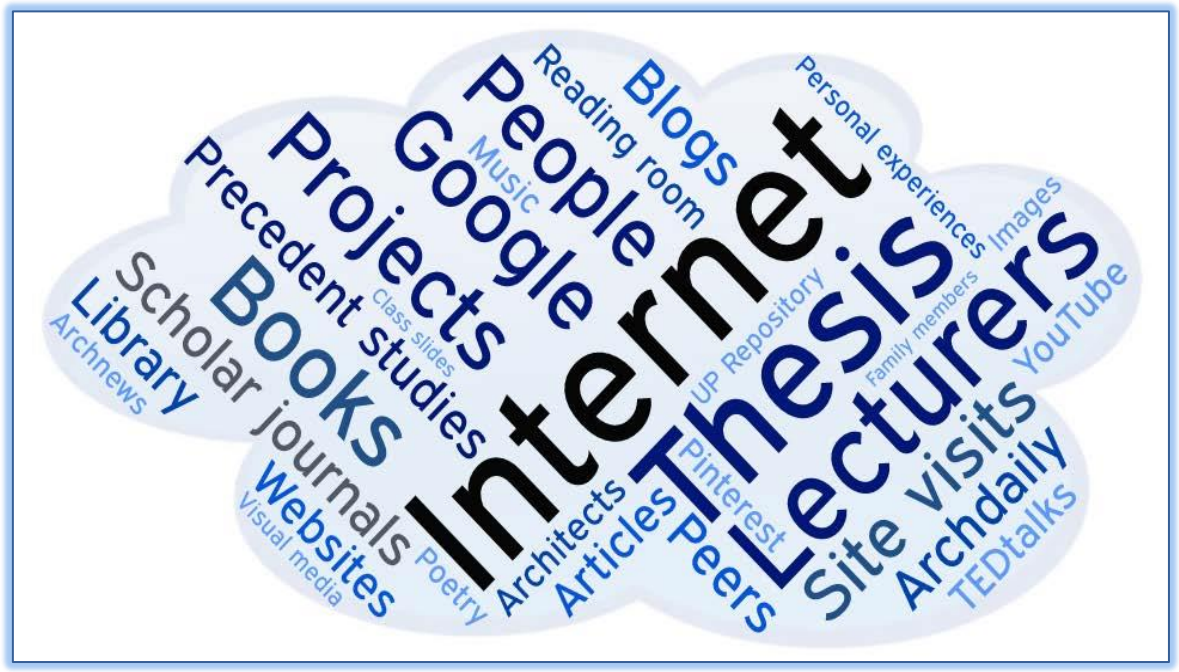


Figure 4.2: Word cloud of popular sources to search for information and answers

The sources most used are the internet (7/19; 37%) and scholarly journals (6/19; 32%), followed by precedent studies (5/19; 26%), lecturers (5/19; 26%), projects (5/19; 26%), theses (5/19; 26%), people (5/19; 26%) and Google (5/19; 26%). Books (4/19; 21%), site-visits (4/19; 21%), reading room (3/19; 16%), library (3/19; 16%), Archdaily (3/19; 16%) and architects (3/19; 16%) followed. Other less popular sources, were: blogs (2/19; 11%), articles (2/19; 11%), personal experience (2/19; 11%), peers (2/19; 11%), websites (2/19; 11%), and class notes (2/19; 11%).

The following sources were mentioned only once each: repositories, Archnews, Pinterest, TEDTalks, YouTube, family members, visuals, poetry, images and music.

4.5.3.4 *Creativity*

Questions 4.1 to 4.5 (see Appendix F) focused on the types of resources that inspire creativity, physical spaces and tools supporting finding solutions and to being creative. The questions also addressed the role of information and information support to complete design projects. The following sub-themes were identified to report findings based on questions 4.1 to 4.5.

a. Sources to inspire creativity

Participants were asked in question 4.1 to discuss the resources they draw on to inspire creativity. A word cloud (see Figure 4.3) was generated to exemplify the resources used by the participants.

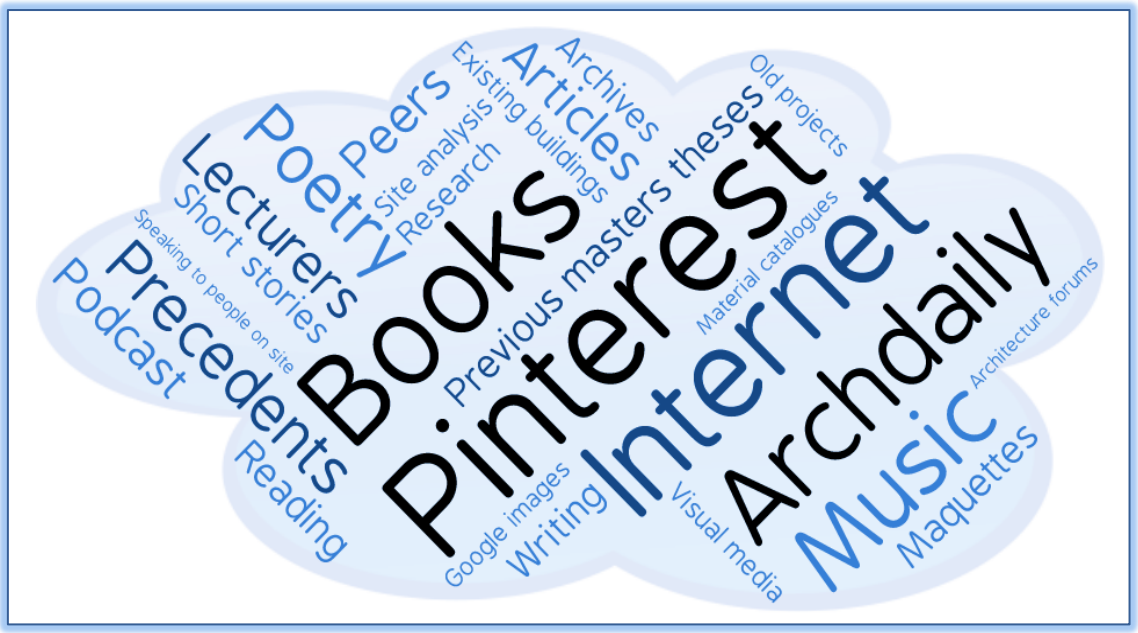


Figure 4.3: Word cloud of popular resources to inspire creativity

The most used resources to inspire creativity were Pinterest (3/19; 16%), books (3/19; 16%) and Archdaily (3/19; 16%). Precedent studies (2/19; 11%), Internet (2/19; 11%), lecturers (2/19; 11%) and dissertations (2/19; 11%) followed.

The remaining resources used to inspire creativity were mentioned once each: poetry, music, peers, short stories, existing buildings, articles, Marquette, material catalogues, Google images, speaking to people, site analysis, writing, reading, research, old projects, archives, visual media and architecture forums.

In question 4.2 participants were asked whether they used any information sources, including people, to inspire creativity. As indicated in Figure 4.2 and 4.3, various information sources, especially information from individuals, were identified. All the participants stated that they used information sources to inspire creativity, especially information acquired from people such as peers, lecturers, practitioners, family members, Architecture South Africa (national body that provides a code of ethics for architectural practices), technical information from people of the design industry, vendors, friends, groups, YouTubers, architects and artists.

b. Physical spaces and tools to support solution finding and creativity

Question 4.3 reports on how the spaces and tools provided by the department help participants to find solutions and be creative. Participants' opinion regarding the spaces and tools to support finding a solution and to be creative ranged from "extremely helpful" to "not helpful at all". During the interview with the lecturer, several spaces of support were noted (section 4.5.2.3) within the department. The following physical spaces and facilities were mentioned by the participants:

- **DESIGN STUDIO**
    - "… studio is not a good working environment. I work from home" (Sue).
    - "I find that our studios are very un-inspirational" (Frank).
    - "To be honest they don't and studio culture has decreased ever since first year. It is not what it meant to be anymore" (Gerrit).
    - "The studio is a perfect place to center myself and focus on design for hours on end. I especially enjoy working there at night time when it is quieter" (Ruan).
    - "The studio is the most important space in order to bounce ideas off peers and lectures" (Tom).
    - "The space (studio) encourages me to work, as it is almost a competitive environment and surrounded by people that I can speak to" (Bianca).
    - "The studio giving us the opportunity to work in an environment where we can compare our projects and swap out precedent ideas" (Melissa).

- "Studio spaces are very conducive towards creativity as this instill an atmosphere where people constantly as questions and bounce ideas off of one another" (Jessica).
- "The studio provides a space of interaction which is key in designing as advice and a second opinion is always beneficial" (Andrew).
- "The studios become a crucible of stress and creativity" (Brad).
- "Provides a working space for model building and aids in exploration" (Megan).

Reasons for the design studio not being supportive in finding solutions or for creativity included: "it is such a mess. It makes me extremely claustrophobic … Especially the third year studios – limited natural light and ventilation and very limited space for all the architecture students" (Frank).

- **READING ROOM AND ARCHIVES**
  - "Reading room is invaluable for information because it is not open long enough" (Sarah).
  - "I prefer the reading room if Google doesn't help me" (Tom).
  - "The reading room and archives are great as they always have something that is relevant" (Mia).
- **COMPUTER (MAC) LABS**
  - "The Mac-labs are extremely helpful in getting our designs to reality" (Bianca).
  - "Availability of computers for design software" (Megan).
  - "The Mac (computer labs) are extremely beneficial for Revit work" (Andrew).
  - "I used the mac desktops to compile my presentation" (Linda).
  - "The mac labs and reading room in the building are also a wonderful place to complete tasks or study before a test" (Ruan).
- **LECTURERS AND STUDENTS**
  - "Other students (though not tools provided by the department) helped a lot. Otherwise the building isn't mind-blowingly creative in space making" (Sarah).
  - "The lectures themselves provide time for vital theory" (Tom).

- **PRINTING ROOM**
    - "The printing rooms help us to print work and from there the design process can continue" (Andrew).
- **INTERNET/WI-FI ACCESS**
    - "There's fairly good facilities to get the job done...internet…drafting ergonomics ... reading room ... they all could be designed better to enhance a habitable and creative space" (Mike).
    - "Availability of Wi-Fi" (Megan).
    - "Wi-Fi enabled me to gain access to the internet" (Linda).

Overall, some of the participants noted that the building as a whole helps students "to understand scale as it is built on a module basis" (Mia); "provides endless sources and support to drive you in the direction where you can excel in" (Joe); "offers a cooperative learning environment with help always readily available" (Bill); and lastly, "provides the storage spaces necessary for model, the distance from the coffee shops is necessary for long discussions and the desks and credenzas are perfect for design work" (Brad).

In essence,

> "the open spaces have been very liberating for me since first year, the semi-informal environment is great as I can take a break any time and discuss work (amongst other things) with all the incredible characters I get to study with, their views, opinions and friendship has changed my worldview significantly since first year both personally and professionally and has challenged me constantly, the atmosphere in studio I also find to be highly conductive to work and I am much more productive there than at home" (James).

c. Role of information and information support to complete design projects

Question 4.4 and 4.5 (Appendix F) covered the role information and information support can play to aid in the successful completion of design projects, and how the participants envision such role (question 4.4) can be achieved. Various physical spaces and facilities have been noted by the students (section 4.5.3.4b), and in the interview with the acting head of department (section 4.5.1.3a) and lecturer (section 4.5.2.3). Participants' opinions regarding

the role of information and information support in successfully completing a design project ranged from “extremely important” to “important”.

The role of information and information support is to “ground ideas from being too whimsical and impractical at times” (Mike), “provide the facts … precedent analysis” (Sue), “support your viewpoint and provide background” (Joe), “expose you to both past and future lessons to strengthen our own understandings” (Bill), “help shape and influence designs … to draw inspiration from” (Bianca), “learn from similar projects and not make the same mistakes” (Melissa), “have a good end product and to understand the design process” (Mia), “back up any decisions you make in design…a platform to work from” (Andrew), generate “creativity and inspiration” (Jessica), “make us aware of what we have available” (Linda), and lastly, “offers a great starting point to get the ball rolling because books sometimes give you answers you didn't even know you were looking for while actually seeking another answer. While the internet takes you straight to and only to what you search for, no room for discovery and additional learning” (Gerrit).

3/19 (16%) participants specifically indicated the role of electronic resources and information support, as follows:

- “To be honest I think that this generation is much more inclined to use electronic resources than previous generations. The ease of access allows me to sit at my table and have a wealth of information available to me from my laptop. This being said, the efficiency of the library website has helped greatly. At times, a book I find in the library will prove to be more useful than most online sources” (Ruan).
- “It is still vital but I feel it is less necessary due to online sources not provided by the library” (Tom).
- “The online materials provided (especially instant access to old theses) are very helpful, I usually take out books from the library more for my own enrichment than for a project as one cannot read a whole book for a project and one cannot know where to begin if you just try to speed read through some of it” (James).

Against the preceding, the importance of information and information support is highlighted by the following verbatim extract from Megan’s input:

> "To design is part imitation and part learning what not to do. You can't design in isolation from information, of any kind. Why, what and who are we designing for are questions answered with the help of, and availability of information resources and support. It is really important to be able to get information and have the right support to help in processing it; turning it into resource for design".

Question 4.5 was an extension of question 4.4. Question 4.5 addressed participants' views of what such role (as mentioned in question 4.4) should envision. Most participants (15/19; 79%) felt that such a role can be envisioned by means of "acting like a creative springboard" (Sue), "connecting individuals through information access" (Joe & Linda), producing "a virtual creative student hub" and offering "on-campus architectural stationery provider" (Sarah), "constructing a satellite station (like our reading room) to produce proper access to sources" (Tom), "broadening information support on campus to the benefit of many disciplines" (Ruan), "gaining quick and easy access to individual essays on a topic pertinent to one's design" (James), "globalising the studio though making available Online InterStudio and IntraStudio information sites and databases, and digital interface interactive platforms" (Megan), "expanding the reading room in our building, because … it is a quiet space" (Frank), and "constructing an interactive library or information space where you can discuss designs, pull out a book and show your team members what you mean, etc." (Andrew).

