Hayashi, Y., et al. (Eds.) (2017). Workshop Proceedings of the 25th International Conference on Computers in Education. New Zealand: Asia-Pacific Society for Computers in Education

Creation Process in Design Research Class

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Abstract: In this paper, we describe the problems in the creation process for a Design Research (DR) class at Faculty of Creative Multimedia, Multimedia University in Malaysia. There were 117 students from their final year studies taking this subject, which served as the research component for their Final Year Projects (FYPs). These students are from the major of Virtual Reality, Animation & Visual Effects, Interface Design, Media Arts and Advertising Design. The aim of this paper is to discuss the creation process using Creative Cognition framework in writing dissertation. This paper illustrates a qualitative approach for studying the creation process. Students approached their FYP projects by conducting critical literature review using secondary research through reading and analyzing research articles in their chosen research topics. There are four (4) steps to guide the students: 1. Ask Questions, 2. The Problem, 3. The Method, 4. The Practice