Overall, accessibility to various spaces (virtual and physical), resources (electronic and printed) and guidance (reading room) are the roles envisioned by the participants for information and information support.

In conclusion, Gerrit points out that "Architecture as a whole is meant for all humans and understanding our relationship with our environment and surroundings … is key to making Architecture more accessible, as it seems to be at the very least of slight interest to everyone".

4.6 TRIANGULATION

According to Wilson (2014: 74), "triangulation refers to using more than one particular approach when doing research in order to get richer, fuller data and/or to help confirm the results of the research". Triangulation has been addressed by various studies (O'Cathain, Murphy & Nicholl, 2010; McNamee & Peterson, 2014; Pickard, 2012) as a method to increase the reliability and validity of research. Wilson (2014: 74) notes that Denzin (1978) and Flick

(2002) describe four types of triangulation, namely: **methodological** (using more than one research method or data collection technique), **data** (using multiple and different data sources), **theoretical** (using multiple theories or perspectives to extend knowledge), and **investigator** (using several participants in gathering data).

For the purpose of this study, data and methodological triangulation were addressed by using multiple sources of data (acting head of department, lecturer and students), applying a mixed methods approach (quantitative and qualitative approaches), and using multiple data collection techniques (literature review, questionnaire and individual interviews). To promote the analytic rigour, validity and reliability of this study, the researcher compared different data sets (acting head of department, lecturer and students) from different research methods (quantitative – descriptive analysis) and (qualitative – thematic analysis). Case and Given (2016), Creswell (2013), Fitts (2009), and Sonnenwald and Pierce (2000) suggested this method of triangulation ensure more reliable and valid research.

Completing the analysis of the profile questionnaire and individual interviews, five trends appeared from the two data collection instruments, namely:

- The first trend was that **creativity** is extremely important during the completion of architecture projects. The importance of information sources to stimulate creativity was noted. Further, the concept of creativity was linked to inspiration. Presenting design projects creatively to the audience was noted as very significant in producing a creative project by all three groups of participants.
- The second trend noted was that the **most popular formal information source used** was books. The use of books as a key information source was confirmed by both data collection instruments, and by the studies of Makri and Warwick (2010) and Campbell (2016) (see section 2.7.1 and 2.7.2). Design-focused books were mostly used from personal collections.
- The third trend noted was the **importance of collaboration** during architectural design projects. Although the students initially indicated that they prefer working alone, it was later confirmed by the acting head of department and lecturer that collaboration is considered to be very important in architecture. As a result, personal preferences at certain stages might be a factor to be considered by information service providers

to enhance a third space. The students also confirmed these findings by stating in their individual interviews that collaboration encourages idea and solution generation and sharing. A study by Makri and Warwick (2010: 1768) confirmed that collaboration among peers are done through sharing images, videos, URLs and bookmarks on social networking sites. Participants noted the value of gaining and sharing informal information resources from search engines and networking sites from or with to peers, specifically, Pinterest and Archdaily (blogs) to draw inspiration (not confirmed by acting head of department or lecturer). However, Campbell (2016), and Makri and Warwick's (2010: 1768) studies confirmed the researcher's findings (see 2.7.2).

- The fourth trend is that the **studio** was noted as the most vital space of support during architectural design projects, especially due to the peer-to-peer and peer-to-lecturer interactions that occur there. In addition, the studio was of great significant for collaboration, inspiration and idea sharing. Findings from all three of the data sets noted terms such as "collaborative", "responsive" and "co-operative environments inspiring creativity".
- The last trend that emerged from the findings is the **integration of various skills and knowledge to produce creative outcomes**. The findings indicated that a range of theoretical, technical, artistic and practical skills and knowledge must be integrated into design projects if they are to succeed. A study by Danaci (2015) confirms that various creativity variables are needed to produce a creative outcome. These variables included personal (artistic), cognitive (theory and technical) and environmental (practical) abilities and skills (Danaci, 2015).

Lastly, all five of the trends had substantial confirmation in the literature.

4.7 FINDINGS ON THE RELEVANCE OF MANIOTES' (2005) THIRD SPACE IN GUIDED INQUIRY MODEL AS A THEORETICAL FRAMEWORK

Chapter 2, section 2.7.3, argued the potential value of Maniotes' (2005) third space and guided inquiry model as a theoretical framework, in addition to Kuhlthau's (1991) ISP model, constructionism theory and zones of intervention, to inform the information activities and interactions that occur among architecture students during design projects. From the findings of this study's empirical component, and bearing in mind the reviewed studies in Table 2.1,

the Maniotes' (2005) third space guided inquiry model (Figure 1.2) is populated with the findings. The researcher used Maniotes' (2005) third space and guided inquiry model and added the empirical findings from the architecture students to provide an information behaviour perspective. Guidance by means of providing information and information support included acting as a creative springboard, assistance to access information, virtual (Online InterStudio and IntraStudio information sites and databases) assistance by generating a creative student hub, availability of past and present design projects, and assistance with the starting point of a project.

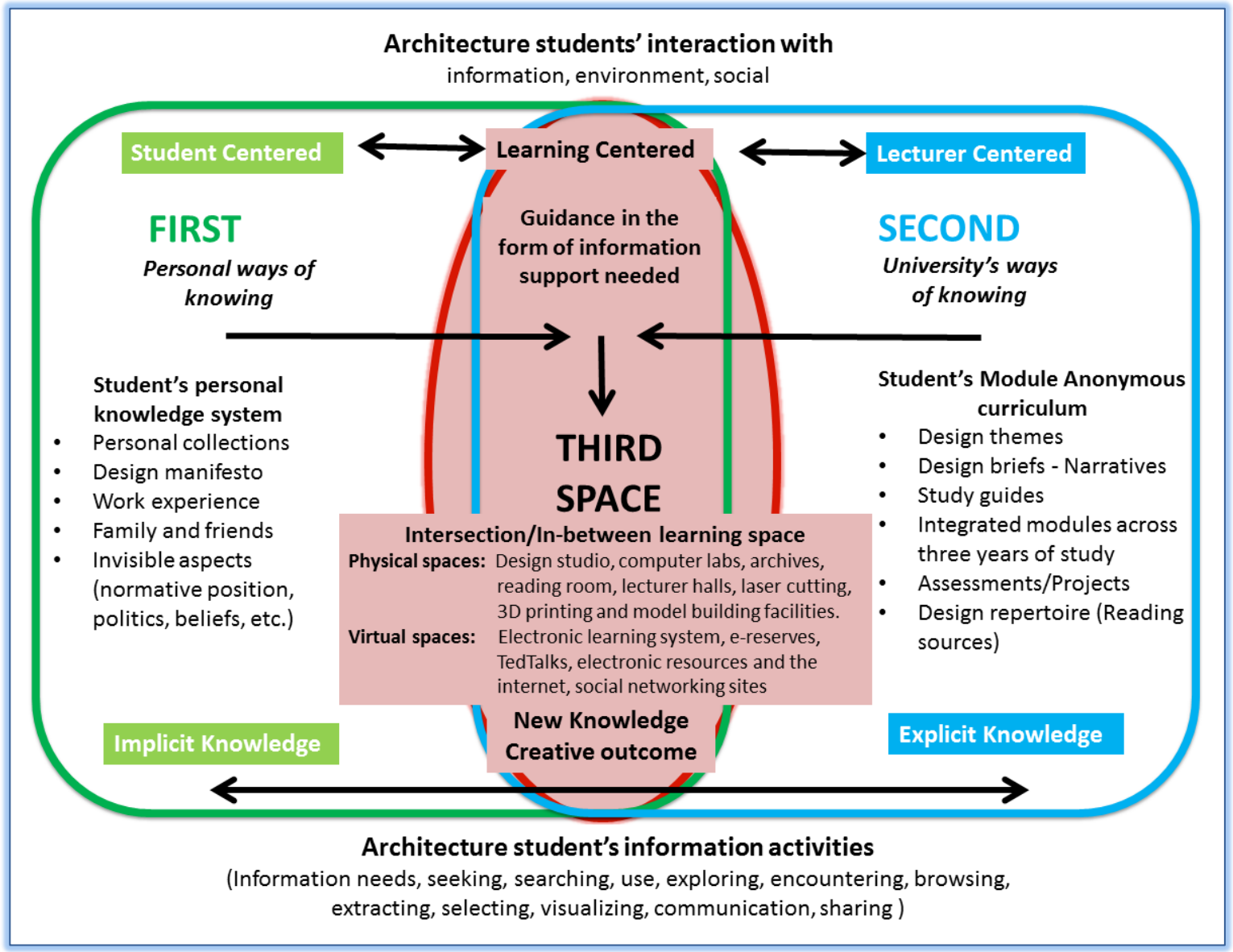


FIGURE 4.4: Third space guided inquiry model relevant to architectural design projects in spaces of creativity

The theoretical framework, as seen in Figure 4.4, provides assistance in the following aspects:

- The third space concept bridges the gap between students' theoretical knowledge (curriculum knowledge) and practical application (personal knowledge) to generate creative outcomes. It also provides insights for lecturers regarding how curriculum-based projects or tests can be constructed to support students' personal knowledge in complex learning environments. For this exploratory study it served as a framework for the planning of an information behaviour study;
- The third space concept in correlation with guided inquiry can be used to promote collective idea generation and sharing during architectural design projects in spaces of creativity. It can thus support information activities relevant to the design projects; and
- Information and information support needed during architectural design projects promote the underlying idea of intervention and guidance, which can indicate the students' information seeking, use and needs (Harris & Simons, 2006; Kuhlthau, 2010).

The application of the third space concept, as a theoretical framework for this exploratory study, helped to reveal information activities and interactions unique to the third-year architecture students such as using and sharing information over social networking sites (specifically Pinterest and Archdaily), preferences for information sources, and the dual need for both individual work as well as collaboration. For instance, collaboration among peers and lecturers for idea and solution generation, during the concept design and development phases, signify the value of understanding Kuhlthau's (1991) ISP model's Stage 3 (Exploration) and Stage 4 (Formulation) to provide intervention and guidance during creative projects.

4.8 CONCLUSION

This chapter reported on the data collected through self-administered online questionnaires via Google Forms, together with data collected from individual interviews with the acting head of department, lecturer of Module Anonymous and third-year architecture students. Findings of the study were depicted in tables, graphs and word clouds. The chapter addresses triangulation through the use of multiple data collection methods (questionnaire, individual interviews and literature review) to investigate the same research topic using quantitative

(descriptive analysis) and qualitative (thematic analysis) approaches in analysing the data. In conclusion, the relevance of Maniotes' (2005) guided inquiry model, as a theoretical framework, was noted to gain a better understanding of the information activities and interactions of architecture students in spaces of creativity. The following chapter discusses the main findings, recommendations and future research topics.

CHAPTER 5: FINDINGS, RECOMMENDATIONS, SUGGESTIONS FOR FURTHER RESEARCH AND CONCLUSION

5.1 INTRODUCTION

The preceding chapter reported on the analyses and findings of the empirical component of this study. This chapter provides a discussion of how the research statement and sub-questions have been addressed, a summary of the study, main findings for the sub-questions, limitations and value of the study, and recommendations for theory, practice and further research. Lastly, an overall conclusion is provided.

5.2 RESEARCH STATEMENT AND SUB-QUESTIONS ADDRESSED

The main research question for this study was, as set in Chapter 1, section 1.3:

Which information activities and information interactions feature in the information behaviour of architecture students during the design stages of a project?

To address the main research question, four sub-questions were set to be answered from the literature and six sub-questions to be answered from the inspection of the study site, as portrayed in Table 5.1 and 5.2.

SUB-QUESTIONS	ANSWERS LOCATED
ANSWERED FROM THE LITERATURE	
What has been reported on information behaviour and makerspaces?	Literature review, Chapter 2, section 2.4.2
What has been reported on information behaviour and creativity?	Literature review, Chapter 2, section 2.5.2
Which characteristics of makerspaces can be allied to spaces of creativity?	Literature review, Chapter 2, section 2.6.1-2.6.7
What has been reported on the information behaviour of architecture students?	Literature review, Chapter 2, section 2.7.1-2.7.2

Table 5.1: Sub-questions answered from the literature

SUB-QUESTIONS	ANSWERS LOCATED
ANSWERED FROM INSPECTION OF THE STUDY SITE	
Which information activities and interactions of architecture students are revealed during the design stages of a project?	Empirical study, Chapter 4, section 4.5.3.3 (students)
How do architecture students draw on their personal experiences and resources during design projects?	Empirical study, Chapter 4, sections: - 4.5.1.1a (acting head of department) - 4.5.2.1c (lecturer) - 4.5.3.1c (students)
How does their architecture curriculum influence their information behaviour during the design stages of a project?	Empirical study, Chapter 4, section 4.5.2.1a (lecturer)
On which resources do they draw to inspire creativity?	Empirical study, Chapter 4, sections: - 4.5.1.2b (acting head of department) - 4.5.2.2b (lecturer) - 4.5.3.4a (students)
How do the physical spaces (i.e. the space of creativity) help them in finding solutions and being creative?	Empirical study, Chapter 4, sections: - 4.5.1.3a (acting head of department) - 4.5.2.3 (lecturer) - 4.5.3.4b (students)
What role can the library play in supporting architecture students during the design stages of their projects in spaces of creativity?	Empirical study, Chapter 4, section 4.5.3.4c (students)

Table 5.2: Sub-questions answered from the inspection of the study site

Further discussions regarding Table 5.1 and 5.2 are provided in section 5.4.

5.3 SUMMARY OF THE STUDY

In Table 5.3 a summary of the study that has been conducted is provided. Table 5.3 takes into account the research topic, time period when the study was conducted, sample group and participants, pilot study, research approach, research method, methods of data collection, and ethical clearance received, as well as, addressing confidentially, reliability and validity of the study.

SUMMARY OF RESEARCH STUDY	
Research topic	The study focused on the use of spaces of creativity such as makerspaces in the academic learning and information context of architecture students, specifically from an information behaviour perspective (information activities and interactions).
Sample group and participants	A purposive sampling method was used in the selection of the sample group for the study. The sample involved three groups, namely: (1) acting head of department, (2) lecturer of Module Anonymous, and (3) third-year architecture students. All participants were invited via an e-mail invitation.
Pilot study	A pilot study was conducted in mid-September 2016 with two postgraduate architecture students at the designated department. The two postgraduate students completed the questionnaire and took part in the individual interviews. The data from the pilot study was not included in the analysis of the data from the actual study.
Research approach	Mixed methods
Research method	Case study
Methods of data collection	Semi-structured online profile questionnaire for the third-year architecture students, and three different individual interview schedules for the head of department (interview conducted with the acting head), the lecturer of Module Anonymous and the students. The questionnaire is available in Appendix B and the three individual interview schedules in Appendices D - F.
Time period of study conducted	The study was conducted from 2016/10/17 to 2016/10/31.
Actual number of participants	23/60 (38%) students completed the profile questionnaire 19/60 (32%) students took part in the individual interviews The lecturer took part in the individual interview The acting head of department took part in the individual interview
Ethical clearance	Permission to conduct this study was requested and received, in July 2016, from the head of department and lecturer of Module Anonymous, and from the Research Committee of the Department of Information Science, University of Pretoria (the institution that will grant the degree). Thereafter, permission was requested from the Faculty Committee for Research Ethics and Integrity, and from the dean of the faculty where the research was conducted. This was requested in August 2016 and received in September 2016.
Addressed confidentiality, reliability and validity	The confidentiality of all the participants was safeguarded by using pseudonyms during the discussion of the findings. The reliability and validity of the study were ensured through triangulation, data collection instruments were pilot-tested, and the research objectives were explained to the participants.

Table 5.3: Sub-questions answered from the inspection of the study site

5.4 MAIN FINDINGS FOR SUB-QUESTIONS

This section reports on the main findings of the answers to the sub-questions set in Chapter 1, section 1.3, as well as, outlined in Table 5.1 and 5.2, namely:

5.4.1 Findings from the literature on information behaviour and makerspaces

Studying the makerspace literature certain information behaviour activities were noted such as recognition of information needs, information seeking, use and sharing. Information needs related to the makers (students) were information resources, tools and services, and the importance of various information literacy skills (including media, visual and digital literacy). In addition, information needs related to the educationalists, facilitators and creators of these makerspaces included: funding opportunities, spatial and layout selection, facilities, and skills and competencies required to operate such spaces. Information-seeking activities reported on involved: seeking ideas or inspiration, finding answers and solving problems. Information was gathered from sources such as academic and personal experience, search engines (Google) and information resources (library collection, staff, peers, and print and electronic reference materials) for guidance and assistance. The sharing and use of information within makerspaces (virtually or physically) was due to collaboration on projects, knowledge and expertise transfer, idea generation, sharing new reflections and understandings on learned skills, and sharing of information resources (e.g. tools, technologies, books).

5.4.2 Findings from the literature on information behaviour and creativity

The literature reported on in Chapter 2 section 2.5.2 provided the researcher with a deeper understanding of what has been published regarding information behaviour and creativity in an academic context. Creativity has been studied in various disciplines, but with regard to information behaviour the focus is mainly on information-seeking activities to drive inspiration and motivation. In the educational context skills such as critical thinking, imagination, holistic thinking, information literacy, problem-solving and active learning were linked to studies of information behaviour and creativity. The construction of a learner-centred teaching philosophy and learning environment, promoting creativity for student interactions, engagements and sharing of information and their personal experiences, were important during creative endeavours. Significant information behaviour activities (performed in the virtual or physical environment) noted throughout the literature reviewed

included: information gathering, encountering (browsing and searching), use, sharing (communication), visualisation and avoidance. Lastly, the literature noted various obstacles during online information seeking, such as costs, lack of time, information in foreign languages, lack of trust in online resources, overload of information, and a lack of digital and information literacy. The findings in the literature aided the researcher in gaining a better understanding of the types of information behaviour activities undertaken during creative endeavours and the obstacles faced during these activities.

5.4.3 Findings from the literature aligning makerspaces characteristics to spaces of creativity

The study focused on information behaviour in spaces of creativity using makerspaces as exemplar. In order for the researcher to have used makerspaces as an example of creative spaces, the literature had to confirm that the characteristics of makerspaces could align to creative spaces. The literature established that seven characteristics of makerspaces aligned to creative spaces, namely: known by various terms; relevant to different contexts; deliver access to a spectrum of tools, knowledge and skills; establish a space and culture that is physically, socially and emotionally safe; establish an open environment for freedom of expression, opinion and ideas; establish a constructivist learning environment for guided and hands-on learning; and lastly, provide a collective space to nurture character traits significant to creativity.

5.4.4 Findings from the literature on the information behaviour of architecture students

The literature reported on in Chapter 2 sections 2.7.1 - 2.7.2 provided the researcher with a retrospective and contemporary view about what has been published on information behaviour and architecture students in the academic context. The retrospective view assisted the researcher in comprehending the spectrum of information needs and wants (e.g. solving complex design problems, decision-making and inspiration) where support could be provided related to architects, and their information use and retrieval behaviour (e.g. design-focused books, journals and websites), specifically focusing on just paper-based sources. Only two recent studies (Campbell, 2016; Makri & Warwick, 2010) were available that dealt with the contemporary (modern-day) view of architecture students' information behaviour. Various

information activities were noted: information encountering, exploring, browsing, visualising (multimedia materials), selection (search query and keys), use (recording and editing) and communication (distributing and sharing). The study by Makri and Warwick (2010) was informed by Ellis's (1989) behavioural model, Kuhlthau's (1991) ISP model and Vakkari's (2001) theory of task-based information retrieval. A significant finding of both studies was that the internet is an add-on resource to printed materials.

5.4.5 Findings from the study site on the information activities and interactions of architecture students during the design stages of a project

In order for the researcher to determine the information activities and interactions of the third-year architecture students, an online profile questionnaire and individual interviews were administered. Most participants' information-seeking behaviour followed a trend of using books as their main formal source of information and search engines (internet) as their main informal source of information. A second trend was that information sharing occurred by means of using social networking sites to collaborate and share images, videos, links and bookmarks. Lastly, information was used to motivate inspiration and creativity, and the most used sources for inspiration were Pinterest and Archdaily. Further details can be found in Chapter 4, section 4.5.3.3.

5.4.6 Findings from the study site on architecture students' personal experiences and resources during design projects

The researcher used Maniotes' (2005) third space in guided inquiry model as an information behaviour lens to inform the development of creative spaces for architecture students. To understand the students' first space, questions related to their personal experience and personal knowledge system (personal resource collection) had to be asked. Findings were obtained from the analyses of the administered individual interviews to the acting head of department (Chapter 4, section 4.5.1.1a), lecturer (Chapter 4, section 4.5.2.1c) and the students (Chapter 4, section 4.5.3.1c). The key findings among the answers analysed were that students draw on the following personal experiences and resources during design projects: personal collections of information sources, design manifesto, industry experience (i.e. internships), family and friends (i.e. support system) and various invisible aspects (normative position, politics, educational background, beliefs, etc.).

5.4.7 Findings from the study site on the influence of the architecture curriculum on information behaviour during the design stages of a project

As noted in the previous sub-question (section 5.4.6), the researcher used Maniotes' (2005) third space in guided inquiry model. Therefore, to understand the students' second space, questions related to their curriculum had to be asked. Findings were obtained from the analyses of the individual interview with the lecturer of Module Anonymous (Chapter 4, section 4.5.2.1a). The key findings were that Module Anonymous shaped the information behaviour of the students by providing the following sources of information during design projects: design themes, design briefs placing projects within a specific context and narrative, study guides, integration of various modules across three years of study, assessments or projects provided by the lecturer and the design repertoire (reading sources) encouraged by Module Anonymous.

5.4.8 Findings from the study site on resources to inspire creativity

Findings regarding the use of information and information resources to inspire creativity were obtained from the analyses of individual interviews with the acting head of department (Chapter 4, section 4.5.1.2b), lecturer (Chapter 4, section 4.5.2.2b) and students (Chapter 4, section 4.5.3.4a). The importance of information resources to inspire creativity was specified across all three groups of participants. A significant finding noted by the acting head of department was that inspiration for architects can be found outside their profession (e.g. biomimicry – nature can inspire). The students highlighted that they use the following information sources to inspire creativity: peers, lecturers, practitioners, family members, Architecture South Africa, technical information from people of the design, vendors, friends, user groups, YouTube, architects and artists.

5.4.9 Findings from the study site on physical spaces (i.e. the space of creativity) to find solutions and be creative

The analyses of the answers provided by the acting head of department (Chapter 4 section 4.5.1.3a), lecturer (Chapter 4 section 4.5.2.3) and students (Chapter 4 section 4.5.3.4b) can aid educators, instructional designers, facilitators and the creators of these creative spaces to gain deeper insights into what spaces (facilities and tools) can be provided in creative spaces

to support students in finding solutions and to be creative during design projects. A trend noted across all three groups of participants was the significance of a design studio as a physical space for collaboration. Further physical spaces of support noted were: the building itself (providing design pinup spaces and atrium space for design critics), reading room, computer labs, archives, lecture halls, and laser cutting, 3D printing and model- building facilities. Although the question mentioned physical spaces only, the acting head of department mentioned that the vision of the department (where the study was conducted) is to combine physical and virtual spaces.

5.4.10 Findings on the role of the library in supporting architecture students during projects in spaces of creativity

As noted, the researcher used Maniotes' (2005) third space in guided inquiry model as a theoretical framework to inform the information activities and interactions in spaces of creativity. The intersection between the first and second space forms a third space where guidance (guided inquiry) can be provided. Participants explained that the role of libraries in providing guidance to information and information support is to:

- Aid in grounding ideas from being too impractical to being realistic by acting as a creative springboard;
- Provide facts by providing access to appropriate scholarly information;
- Support participants' perspectives by generating a creative student hub to encourage idea sharing and generation;
- Expose participants to past and present projects by providing access to previous and current design projects;
- Offer a great starting point to get the ball rolling by teaching participants how to seek, analyse, evaluate and reference information correctly (information literacy training); and
- Help shape and influence designs by drawing on various sources of inspiration, thus providing access to virtual and physical spaces of information sources and services.

5.5 LIMITATIONS OF THE STUDY

Limitations of the study included: limited literature on makerspaces and information behaviour. The field of "making" and makerspaces only started flourishing around 2006 (during the first maker faire). The response rate to the study was lower than the researcher wished and participants had to be invited several times to take part. However, as noted in Chapter 4, section 4.3.2.2 a reason could be the time of year the study was conducted. The case study was conducted at only one institution with third-year architecture students; results might differ if the study was conducted at other institutions with a different year group of architecture students.

5.6 VALUE OF THE STUDY

The study holds value for theory and practice, as discussed next.

5.6.1 Theoretical value of the study

- The study contributes to the limited number of publications on studies in the library and information science discipline exploring makerspaces as examples of creative spaces through an information behaviour research lens.
- The study demonstrated the value of Maniotes' (2005) third space and guided inquiry model as a theoretical model, to bridge students' theoretical knowledge (curricula knowledge) and practical application (personal knowledge) to generate creative outcomes.
- The study provided valuable insight into the information needs, information-seeking behaviour, information-use behaviour and information-sharing behaviour of architecture students during design projects. This might also hold value for similar design disciplines such as interior architects, landscape architects, graphic designers and fashion designers.

5.6.2 Practical value of the study

- The study holds value for the designers of physical and virtual makerspaces regarding the information resources and services required, obstacles faced by students during online information-seeking activities, and information support needed (studying the questions asked by students during the design stages of a project).

- The study promotes the importance of aligning makerspaces, as creative spaces, with information literacy training, support from libraries, and constructivist learning to cultivate creativity and innovation.
- Findings of the study demonstrate the role that libraries and information specialists can play in providing guidance (zones of intervention) in the form of information and information support during architectural design projects.

5.7 RECOMMENDATIONS

The following theoretical recommendations and practical recommendations are offered from the findings of the study.

5.7.1 Theoretical recommendations

- From a theoretical perspective, Maniotes' (2005) model can further be advanced by focusing on the space of guidance and the support required within this space, and adapting this model for general use of various creative activities.
- Combining other creativity models (such as Webster's (2002) model of creative thinking or Velikovsky's (2012) creative practice theory model) and information behaviour models (e.g. Ellis' (1989) information-searching model or Choo's (1998) sense-making model) with Maniotes' (2005) third space and guided inquiry model to provide a more comprehensive theoretical and conceptual model for studying creative spaces through an information behaviour lens.
- Exploring the use of creative activities for data collection, such as brainstorming, visual narratives, infographics, analogy metaphors, biomimicry and mind mapping.
- Since the focus of this study was mainly on the information behaviour activities and interactions in spaces of creativity, the researcher suggests that further studies regarding the intrinsic and extrinsic motives of individuals to use such spaces for creative endeavours should be explored.
- Studying information behaviour in creative spaces through various research paradigms (user, affective, system, psychological and socio-cognitive paradigms) in multidimensional contexts.

5.7.2 Practical recommendations

- Incorporate context-sensitive support or guidance during the various design projects in spaces of creativity.
- Space makers (i.e. the creators of makerspaces) should explore the extension of physical spaces into spaces of creativity.
- The skills and competencies of information specialists and library services should be more prominently highlighted and advertised in spaces of creativity.
- Notifications of new services, tools, facilities and resources available within these spaces of creativity should be e-mailed to staff members to promote the value of these spaces.
- Information literacy training programmes should be provided in creative spaces, as well as visual, media and digital literacy training.

5.8 RECOMMENDATIONS FOR FURTHER RESEARCH

The following are suggestions for further research:

- Exploring the value of sensory design to inform the construction of creative spaces within an academic context.
- Exploring the value of autoethnographic research to understand the individual and collective experiences of students within spaces of creativity.
- Investigating the intrinsic and extrinsic motivators for students to make use of spaces of creativity.
- Examining the integration of various spaces (collaboration, reflective, social, virtual, etc.) within creative spaces to enhance specific creative activities related to different creative contexts.
- Extending disciplinary variances in the usage, contexts and users of creative spaces explored through an information behaviour lens.
- Studying the relations between creative thinking and design thinking within spaces of creativity.
- Examining the question-asking behaviour of students during creative activities to note the perfect zones of intervention and guidance at various decision points.

- Applying the principles of guided inquiry in a constructivist learning environment.
- Enriching Maniotes' (2005) third space and guided inquiry model through the exploration of creativity as a multi-dimensional lens in various information-related tasks.

5.9 CONCLUSION

The closing findings, recommendations and future research ideas drawn from the findings of this study in relation to the research question and sub-questions were discussed. In addition, the value and limitations of the study were noted in this chapter. In conclusion, the value of creativity for architectural design projects was noted, specifically spaces providing tools, facilities, expertise and information resources for creative endeavours, as "everything we do is an act of creation, and our use of tools to transform our environment is what distinguishes us the most from other species", therefore, why not "call our species Homo Faber, the creative people, instead of Homo sapiens, the thinking people" (Maker Media, 2013: 23).

REFERENCES

Abram, S. & Dysart, J. 2014. The maker movement and the library movement: Understanding the makerspaces opportunity. *Feliciter*, 60(1):11-13.

Abram, S. 2013. Makerspaces in libraries, education, and beyond. *Internet@ Schools*, 20(2):18-20. [Online]. Available at: <https://teamhughmanatee.files.wordpress.com/2013/04/abram-makerspaces-in-libraries-education-and-beyond.pdf> [Accessed on 21 February 2016].

Agency for Healthcare Research and Quality (AHRQ). 2013. *Anthropological approaches: Uncovering unexpected insights about the implementation and outcomes of patient-centered medical home models*. [Online]. Available at: <https://www.pcmh.ahrq.gov/sites/default/files/attachments/anthropological-approaches-brief.pdf> [Accessed on 18 October 2016].

Alomar, M.A. 2003. Creativity in architecture and management. In *6th Asian design International conference, Tsukuba, Japan*. [Online]. Available at: <http://www.idemployee.id.tue.nl/g.w.m.rauterberg/conferences/CD_doNotOpen/ADC/final_paper/124.pdf> [Accessed on 15 August 2016].

Anderson, T.D. 2011. Beyond eureka moments: Supporting the invisible work of creativity and innovation. *Information Research*, 16(1). [Online]. Available at: <http://www.informationr.net/ir/16-1/paper471.html> [Accessed on 3 June 2015].

Asasoglu, A., Gur, S.O. & Erol, S.Y. 2010. Basic design dilemmas in architectural education. *Scientific Research and Essays*, *5*(22):3538-3549.

Association of College and Research Libraries (ACRL). 2000. *Information literacy competency standards for higher education*. [Online]. Available at: <http://www.ala.org/acrl/files/standards/standards.pdf> [Accessed on 11 August 2015].

Auger, P. & Woodman, R. 2016. Creativity and intrinsic motivation. *Journal of Applied Behavioral Science*, 52(3):342-366.

Bang, C.L. 2015. Promoting mental health and community participation: A study on participatory arts practice, creativity and play in the city of Buenos Aires, Argentina. *Health, Culture and Society*, 8(1):58.

Barab, S.A. & Squire, K. 2016. *Design-based research: Clarifying the terms. A special issue of the journal of the learning sciences*. Kolodner, J.L. (Ed.). New York: Psychology Press.

Barniskis, S.C. 2014. Makerspaces and teaching artists. *Teaching Artist Journal*, 12(1):6-14.

Bates, M.J. 1989. The design of browsing and berry picking techniques for the online search interface. *Online review*, 13(5):407-424.

Bates, M.J. 2010. Information behavior. In *Encyclopedia of Library and Information Sciences*, 3rd ed. Bates, M.J & Maack, M.N. (Eds.). New York: CRC Press:2381-2391.

Bell, J. 2015. School librarians push to create "Maker Spaces". *Education Week*, 34(30):10.

Bennett, H. 2006. Bringing the studio into the library: Addressing the research needs of studio art and architecture students. *Art Documentation: Journal of the Art Libraries Society of North America*, 25(1):38-42.

Benton, C., Mullins, L., Shelley, K. & Dempsey, T. 2013. Makerspaces: Supporting entrepreneurial systems, *Co-Learning Plan Series*, MSU EDA University Center for Regional Economic Innovation (REI). [Online]. Available at: <http://reicenter.org/upload/documents/colearning/benton2013_report.pdf> [Accessed on 15 August 2015].

Bevan, B., Gutwill, J.P., Petrich, M. & Wilkinson, K. 2015. Learning through STEM-Rich tinkering: Findings from a jointly negotiated research project taken up in practice. *Science Education*, 99(1):98-120.

Bhabha, H.K. 1994. *The location of culture*, London, UK: Routledge.

Bohm, D. 1998. *On creativity*. London: UK. Routledge.

Borman, L.D. 2016. Makerspaces, digital literacy, advocacy at AASL15. *American Libraries*, 47(1/2):20.

Bowler, L. 2014. Creativity through "maker" experiences and design thinking in the education of librarians. *Knowledge Quest*, 42(5):58-61.

Bowler, L. & Champagne, R. 2016. Mindful makers: Question prompts to help guide young peoples' critical technical practices in maker spaces in libraries, museums, and community-based youth organizations. *Library and Information Science Research*, 38(2):117-124.

Brace, I. 2013. *Questionnaire design: How to plan, structure and write survey material for effective market research*. Market Research in Practice Series. 3rd ed. London, UK: Kogan Page Limited.

Britton, L. 2012. A fabulous laboratory: The makerspace at the Fayetteville Free Library. *Public Libraries*, 51(4):30-33.

Burke, J. 2014. *Makerspaces: A practical guide for librarians*. Lanham, US: Rowman and Littlefield Publishers.

Burke, J. 2015. Making sense: Can makerspaces work in academic libraries? *Computer Workstations*, 73(67):497-504.

Burnard, P., Gill, P., Stewart, K., Treasure, E. & Chadwick, B. 2008. Analysing and presenting qualitative data. *British Dental Journal*, 204(8):429-432.

Campbell, L. 2016. The information seeking habits of architecture faculty. *College and Research Libraries*. [Online]. Available at: <http://crl.acrl.org/content/early/2016/07/27/crl16-930.full.pdf> [Accessed 17 December 2016].

Canino-Fluit, A. 2014. School library maker spaces: Making it up as I go. *Teacher Librarian*, 41(5):21-27.

Carruthers, A. 2014. Bigger than our buildings: The exciting potential of online makerspaces. *Canadian Library Association*, 60(1):18-20.

Casakin, H. & Kreitler, S. 2010. Motivation for creativity in architectural design and engineering design students: Implications for design education. *International Journal of Technology and Design Education*, 20(4):477-493.

Case, D.O. 2007. *Looking for information: A survey of research on information seeking, needs, and behaviour.* San Diego, CA: Academic Press.

Case, D.O. 2012. *Looking for information: a survey of research on information seeking, needs and behaviour*. 3rd edition. (Series editor: Amanda Spink). Bingley: Emerald Group Publishing.

Case, D.O. & Given, L.M. (Eds.). 2016. *Looking for information: A survey of research on information seeking, needs, and behavior.* Bingley, UK: Emerald Group Publishing.

Chan, D.L.H. & Spodick, E. 2014. Space development: A case study of HKUST Library. *New Library World*, 115(5/6):250-262.

Chang, C.P. & Hsu, P.C. 2015. The correlation between employee information literacy and employee creativity. *Quality and Quantity*, 49(1):221-234.

Chen, K.N. & Lin, P.C. 2011. Information literacy in university library user education. *Aslib Proceedings: New information perspectives*, 63(4):399-418.

Chen, Z. 2013. *The role of research in landscape architecture practice*. [Online]. Available at: <https://vtechworks.lib.vt.edu/bitstream/handle/10919/23095/Chen_Z_D_2013.pdf?sequence=1> [Accessed 17 December 2016].

Choo, C.W. 1998. *The knowing organization: how organizations use information to construct meaning, create knowledge, and make decisions*. New York, US: Oxford University Press.

Choy, F.C. & Goh, S.N. 2016. A framework for planning academic library spaces. *Library Management*, 37(1/2):13-28.

Chua, M. 2014. Special library in teacher training and information literacy: Singapore's National Institute of Education (NIE) Library as a case. *New Library World*, 115(3/4):175-178.

Chulach, T. & Gagnon, M. 2015. Working in a "third space": A closer look at the hybridity, identity and agency of nurse practitioners. *Nursing inquiry*, 23(1):52-63.

Colegrove, P. 2013. Editorial board thoughts: Libraries as makerspace?. *Information Technology and Libraries*, 32(1):2-5.

Connaway, L.S. & Powell, R.R. 2010. *Basic research methods for librarians*. 5th ed. Santa Barbara, CA: Libraries Unlimited.

Cook, M. 2005. 'A place of their own': Creating a classroom "Third Space" to support a continuum of text construction between home and school. *Literacy,* 39(2):85-90.

Cooper, D.R. & Schindler, P.S. 2013. *Business research methods*. 12th ed. New York: McGraw-Hill.

Craddock, I.L. 2015. Makers on the move: A mobile makerspace at a comprehensive public high school. *Library Hi Tech*, 33(4):497-504.

Creswell, J.W. 2013. *Research design: Qualitative, quantitative and mixed methods approaches*. 3nd ed. Thousand Oaks, CA: SAGE publications.

Creswell, J.W. 2014. *Research design: Qualitative, quantitative, and mixed methods approaches*. 4th ed. Thousand Oaks, CA: SAGE Publications.

Creswell, J.W. 2015. *A concise introduction to mixed methods research design.* Thousand Oaks, CA: SAGE Publications.

Creswell, J.W. & Clark, V.L.P. 2011. *Designing and conducting mixed methods research*. 2nd ed. Thousand Oaks, CA: SAGE publications.

Crossman, A. 2016. *Pilot study: An overview.* [Online]. Available at: <http://sociology.about.com/od/P_Index/g/Pilot-Study.htm> [Accessed on 08 October 2016].

Daley, M. & Child, J. 2015. Makerspaces in the school library environment. *Access*, 29(1):42-49.

Danaci, H.M. 2015. Creativity and knowledge in architectural education. *Procedia-Social and Behavioral Sciences*, 174(2015):1309-1312.

Davee, S. 2012. *The Makery: A pop-up makerspace model.* [Online]. Available at: <http://makered.org/the-makery-a-pop-up-makerspace-model/> [Accessed on 21 August 2016].

Davee, S., Regalla, L. & Chang, S. 2015. *Makerspaces: Highlights of select literature*. [Online]. Available at: <http://makered.org/wp-content/uploads/2015/08/Makerspace-Lit-Review-5B.pdf> [Accessed on 21 February 2016].

Dayaratne, R. 2013. Environment-behaviour research and the teaching of Architecture in the design studio: An experiment in Bahrain. *Procedia-Social and Behavioral Sciences*, 105(2013):314-324.

De Boer, J. 2015. The business case of FryskLab, Europe's first mobile library FabLab. *Library Hi Tech*, 33(4):505-518.

Dean, T., Griffith, D.A. & Calantone, R.J. 2016. New product creativity: Understanding contract specificity in new product introductions. *Journal of Marketing*, 80(2):39-58.

Denzin, N.K. 1978. Strategies of multiple triangulation. In N.K. Denzin (Ed.). *The research act: A theoretical introduction to sociological methods*. Chicago, IL: Aldine.

Denzin, N.K. & Lincoln, Y.S. 1994. *Handbook of qualitative research*. Thousand Oaks, CA: SAGE Publications.

Dervin, B. 1983. An overview of sense-making research: Concepts, methods and results to date. In *International Communications Association Annual Meeting, 1983.* Dallas, Texas, US: TX May:1-75.

Dorkfort, A. 2016. *Waterspace floating makerspace as Arts Ambassador Philippines*. [Online]. Available at: <http://andy.dorkfort.com/andy/digitalnatural/2016/02/28/waterspace-floating-makerspace-as-arts-ambassador-philippines/> [Accessed on 24 August 2016].

Dougherty, D. 2013. *The maker mindset*. [Online]. Available at: <https://llk.media.mit.edu/courses/readings/maker-mindset.pdf> [Accessed on 24 October 2016].

du Preez, M. & Meyer, H.W.J. 2016. Consulting engineers' social networks and their collaborative information behaviour. In *Proceedings of ISIC, the Information Behaviour Conference, Zadar, Croatia, 20-23 September, 2016: Part 1*. *Information Research,* 21(4), paper isic1611. [Online]. Available at: <http://www.informationr.net/ir/21-4/isic/isic1611.html> [Accessed on 20 December 2016].

Ebrahimy, S., Hekmat, Z.F. & Jowkar, A. 2015. Prediction of information seeking behavior of Shiraz University graduate students based on the dimensions of goal orientations and creativity. *Iranian Journal of Information Processing and Management*, 30(4):965-995.

Elliott, A. 2002. *Computational support for sketching and image browsing during the early phase of architectural design*. Unpublished doctoral thesis, University of California, Berkley.

Ellis, D. 1989. A behavioural approach to information retrieval system design. *Journal of Documentation*, 45(3):171-212.

Elmansy, R. 2014. *Disney's creative strategy: The dreamer, the realist and the critic*. [Online]. Available at: <http://www.designorate.com/disneys-creative-strategy/> [Accessed on 10 September 2016].

Elmborg, J.K. 2011. Libraries as the spaces between us: Recognizing and valuing the third space. *Reference and User Services Quarterly*, 50(4):338-350.

Enis, M. 2015. Meet your maker. *Library Journal*, 40(12):24-26.

Ergen, Z. & Akyol, A. 2012. An investigation of creativity among children attending preschools. *Journal of Theoretical Educational Science,* 5(2):156-157.

Extremera, N. & Fernández-Berrocal, P. 2006. Emotional intelligence as predictor of mental, social, and physical health in university students. *The Spanish Journal of Psychology*, 9(1):45-51.

Fagence, M. 2014. 'Servicescape' as a negotiated 'Third Space' in tourism culture. *Tourism Recreation Research*, 39(1):131-134.

Farkas, M. 2015. Making for STEM success. *American Libraries*. [Online]. Available at: <http://americanlibrariesmagazine.org/2015/05/18/making-for-stem-success/> [Accessed on 22 February 2016].

Fereday, J. & Muir-Cochrane, E. 2008. Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, 5(1):80-92.

Fisher, E. 2012. Makerspaces move into academic libraries. *ACRL TechConnect*. [Online]. Available at: <http://acrl.ala.org/techconnect/post/makerspaces-move-into-academic-libraries> [Accessed on 3 June 2015].

Fisher, K.E. & Julien, H. 2009. Information behavior. *Annual Review of Information Science and Technology*, 43:317-358.

Fitts, S. 2009. Exploring third space in a dual-language setting: Opportunities and challenges. *Journal of Latinos and Education*, 8(2015):87-104.

Flick, U. 2002. *An introduction to qualitative research*. 2nd ed. London: SAGE Publications.

Foertsch, A. 2013. *Innovation in manufacturing: Makerspaces*. [Online]. Available at: <http://ampitupma.com/pdf/makerspacesreport_april2013.pdf> [Accessed on 15 April 2016].

Ford, N. 2015. *Introduction to information behaviour*. London, UK: Facet Publishing.

Fouka, G. & Marianna, M. 2011. What are the major ethical issues in conducting research? Is there a conflict between the research ethics and the nature of nursing?. *Health Science Journal*, 5(1):3-14.

Fourie, I. & Meyer, A. 2015. What to make of makerspaces: Tools and DIY only or is there an interconnected information resources space?. *Library Hi Tech*, 33(4):519-525.

France, A. 1920. *Science quotes by Anatole France*. [Online]. Available at: <http://todayinsci.com/F/France_Anatole/FranceAnatole-Quotations.htm> [Accessed on 3 June 2015].

Fullerton, S. 2016. Fanfiction and writing groups in the library: Makerspaces for creative writing. *Alki*, 32(2):26.

Gaut, B. 2010. The philosophy of creativity. *Philosophy Compass*, 5(12): 1034-1046.

Gierdowski, D. & Reis, D. 2015. The MobileMaker: An experiment with a mobile makerspace. *Library Hi Tech*, 33(4):480-496.

Given, L.M. 2015. *100 questions (and answers) about qualitative research*. Thousand Oaks, CA: SAGE Publications.

Glăveanu, V.P. 2010. Paradigms in the study of creativity: Introducing the perspective of cultural psychology. *New Ideas in Psychology*, 28(1):79-93.

Goodall, K.T., Newman, L.A. & Ward, P.R. 2014. Improving access to health information for older migrants by using grounded theory and social network analysis to understand their information behaviour and digital technology use. *European Journal of Cancer Care*, 23(6):728-738.

Goodey, J. & Matthew, K. 1971. Architects and information. *Institute of Advanced Architectural Studies*. Research Paper 1. York, UK: University of York.

Goodman, M. & Dingli, S.M. 2013. *Creativity and strategic innovation management*. London, UK: Routledge.

Gorman, G.E. & Clayton, P. 2005. *Qualitative research for the information professional: A practical handbook*. 2nd ed. London, UK: Facet publishing.

Graves, C. 2014. Teen experts guide makerspace makeover. *Knowledge Quest*, 42(4):8-13.

Guest, G., MacQueen, K.M. & Namey, E.E. 2011. *Applied thematic analysis*. Thousand Oaks, CA: SAGE Publications.

Gustafson, E. 2013. Meeting needs: Makerspaces and school libraries. *School Library Monthly*, 29(8):35-36.

Gutiérrez, K.D. 2008. Developing a sociocritical literacy in the third space. *Reading Research Quarterly*, 43(2):148-164.

Hagens, V., Dobrow, M.J. & Chafe, R. 2009. Interviewee transcript review: Assessing the impact on qualitative research. *BMC medical research methodology*, 9(1):1-47.

Hall, J. 2013. *Everyone was born creative*. [Online]. Available at: <http://www.jonathanhalls.com/resource/everyone-was-born-creative/> [Accessed on 19 December 2016].

Hall, M. 2014. Using makerspaces to teach English language arts Common Core State Standards. *Library Media Connection*, 33(2014):32-33.

Harris, R. & Simons, M. 2006. VET practitioners working with private enterprises: A 'third space'?, *Journal of Workplace Learning*, 18(7/8):478-494.

Harris, S. 2010. *The place of virtual, pedagogic and physical space in the 21st century classroom*. Sydney, AUS: Sydney Centre for Innovation in Learning. [Online]. Available at: <https://static1.squarespace.com/static/510b86cce4b0f6b4fb690106/t/51998ebce4b00c954c5fd2f0/1369018044049/stephen-harris_virtual-pedagogical-physical-space-21st-century.pdf> [Accessed on 3 June 2015].

Hatch, M. 2014. *The maker movement manifesto*. McGraw-Hill Education. [Online]. Available at: <http://www.techshop.ws/images/0071821139%20Maker%20Movement%20Manifesto%20Sample%20Chapter.pdf> [Accessed on 3 June 2015].

Hemmig, W.S. 2008. The information-seeking behavior of visual artists: A literature review. *Journal of Documentation*, 64(3):343-362.

Hemmig, W.S. 2009. An empirical study of the information-seeking behavior of practicing visual artists. *Journal of Documentation*, 65(4):682-703.

Hensley, R.B. 2004. Curiosity and creativity as attributes of information literacy. *Reference and User Services Quarterly*, 44(1):31-36.

Hepworth, M. & Walton, G. 2009. *Teaching information literacy for inquiry-based learning*. Oxford: Elsevier Publishers.

Hepworth, M. & Walton, G. (Eds.). 2013. *Developing people's information capabilities: Fostering information literacy in educational, workplace and community contexts*. Bingley, UK: Emerald Group Publishing.

Hira, A., Joslyn, C.H. & Hynes, M.M. 2014. Classroom makerspaces: Identifying the opportunities and challenges. In *2014 IEEE Frontiers in Education Conference (FIE),* Madrid, Spain:1-5.

Hollinshead, K. 1998. Tourism, hybridity, and ambiguity: The relevance of Bhabha's 'Third Space' cultures. *Journal of Leisure Research*, 30(1):121-156.

Houston, C. 2013. Makerspaces@ your school library: Consider the possibilities. *Kentucky Libraries*, 77(3):26-28.

Idi, D.B. & Khaidzir, K.A.B.M. 2015. Concept of Creativity and Innovation in Architectural Design Process. *International Journal of Innovation, Management and Technology*, 6(1):16-20.

Imdadullah, M. 2015. *Sampling theory, introduction and reasons to sample*. [Online]. Available at: < http://itfeature.com/statistics/sampling-theory-introduction-and-reasons-to-sample> [Accessed on 07 October 2016].

Ingwersen, P. & Järvelin, K. 2005. *The turn: Integration of information seeking and retrieval in context.* Dordrecht: Springer.

Jensen, K. 2013. Tapping into teen's creativity and turning libraries into makerspaces. *VOYA Voice of Youth Advocates*, 36(3). [Online]. Available at: <http://edition.pagesuite-

professional.co.uk//launch.aspx?eid=c6458a0b-d45c-44a5-9428-cecb81e9de41> [Accessed on 21 August 2016].

Jiang, A., Beavers, K., Cady, J.E. & McCoy, L. 2015. Re-positioning library technology support on Campus-Wilson Library's journey. *Library Hi Tech News*, 32(9):14-16.

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A. & Hall, C. 2016. *NMC Horizon Report: 2016 Higher Education Edition*. Austin, Texas: The New Media Consortium. [Online]. Available at: <http://cdn.nmc.org/media/2016-nmc-horizon-report-he-EN.pdf> [Accessed on 21 August 2016].

Johnson, R.B. & Onwuegbuzie, A.J. 2004. Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7):14-26.

Jónsdóttir, S.R., Gísladóttir, K.R. & Guðjónsdóttir, H. 2015. Using self-study to develop a third space for collaborative supervision of master's projects in teacher education. *Studying Teacher Education*, 11(1):32-48.

Julien, H. & Barker, S. 2009. How high-school students find and evaluate scientific information: A basis for information literacy skills development. *Library and Information Science Research*, 31(1):12-17.

Jutraž, A. & Zupančič, T. 2014. The role of architect in interdisciplinary collaborative design studios. *The Creativity Game (CG) –Theory and Practice of Spatial Planning*, 2(2014):34-42.

Karim, S.A. & Sarfraz, S.U. 2016. Creativity is everyone's business: How to enhance employee creativity in telecommunication sector. *Annals of the University of Oradea, Economic Science Series*, 25(1):515-524.

Kelly, A. 2013. Why do we need one of those? The role of the public library in creating and promoting makerspaces. In *ALIA National Library and Information Technicians Symposium*. [Online]. Available at: <https://alialibtech2013.files.wordpress.com/2013/05/kelly-final.pdf> [Accessed on 15 August 2015].

Khan, S.A., Bhatti, R. & Khan, G. 2011. Information-seeking behavior of law practitioners: A survey of Bahawalpur city. *Library Philosophy and Practice (e-journal)*. Paper 581. [Online]. Available at: <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1612&context=libphilprac> [Accessed on 10 December 2016].

Kinga, S., Paul, M. & Şefan, S. 2015. Associations between Hexaco model of personality structure, motivational factors and self-reported creativity among architecture students. *Procedia - Social and Behavioral Sciences*, 187(2015):130-135.

Klipper, B. 2014. Making makerspaces work for everyone. *Children and Libraries*, 12(3):5-6.

Koh, K. & Abbas, J. 2015. Competencies for information professionals in learning labs and makerspaces. *Journal of Education for Library and Information Science*, 56(2):114-129.

Kostagiolas, P., Lavranos, C., Martzoukou, K. & Papadatos, J. 2015. The impact of personality traits on music information seeking and musical creativity. *In i3 Conference Proceedings - Information: Interaction and Impact*. Aberdeen, Scotland, 23-26 June, 2015. [Online]. Available at: <http://www.rgu.ac.uk/file/i3-kostagiolas-et-al-pdf-3mb> [Accessed on 13 December 2016].

Kowaltowski, D.C.C.K. Bianchi, G. & De Paiva, V.T. 2010. Methods that may stimulate creativity and their use in architectural design education. *International Journal of Technology and Design Education*, 20(4):453-476.

Kuhlthau, C.C. 1989. Information search process: A summary of research and implications for school library media programs. *School Library Media Quarterly*, 18(1989):19-25.

Kuhlthau, C.C. 1991. Inside the search process: Information seeking from the user's perspective. *Journal of the American Society for Information Science*, 42(5):361-371.

Kuhlthau, C.C. 1994. Students and the information search process: Zones of intervention for librarians. *Advances in Librarianship*, 18:57-72.

Kuhlthau, C.C. 2004. *Seeking meaning: A process approach to library and information services*. 2nd ed. Westport, CT: Libraries Unlimited.

Kuhlthau, C.C. 2007. The ‘‘information search process’’ revisited: Is the model still useful?. *Information Research*, 13(4):355. [Online]. Available at: <http://www.informationr.net/ir/13-4/paper355.html> [Accessed on 15 August 2015].

Kuhlthau, C.C. 2010. Guided inquiry: School libraries in the 21st century. *School Libraries Worldwide*, 16(1):17-28.

Kuhlthau, C.C. 2013. Rethinking the 2000 ACRL standards: Some things to consider. *Communications in Information Literacy*, 7(2):92-97.

Kuhlthau, C.C. & Cole, C. 2012. Third space as an information system and services intervention methodology for engaging the user's deepest levels of information need. *Proceedings of the American Society for Information Science and Technology*, 49(1):1-6.

Kuhlthau, C.C, Maniotes, L. & Caspari, A.K. 2007. *Guided inquiry: Learning in the 21st century*. 1st ed. Santa Barbara, CA: Libraries Unlimited.

Kuhlthau, C.C., Maniotes, L.K. & Caspari, A.K. 2012. *Guided inquiry design: A framework for inquiry in your school*. Santa Barbara, CA: Libraries Unlimited.

Kuhlthau, C.C, Maniotes, L. & Caspari, A.K. 2015. *Guided inquiry: Learning in the 21st century*. 2nd ed. Santa Barbara, CA: Libraries Unlimited.

Kulemeka, O. 2012. The globalization of advertising: Agencies, cities and spaces of creativity. *Journal of Advertising Education*, 16(2). [Online]. Available at: <https://www.questia.com/library/journal/1P3-2850644791/the-globalization-of-advertising-agencies-cities> [Accessed on 15 December 2016].

Kumar R. 2011. *Research methodology: A step-by-step guide for beginners*. Thousand Oaks, CA: SAGE Publications.

Kurti, R.S., Kurti, D.L. & Fleming, L. 2014a. Practical implementation of an educational makerspace. Part 3 of making an educational makerspace. *Teacher Librarian*, 42(2):20-24.

Kurti, R.S., Kurti, D.L. & Fleming, L. 2014b. The environment and tools of great educational makerspaces. Part 2 of making an educational makerspace. *Teacher Librarian*, 41(2):8-13.

Kurti, R.S., Kurti, D.L. & Fleming, L. 2014c. The Philosophy of educational makerspaces. Part 1 of making an educational makerspace. *Teacher Librarian*, 41(2):8-11.

Kvale, S. 2008. *Doing interviews*. Thousand Oaks, CA: SAGE Publications.

Lamb, A. 2015. Makerspaces and the school library part 1: Where creativity blooms. *Teacher Librarian*, 43(2):56-59.

Lavranos, C., Kostagiolas, P. & Martzoukou, K. 2016. Theoretical and applied issues on the impact of information on musical creativity: An information seeking behavior perspective. In Kostagiolas, P., Martzoukou, K. & Lavranos, C. (Eds.). *Trends in Music Information Seeking, Behavior, and Retrieval for Creativity*. Hershey, PA: IGI Global:1-16.

Lavranos, C., Kostagiolas, P.A., Martzoukou, K. & Papadatos, J. 2015. Music information seeking behaviour as motivator for musical creativity: Conceptual analysis and literature review. *Journal of Documentation*, 71(5):1070-1093.

Lee, J.S. 2009. *Spatializing English-literacy classrooms and third-space possibility: Classroom analyses based on teacher-student power relationships within a Korean secondary-school context*. University at Buffalo, State University of New York.

Leedy, P.D. & Ormrod, J.E. 2014. *Practical research: Planning and design.* 10th ed. London, UK: Pearson Education Limited.

Leeuw, F. & Vaessen, J. 2009. Impact evaluations and development: NONIE guidance on impact evaluation. *Washington, D.C.: The Network of Networks on Impact Evaluation (NONIE)*. [Online]. Available at: <http://siteresources.worldbank.org/EXTOED/Resources/nonie_guidance.pdf> [Accessed on 26 September 2016].

Lenton, E. & Dineen, C. 2016. Set it and forget it (almost): How we make DIY 3D printing work in our library. *Public Services Quarterly*, 12(2):179-186.

Levy, R. 2008. "Third spaces" are interesting places: Applying "third space theory" to nursery-aged children's constructions of themselves as readers. *Journal of Early Childhood Literacy*, 8(1):43–66.

Likar, B., Cankar, F. & Zupan, B. 2015. Educational model for promoting creativity and innovation in primary schools. *Systems Research and Behavioral Science*, 32(2):205-213.

Little, T. & Dobbins, N. 2015. Using a makerspace to connect innovation, creativity and community: Engaging students and teacher candidates in innovative learning with teachers, community members, and university faculty. In *EDULEARN15 Proceedings: 7th International conference ON Education and New Learning Technologies*, 6-8 July, 2015, Barcelona, Spain.

Litts, B.K. 2015. Resources, facilitation, and partnerships: Three design considerations for youth makerspaces. In *Proceedings of the 14th International Conference on Interaction Design and Children, June 21 - 25, 2015, Medford*. New York, USA: ACM:347-350.

Loertscher, D.V. 2015. The virtual makerspace: A new possibility?. *Teacher Librarian*, 43(1):50-51.

Loertscher, D.V., Preddy, L. & Derry, B. 2013. Makerspaces in the school library. *Teacher Librarian*, 41(2):48-52.

Lotts, M. 2015a. Implementing a culture of creativity Pop-up making spaces and participating events in academic libraries. *College and Research Libraries News*, 76(2):72-75.

Lotts, M. 2015b. Lego® Play: Implementing a culture of creativity and making in the academic library. *ACRL Conference Proceedings in Portland, Oregon March 2015*:409-418. [Online]. Available at: <http://www.ala.org/acrl/sites/ala.org.acrl/files/content/conferences/confsandpreconfs/2015/Lotts.pdf> [Accessed on 15 August 2015].

Lucas, B. 2016. A five-dimensional model of creativity and its assessment in schools. *Applied Measurement in Education*, 29(4):278-290.

Lumb, D. 2016. *With BOAT Lab, Tech, Art, and Ecology Converge in one floating makerspace*. [Online]. Available at: <http://www.fastcompany.com/3061489/most-creative-people/with-boat-lab-tech-art-and-ecology-converge-in-one-floating-makerspace> [Accessed on 24 August 2016].

Machi, L.A. & McEvoy, B.T. 2016. *The literature review: Six steps to success*. 3rd ed. Thousand Oaks, CA: Corwin Press.

Mackinder, M. 1983. The architect's information needs. *Architects' Journal*, 178(1983):103-105.

Mahdavinejad, M., Shahrigharahkoshan, S. & Ghasempourabadi, M. 2012. The role of site analysis in creativity of students of Bachelor of Architecture, Case: Design Studio III. *Procedia - Social and Behavioral Sciences*, 51(2012):1000-1004.

Maker Media. 2013. *Makerspace playbook. School edition.* [Online]. Available at: <http://makerspace.com/wp-content/uploads/2013/02/MakerspacePlaybook-Feb2013.pdf> [Accessed on 21 February 2016].

Makerboat. 2014. *What is a Maker Space?.* [Online]. Available at: <http://www.makerboat.com/what-is-a-maker-space-2/> [Accessed on 24 August 2016].

Makeschools Higher Education Alliance. 2015. *State of making report*. [Online]. Available at: <http://make.xsead.cmu.edu/week_of_making/report> [Accessed on 21 August 2016].

Makri, S. & Warwick, C. 2010. Information for inspiration: Understanding architects' information seeking and use behaviors to inform design. *Journal of the American Society for Information Science and Technology*, 61(9):1745-1770.

Malina, M.A., Nørreklit, H.S.O. & Selto, F.H. 2011. Lessons learned: Advantages and disadvantages of mixed method research. *Qualitative Research in Accounting and Management*, 8(1):59-71.

Maniotes, L.K. & Kuhlthau, C.C. 2014. Making the shift. *Knowledge Quest*, 43(2):8-17.

Maniotes, L.K. 2005. *The transformative power of literary third space*. University of Colorado at Boulder, CO: ProQuest Dissertation and Theses.

Maniotes, L.K. 2010. Teaching in the zone: Formative assessments for critical thinking. *Library Media Connection*, 29(1):36-39.

Maniotes, L.K., Harrington, L. & Lambusta, P. 2015. *Guided inquiry design in action: Middle school*. Santa Barbara, CA: Libraries Unlimited.

Martin, P. 2010. *Making space for creativity*. University of Brighton, UK: Creativity Centre.

Martin, P. 2014. MakeHERSpaces: STEM, girls, and the maker movement. *California Commission on the Status of Women and Girls in support of the 2014 California Department of Education Second Annual STEM* Symposium. [Online]. Available at: <https://www.library.ca.gov/crb/14/S-14-022.pdf> [Accessed on 30 June 2015].

McCaughan, E. & McKenna, H. 2007. Never-ending making sense: towards a substantive theory of the information-seeking behaviour of newly diagnosed cancer patients. *Journal of Clinical Nursing*, 16(11):2096-2104.

McCormick, 2014. *A holistic approach to creativity: An interview with Thomas Vogel*. [Online]. Available at: <http://mediaman.com/en/blog/a-holistic-approach-to-creativity-an-interview-with-thomas-vogel/> [Accessed on 11 December 2016].

McDonough, S. 2014. Rewriting the script of mentoring pre-service teachers in third space: Exploring tensions of loyalty, obligation and advocacy. *Studying Teacher Education*, 10(3):210-221.

McLaughlin, H. 2014. Where is the Science in a Maker Space?. In *Association of Science – Technology Centers (ASTC) 2014 Annual Conference*. [Online]. Available at: <http://www.astc.org/annual-conference/where-is-the-science-in-a-maker-space/> [Accessed on 11 August 2015].

McNamee, L.G. & Peterson, B.L. 2014. Reconciling "third space/place": Toward a complementary dialectical understanding of volunteer management. *Management Communication Quarterly*, 28(2014):214–243.

Medaille, A. 2010. Creativity and craft: The information-seeking behavior of theatre artists. *Journal of Documentation*, 66(3):327-347.

Meho, L.I. & Tibbo, H.R. 2003. Modelling the information-seeking behavior of social scientists: Ellis's study revisited. *Journal of the American Society for Information Science and Technology*, 54(6):570-587.

Meyer, A. & Fourie, I. 2016. Thematic analysis of the value of Kuhlthau's work for the investigation of information behaviour in creative workspaces in academic libraries. *Presented at the ISIC: The information behaviour conference 2016 in Zadar, Croatia on 20-23 September*. (Submitted for publication to *Information Research*)

Mills, L.A., Knezek, G. & Khaddage, F. 2014. Information seeking, information sharing, and going mobile: three bridges to informal learning. *Computers in Human Behavior*, 32(2014):324-334.

Minichiello, T. 2011. *Adventurous student work*. [Online]. Available at: <http://www.metropolismag.com/Point-of-View/January-2011/Adventurous-Student-Work/> [Accessed on 12 September 2016].

Moeller, R., Bastiansen, C., Gates, L. & Subramaniam, M. 2015. Universally accessible makerspace recommendation to the district of Columbia Public Library. In *Accessibility for Persons with Disabilities and the Inclusive Future of Libraries*. Bingley, UK: Emerald Group Publishing Limited:33-50.

Moorefield-Lang, H.M. 2014. Makers in the library: Case studies of 3D printers and maker spaces in library settings. *Library Hi Tech*, 32(4):583-593.

Moorefield-Lang, H.M. 2015a. Making, libraries, and literacies. *Library Media Connection*, 33(4):30-31.

Moorefield-Lang, H.M. 2015b. User agreements and makerspaces: A content analysis. *New Library World*, 116(7/8):358-368.

Moorefield-Lang, H.M. 2015c. When makerspaces go mobile: Case studies of transportable maker locations. *Library Hi Tech*, 33(4):462-471.

Mouton, J. 2001. *How to succeed in your Master's and Doctoral Studies: A South African Guide and Resource Book*. Pretoria: Van Schaik Publishers.

Musa, O. 2013. An introduction to creative thinking in architectural design. *International Journal of Engineering and Technology*, 13(5):44-53.

Naiman, L. 2014. *Creativity of work.* [Online]. Available at: <http://www.creativityatwork.com/2014/02/17/what-is-creativity/> [Accessed on 14 October 2016].

O'Cathain, A., Murphy, E. & Nicholl, J. 2010. Three techniques for integrating data in mixed methods studies. *BMJ 341*. [Online]. Available at: <http://dx.doi.org/10.1136/bmj.c4587> [Accessed on 27 September 2016].

O'Connell, B. 2015. Going from curious to maker: New user experiences in a university makerspace. *VentureWell*. [Online]. Available at: <http://venturewell.org/open2015/wp-content/uploads/2013/10/OCONNELL.pdf> [Accessed on 17 December 2016].

Office of Research Ethics and Integrity (OREI). 2015. *QUT code of conduct for research*. [Online]. Available at: <http://www.orei.qut.edu.au/integrity/> [Accessed on 10 September 2015].

Ojeda-Zapata, J. 2016. *At St. Paul library 'makerspaces,' noisy, techie creativity is OK*. [Online]. Available at: <http://www.twincities.com/2016/03/22/st-paul-libraries-makerspaces-tech-creativity/> [Accessed on 26 September 2016].

Olson, E. 2011. *Creative problem solvers*. [Online]. Available at: <http://creativeproblemsolvers.blogspot.co.za/2011/03/first-annual-engineering-egg-drop.html> [Accessed on 15 January 2017].

Onsman, A. 2016. Assessing creativity in a "New Generation" architecture degree. *Thinking Skills and Creativity*, 19(March 2016[10]):210-218.

Onuoha, C.O., Anyanwu, E.U., Ossai-onah, O.V. & Amaechi, N.M. 2015. Challenges of promoting innovation and creativity among library and information science professionals in Nigeria: The experience of selected libraries in Imo State, Nigeria. *Journal of Emerging Trends in Computing and Information Sciences*, 6(1):25-30.

Ostwald, S.K., Bernal, M.P., Cron, S.G. & Godwin, K.M. 2009. Stress experienced by stroke survivors and spousal caregivers during the first year after discharge from inpatient rehabilitation. *Topics in Stroke Rehabilitation*, 16(2):93-104.

Pane, D. 2007. Third space theory: Reconceptualizing content literacy learning. In Nielsen, S.M. & Plakhotnik, M.S. (Eds.). *Proceedings of the Sixth Annual College of Education Research Conference: Urban and International Education Section.* Miami, USA: Florida International University:78-83. [Online]. Available at: <http://digitalcommons.fiu.edu/cgi/viewcontent.cgi?article=1265&context=sferc> [Accessed on 17 December 2016].

Paul, E.S. & Kaufman, S.B. (Eds). 2014. *The philosophy of creativity: New essays*. London, UK: Oxford University Press.

Peck, J. 2012. Recreative city: Amsterdam, vehicular ideas and the adaptive spaces of creativity policy. *International Journal of Urban and Regional Research*, 36(2012):46-485.

Pelaprat, E. & Cole, M. 2011. 'Minding the gap': Imagination, creativity and human cognition. *Integrative Psychological and Behavioral Science*, 45(4):397-418.

Peppler, K. & Bender, S. 2013. Maker movement spreads innovation one project at a time. *Phi Delta Kappan*, 95(3):22-27.

[10] The issue number is identical to the date of publication, as this is an open access online journal.

Petrich, M., Wilkinson, K. & Bevan, B. 2013. It looks like fun, but are they learning? In M. Honey & D. Kanter (Eds.). *Design, make, play: Growing the next generation of STEM innovators*. New York, US: Routledge:50-70.

Pettigrew, K.E., Fidel, R. & Bruce, H. 2001. Conceptual frameworks in information behaviour. *Annual Review of Information Science and Technology*, 35:43-78.

Pickard, A. J. 2013. *Research methods in information.* 2nd ed. London, UK: Facet Publishing.

Plemmons, A. 2014. Building a culture of creation. *Teacher Librarian*, 41(5):12-16.

Pope, R. 2005. *Creativity: Theory, history, practice*. London, UK: Routledge.

Popova, M. 2013. *What is creativity? Cultural Icons on what ideation is and how it works*. [Online]. Available at: <https://www.brainpickings.org/2013/09/06/what-is-creativity/> [Accessed on 10 September 2016].

Povilanskas, R. & Armaitienė, A. 2014. Marketing of coastal barrier spits as liminal spaces of creativity. *Procedia-Social and Behavioral Sciences*, 148(2014):397-403.

Powell, J. & Nichols, T. 1982. Utilization of technical information in design of buildings - A case study for energy conservation. *Transfer and Exploitation of Science and Technology Information*. Unpublished technical report. Luxembourg, UK: Office for Official Publications of the European Communities:305-316.

Preddy, L. 2013. Creating school library "makerspace". *School Library Monthly*, 29(5):41-42.

Provenzano, N. 2015. *Fostering creativity with makerspaces*. [Online]. Available at: <https://www.psychologytoday.com/blog/live-long-and-prosper/201503/comforting-third-spaces> [Accessed on 14 October 2016].

Pryor, S. 2014. Implementing a 3D printing service in an academic library. *Journal of Library Administration*, 54(1):1-10.

Purnell, D. 2015. Expanding Oldenburg: Homes as third places. *Journal of Place Management and Development*, 8(1):51-62.

Range, E. & Schmidt, J. 2014. Explore, plan, create: developing a makerspace for your school community. *School Library Monthly*, 30(7):8-10.

Raviz, F.K., Abad, S.R.S. & Nikpour, M. 2015. The relationship between physical characteristics of the architectural education and creativity. *European Online Journal of Natural and Social Sciences*, 3(3):378-383.

Reddy, M.C. & Jansen, B.J. 2008. A model for understanding collaborative information behavior in context: a study of two healthcare teams. *Information Processing and Management*, 44(1):256-273.

Reuter, M.E. 2015. *Creativity - A sociological approach*. London, UK: Springer.

Rivas, L. 2014. Creating a classroom makerspace. *Educational Horizons*, 93(1):25-26.

Royal Institute of British Architects (RIBA). 2012. *Study of the earnings of architecture students 2011-12*. [Online]. Available at: <https://goo.gl/xBkQlv> [Accessed 17 December 2016].

Runco, M.A. & Pritzker, S.R. (Eds.). 1999. *Encyclopaedia of creativity*. Volume 1. San Diego, CA: Academic Press.

Savolainen, R. 1995. Everyday life information seeking: approaching information seeking in the context of "way of life". *Library and Information Science Research*, 17(3):259-294.

Savolainen, R. 2007. Information behavior and information practice: Reviewing the "umbrella concepts" of information-seeking studies. *Library Quarterly*, 77(2):109-132.

Shaaban, S., Lockley, S. & Elkadi, H. 2001. Information visualisation for the architectural practice. In *Fifth* IEEE *International Conference Proceedings 2001 on Information Visualisation, 25-27 July 2001, London, England.* New York, US: Institute of Electrical and Electronics Engineers (IEEE):43-50.

Sidawi, B. 2013. Rethinking architectural education: A focus on creativity. In *AAE International Conference on Architectural Education*, *Denver, USA, 31 October-03*

November, 2013:1-6. [Online]. Available at: <https://architecturaleducators.files.wordpress.com/2013/12/sidawi-2013-rethinking-architectural-education-a-focus-on-creativity.pdf> [Accessed on 12 December 2016].

Siestrzewitowska, M. 2015. Public spaces for the 21st century youth–composition, architectural form, modern technical solutions. *Technical transactions, Architecture, 2-A/2013*. [Online]. Available at: <http://www.ejournals.eu/sj/index.php/Cz/article/view/1778/1794> [Accessed on 11 October 2016].

Singh, K.J. 2010. *What is sampling? What are its characteristics, advantages and disadvantages?*. [Online]. Available at: <http://www.mbaofficial.com/mba-courses/research-methodology/what-is-sampling-what-are-its-characteristics-advantages-and-disadvantages/> [Accessed on 08 October 2016].

Skattebol, J. & Arthur, L.M. 2014. Collaborative practitioner research: Opening a third space for local knowledge production. *Asia Pacific Journal of Education*, 34(3):351-365.

Slatter, D. & Howard, Z. 2013. A place to make, hack, and learn: Makerspaces in Australian public libraries. *The Australian Library Journal*, 62(4):272-284.

Small, R.V., Laura, J. & Meredith, L.D. 2014. The motivational and information needs of young innovators: Stimulating student creativity and inventive thinking. *School Library Media Research*, 17(2014[11]):1-36.

Smoyak, S.A. 2015. Creativity is the heart of psychiatric-mental health nursing. *Journal of Psychosocial Nursing and Mental Health Services*, 53(1):3-4.

Snow, C. 1975. Architects' wants and needs for information, demonstrated through a university-based information service. *Sahib Proceedings*, 27(3):112-123.

Soja, E. 1996. *Thirdspace: Journeys to Los Angeles and their real and imagined places*. Cambridge, Mass.: Blackwell.

[11] The issue number is identical to the date of publication, as this is an open access online journal.

Sonnenwald, D.H. & Pierce, L.G. 2000. Information behavior in dynamic group work contexts: interwoven situational awareness, dense social networks and contested collaboration in command and control. *Information Processing and Management*, 36(3):461-479.

Stager, G.S. 2013. Papert's prison fab lab: implications for the maker movement and education design. In *Proceedings of the 12th International Conference on Interaction Design and Children*. New York, USA: ACM:487-490.

Stake, R.E. 1994. Case studies. In Denzin, N.K. & Lincoln, Y.S. (eds.). *Handbook of qualitative research*. London: SAGE publications:236-247.

Steele, R. 2015. The journey from library to learning commons. *Teacher Librarian*, 42(3):12-17.

Sternberg, R. 2005. Creativity or creativities?. *International Journal of Human-Computer Studies*, 4-5(63):370-382.

Struwig, F.W. & Stead, G.B. 2001. *Planning, designing and reporting research*. Pinelands, Cape Town, SA: Pearson Education South Africa.

Szabó, K., Mutic, P. & Szamosközi, T. 2015. Associations between Hexaco model of personality structure, motivational factors and self-reported creativity among architecture students. *Procedia-Social and Behavioral Sciences*, 187(2015[12]):130-135.

Tahmaseb-McConatha, J. 2015. Comforting third spaces: Access to "third spaces" can promote health and well-being. *Live Long and Prosper*. [Online]. Available at: <https://www.psychologytoday.com/blog/live-long-and-prosper/201503/comforting-third-spaces> [Accessed on 11 August 2015].

Taylor, B.D. 2012. *The creative edge: 17 Biographies of cultural icons*. Melbourne, AUS: John Wiley and Sons.

[12] The issue number is identical to the date of publication, as this is an open access online journal.

Taylor, R. 1968. Question-negotiation and information seeking in libraries. *College and Research Libraries,* 29(3):178-194.

Taylor, R.S. 1991. Information use environments. In B. Dervin & M. Voigt (Eds.). *Progress in communication science*. Norwich, NJ: Ablex:173-216.

Terre Blanche, M., Durrheim, K. & Painter D. 2006. *Research in practice: Applied methods for the social sciences*. 2nd ed. Cape Town, SA: Juta and Company Ltd.

Thomas, D.R. 2016. Feedback from research participants: are member checks useful in qualitative research?. *Qualitative Research in Psychology*, 14(1):23-41.

Tong, V., Raynor, D.K. & Aslani, P. 2014. Gender differences in health and medicine information seeking behaviour - A review. *Journal of the Malta College of Pharmacy Practice*, 20(5):14-16.

Torun, A.Ö., Tekçe, I. & Esin, N. 2011. Teaching creativity in self-organizing studio network: Implications for architectural education. *Procedia - Social and Behavioral Sciences*, 28(2011[13]):749-754.

Turner, A., Welch, B. & Reynolds, S. 2013. Learning spaces in academic libraries - A review of the evolving trends. *Australian Academic and Research Libraries*, 44(4):226-234.

Tzonis, A. 2014. Creativity real and imagined in architectural education. *Frontiers of Architectural Research*, 3(3):331-333.

Uden, R. 2011. Making space for creativity. *The Digital Shit - Library Journal*. [Online]. Available at: <http://www.thedigitalshift.com/2011/11/media/making-space-for-creativity/> [Accessed on 11 December 2016].

Vakkari, P. 2001. A theory of the task-based information retrieval process. *Journal of Documentation*, 57(1):44-60.

[13] The issue number is identical to the date of publication, as this is an open access online journal.

Velikovsky, J.T. 2012. *Creative practice theory: The Model*. [Online]. Available at: <https://storyality.wordpress.com/creative-practice-theory/> [Accessed on 13 December 2016].

Verbaan, E. & Cox, A.M. 2014. Occupational sub-cultures, jurisdictional struggle and third space: Theorising professional service responses to Research Data Management. *The Journal of Academic Librarianship*, 40(3):211-219.

Visick, R., Hendrickson, J. & Bowman, C. 2006. *Seeking information during the creative process – a pilot study of artists*. [Online]. Available at: <http://staff.washington.edu/jath/portfolio/570final.pdf> [Accessed on 10 December 2016].

Vogel, T. 2014. *Breakthrough thinking: A guide to creative thinking and idea generatio*n. Blue Ash, Ohio, US: F&W Media Incorporated.

Vossoughi, S. & Bevan, B. 2014. Making and tinkering: A review of the literature. *National Research Council Committee on Out of School Time STEM*:1-55. [Online]. Available at: <http://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_089888.pdf> [Accessed on 10 December 2016].

Vygotsky, L.S. 1978. Interaction between learning and development (M. Lopez Morillas, Trans). In Cole, M., John-Steiner, V., Scribner, S. & Souberman, E. (Eds.). *Mind in society: The development of higher psychological* processes. Cambridge, MA: Harvard University Press:79-91.

Waters, P. 2014. *Makerspaces for students with special needs*. [Online]. Available at: <https://www.edutopia.org/blog/makerspaces-students-with-special-needs-patrick-waters> [Accessed on 11 August 2015].

Webster, P. 2002. Creative thinking in music: Advancing a model. In T. Sullivan & L. Willingham (Eds.). *Creativity and music education*. Edmonton, AB, Canada: Canadian Music Educators' Association: 16-34.

Williams, A., Ostwald, M. & Askland, H.H. 2010. Assessing creativity in the context of architectural design education. *In Proceedings of Design Research Society (DRS)*.

Montréal, Canada, 7-9 July 2010. [Online]. Available at: <http://www.drs2010.umontreal.ca/data/PDF/129.pdf> [Accessed on 12 December 2016].

Wilson V. 2014. Research methods: Triangulation. *Evidence Based Library and Information Practice*, 9(1):74-75.

Wilson, A. 2000. There is no escape from third Space theory: Borderline discourse and the "In Between" literacies of prisons. In Barton, D., Hamilton, M. & Ivanic, R. (Eds.). *Situated Literacies: Reading and Writing in Context*. London, UK: Routledge:54-69.

Wilson, T.D. 1997. Information behavior: An interdisciplinary perspective. *Information Processing and Management*, 33(4):551-572.

Wilson, T.D. 1999. Models in information behaviour research. *Journal of Documentation*, 55(3):249-270.

Wilson, T.D. 2016. A general theory of human information behaviour. In *Proceedings of ISIC, the Information Behaviour Conference, Zadar, Croatia, 20-23 September, 2016: Part 1*. *Information Research,* 21(4), paper isic1601. [Online]. Available at: <http://InformationR.net/ir/21-4/isic/isic1601.html> [Accessed on 20 December 2016].

Yin, R.K. 2013. *Case study research: Design and methods*. 5th ed. Thousand Oaks, CA: SAGE publications.

Zach, L. 2005. When is "enough" enough? Modelling the information-seeking and stopping behavior of senior arts administrators. *Journal of the American Society for Information Science and Technology*, 56(1):23-35.

Zhao, Z.Q. & Tao, L. 2014. Cultivation of students' creativity in university architectural education in the 21st century. *Advanced Materials Research*, 962(1):3016-3019.

APPENDIX A: LETTER OF INVITATION

Title of the study: ***Information Behaviour in Academic Spaces of Creativity: a Building Science Pseudo-Makerspace***

This letter is an invitation to consider participating in a study I am conducting in partial fulfilment of the requirements for a Master's degree in Information Technology (MIT) in the Department of Information Science (tertiary institution in South Africa). It would be sincerely appreciated if you could find the time to participate in this study.

The purpose of the study is to explore which information activities and interactions feature in the information behaviour of architecture students when performing creative tasks in academic spaces. The findings will be used to advise tertiary institutions and libraries on how academic spaces of creativity can kindle various information activities (such as information seeking and selection, and the utilisation of information resources and services) to empower independent exploration and critical thinking; how tertiary institutions and libraries can facilitate an inventive, creative and dynamic academic learning space; and how architecture students can benefit from these environments from a third space research lens.

The study will comprise two components, namely a questionnaire and an interview. The study has been reviewed and has received ethical clearance from the Research Committee of the Department of Information Science, Faculty Committee for Research Ethics and Integrity (Engineering, Built Environment and Information Technology (EBIT)), and the dean of the Faculty of the tertiary institution in South Africa.

I am confident that the results of my study will be of benefit to the tertiary institution directly involved in the study, other tertiary institutions not directly involved in the study, as well as to the broader academic community.

Researcher's name: Ms Anika Meyer **Contact details:** Email: anika.meyer@up.ac.za Office phone: (012) 420 4655	**Supervisor's name:** Professor Ina Fourie **Contact details:** Email: ina.fourie@up.ac.za Office phone: (012) 420 5216

If you are willing to participate, please refer to the form of informed consent. If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please do not hesitate to contact me. Thank you in advance for your assistance and support.

APPENDIX B: PROFILE QUESTIONNAIRE FOR THIRD-YEAR ARCHITECTURE STUDENTS

Title of the study: ***Information Behaviour in Academic Spaces of Creativity: a Building Science Pseudo-Makerspace***

The profile questionnaire is part of a study in partial fulfilment of the requirements for a master's degree study (Master's in Information Technology (MIT)). The profile questionnaire will take approximately five minutes to complete. Your time and participation are much appreciated.

The purpose of the study is to explore which information activities and interactions feature in the information behaviour of architecture students when performing creative tasks in academic spaces. The findings will be used to advise tertiary institutions and libraries on how academic spaces of creativity can kindle various information activities.

The study has been reviewed and has received ethical clearance from the Research Committee of the Department of Information Science, Faculty Committee for Research Ethics and Integrity (Engineering, Built Environment and Information Technology (EBIT)), and the dean of the Faculty.

Researcher's name: Ms Anika Meyer **Contact details:** Email: anika.meyer@up.ac.za Office phone: (012) 420 4655	**Supervisor's name:** Professor Ina Fourie **Contact details:** Email: ina.fourie@up.ac.za Office phone: (012) 420 5216

PROFILE SKETCH

1. Please confirm that you are a third-year architecture student. Yes ☐ No ☐

2. Do you have any industry work experience? Yes ☐ No ☐
   If yes, can you please elaborate?

   _____

3. What is your preference, working in collaboration or individually when working on an architecture design project? Please indicate your preference on the scale below.

Collaboration | | | | | | | | | | Individual

4. Please rate on the scale below how important creativity is to you during the completion of a design project.

Not important at all | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Extremely important

5. Please rate on the scale below how confident you are of your creative abilities.

Not confident at all | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Extremely confident

6. Please rate on the scale below to which extent you use the following formal sources and sources of scholarly information for your architecture design projects.

	Never		Seldom		Often		Very frequently	
1. Libraries								
2. Databases to which libraries subscribe								
3. Google Scholar								
4. Journal articles								
5. Conference papers								
6. Books								
7. Design standard/technical instruction manuals								
8. Multimedia (e.g. audio/video CD-ROM/DVD)								

Please add any other formal sources and sources of scholarly information you use for your architecture design projects:

_____

_____

7. Please rate on the scale below to which extent you use the following informal sources and sources of scholarly information for your architecture design projects.

	Never	Seldom	Often	Very frequently
1. People you know (e.g. experts, peers, friends, etc.)				
2. People you do not know (e.g. Q&A sites)				
3. Search engines (e.g. multimedia and image search engines)				
4. Social networking sites (e.g. YouTube, Pinterest, Facebook, Instagram, etc.)				

Please add any other informal sources and sources of scholarly information you use for your architecture design projects:

_____

_____

THANK YOU FOR YOUR TIME AND PARTICIPATION.

xxxxx
Researcher: Anika Meyer

APPENDIX C: INFORMED CONSENT FORM

Title of the study: ***Information Behaviour in Academic Spaces of Creativity: a Building Science Pseudo-Makerspace***

I …… hereby acknowledge that I have received and understood all significant information regarding the study and have had the opportunity to ask questions.

1. The nature and objective, as well as possible safety and health implications, have been explained to me and I understand them.
2. I understand my right to choose whether to participate in the project and that my participation is voluntary.
3. I am aware that the results of the study may be used for the purposes of publication and that the information provided will be handled in a way that ensures anonymity and confidentiality.
4. I grant permission that all information provided in the interview may be recorded for research purposes.

Upon signing the consent form, you will be given a copy to keep for your own record.

If you agree to participate in the study, please sign and date below.

Signed: _____ Date: _____

Witness: _____ Date: _____

Researcher: _____ Date: _____

APPENDIX D: INTERVIEW SCHEDULE FOR HEAD OF DEPARTMENT

Title of the study: ***Information Behaviour in Academic Spaces of Creativity: a Building Science Pseudo-Makerspace***

The interview is part of a study in partial fulfilment of the requirements for a master's degree (Master's in Information Technology (MIT)). The individual interview will last approximately 30 minutes. Your time and participation are much appreciated.

The purpose of the study is to explore which information activities and interactions feature in the information behaviour of architecture students when performing creative tasks in academic spaces. The findings will be used to advise tertiary institutions and libraries on how academic spaces of creativity can kindle various information activities.

The study has been reviewed and has received ethical clearance from the Research Committee of the Department of Information Science, Faculty Committee for Research Ethics and Integrity (Engineering, Built Environment and Information Technology (EBIT)), and the dean of the Faculty.

Researcher's name: Ms Anika Meyer **Contact details:** Email: anika.meyer@up.ac.za Office phone: (012) 420 4655	**Supervisor's name:** Professor Ina Fourie **Contact details:** Email: ina.fourie@up.ac.za Office phone: (012) 420 5216

Clarification of information behaviour: Information behaviour as an umbrella term encompasses various information activities such as information seeking, information encountering, browsing, information discovery, information sharing, information use, choice of information sources, preferences for information sources and channels, information avoidance and ignoring information needs.

1. ARCHITECTURE DESIGN PROJECTS

1.1 What are your expectations of how students' artistic, technical, practical and theoretical knowledge and skills should culminate in architecture design projects?

1.2 How important is group work from the departmental approach to architectural design projects?

1.3 What is your point of view on the use of information and information resources in the completion of a design project?

2. ROLE OF CREATIVITY DURING DESIGN PROJECTS

2.1 In your opinion, how should creativity feature in design projects such those as for the Module Anonymous?

2.2 In your opinion, what role can the use of information and information resources play in triggering a creative thought or idea?

3. SPACES OF SUPPORT

3.1 Which spaces of support (physical or virtual) are currently provided by the Department of Architecture to assist students during the completion of design projects?

3.2 What is your vision for such spaces in the near future?

3.3 How should information, information resources and information support, in your opinion, feature in such spaces?

4. GENERAL

4.1 Is there anything else you would like to add?

THANK YOU FOR YOUR TIME AND PARTICIPATION.

xxxxx
Researcher: Anika Meyer

APPENDIX E: INTERVIEW SCHEDULE FOR LECTURER OF MODULE ANONYMOUS

Title of the study: ***Information Behaviour in Academic Spaces of Creativity: a Building Science Pseudo-Makerspace***

The interview is part of a study in partial fulfilment of the requirements for a master's degree (Master's in Information Technology (MIT)). Individual interviews will last approximately 30 minutes. Your time and participation are much appreciated.

The purpose of the study is to explore which information activities and interactions feature in the information behaviour of architecture students when performing creative tasks in academic spaces. The findings will be used to advise tertiary institutions and libraries on how academic spaces of creativity can kindle various information activities.

The study has been reviewed and has received ethical clearance from the Research Committee of the Department of Information Science, Faculty Committee for Research Ethics and Integrity (Engineering, Built Environment and Information Technology (EBIT)), and the dean of the Faculty.

Researcher's name: Ms Anika Meyer **Contact details:** Email: anika.meyer@up.ac.za Office phone: (012) 420 4655	**Supervisor's name:** Professor Ina Fourie **Contact details:** Email: ina.fourie@up.ac.za Office phone: (012) 420 5216

Clarification of information behaviour: Information behaviour as an umbrella term encompasses various information activities such as information seeking, information encountering, browsing, information discovery, information sharing, information use, choice of information sources, preferences for information sources and channels, information avoidance and ignoring information needs.

1. MODULE ANONYMOUS CURRICULUM

1.1 Can you tell me a bit more about the module and provide me with documentation on the module curriculum?

1.2 What is your vision for the Module Anonymous?

1.3 What are your expectations on how students' artistic, technical, practical and theoretical knowledge and skills should integrate into the Module Anonymous?

1.4 How important is group work for the design projects in the Module Anonymous?

1.5 What is your point of view on the use of information and information resources in the Module Anonymous?

2. ROLE OF CREATIVITY DURING DESIGN PROJECTS

2.1 In your opinion, how should creativity feature in design projects such as those for the Module Anonymous?

2.2 In your opinion, what role can the use of information and information resources play in triggering a creative thought or idea?

3. SPACES OF SUPPORT

3.1 Which spaces of support (physical or virtual) are currently provided by the Department of Architecture to assist students during the completion of design projects in the Module Anonymous?

3.2 What is your opinion on the usefulness of these spaces in supporting creativity, and are there things you think should be added in this regard?

4. GENERAL

4.1 Is there anything else you would like to add?

THANK YOU FOR YOUR TIME AND PARTICIPATION.

xxxxx

Researcher: Anika Meyer

APPENDIX F: INTERVIEW SCHEDULE FOR THIRD-YEAR ARCHITECTURE STUDENTS

Title of the study: ***Information Behaviour in Academic Spaces of Creativity: a Building Science Pseudo-Makerspace***

The interview is part of a study in partial fulfilment of the requirements for a master's degree study (Master's in Information Technology (MIT)). The individual interview will last approximately 30 minutes. Your time and participation are much appreciated.

The purpose of the study is to explore which information activities and interactions feature in the information behaviour of architecture students when performing creative tasks in academic spaces. The findings will be used to advise tertiary institutions and libraries on how academic spaces of creativity can kindle various information activities.

The study has been reviewed and has received ethical clearance from the Research Committee of the Department of Information Science, Faculty Committee for Research Ethics and Integrity (Engineering, Built Environment and Information Technology (EBIT)), and the dean of the Faculty.

Researcher's name: Ms Anika Meyer **Contact details:** Email: anika.meyer@up.ac.za Office phone: (012) 420 4655	**Supervisor's name:** Professor Ina Fourie **Contact details:** Email: ina.fourie@up.ac.za Office phone: (012) 420 5216

Clarification of information behaviour: Information behaviour as an umbrella term encompasses various information activities such as information seeking, information encountering, browsing, information discovery, information sharing, information use, choice of information sources, preferences for information sources and channels, information avoidance and ignoring information needs.

1. DESIGN PROJECT OVERVIEW

1.1 Please provide a short description of a *design project* for Module Anonymous that you completed in 2016.

1.2 What is your perception of the importance of and integration of creativity into your design?

1.3 How did your prior learning and experience (e.g. industry experience) help you to complete your design project (i.e. the one we are discussing) for Module Anonymous?

2. PROJECT DESIGN STAGES

2.1. Please describe the project stages you went through to complete the project; not overall, but for this specific project. *(Researcher will compile a list of the stages and provide her interpretation to the participant for validation)*.

2.2. Were you working alone during these stages or were you working with others (in a formal or informal manner, e.g. sharing information, asking advice)?

3. AN INFORMATION BEHAVIOUR PERSPECTIVE OF THE STAGES IN THE DESIGN PROCESS

3.1 What type of questions did you need to ask at (i) the start, (ii) during the stages and (iii) at the end of this design project? Can you give a few examples?

3.2 Where and how did you look/search for information and answers (e.g. drawing on your personal experiences and resources)? Can you please explain your choices?

4. CREATIVITY

4.1 On which resources did you draw to inspire creativity during the design of this project?

4.2 Did you use any information sources, including people, to inspire creativity?

4.3 How do the physical spaces and tools provided by the department help you to find solutions and be creative?

4.4 What is your opinion on the role of information and information support (e.g. provided by the library) to complete the design project successfully?

4.5 If you feel there is such a role (as set out in question 4.4), how do you envision this?

5. GENERAL

5.1 Is there anything else you would like to add?

THANK YOU FOR YOUR TIME AND PARTICIPATION.

xxxxx
Researcher: Anika Meyer

APPENDIX G: RESEARCHER DECLARATION

Title of the study: ***Information Behaviour in Academic Spaces of Creativity: a Building Science Pseudo-Makerspace***

Hereby I, Anika Meyer, in my capacity as a Master of Information Technology researcher/student, declare that:

1. Research subjects will be informed, information will be handled confidentially, research subjects reserve the right to choose whether to participate and, where applicable, written permission will be obtained for the execution of the project (example of permission attached).

2. No conflict of interests or financial benefit, whether for the researcher, company or organisation, that could materially affect the outcome of the investigation or jeopardise the name of the university is foreseen.

3. Inspection of the experiments in loco may take place at any time by the committee or its proxy.

4. The information I furnish in the application is correct to the best of my knowledge and that I will abide by the stipulations of the committee as contained in the regulations.

5. Signed: xxxxx

6. Date: 2016-07-29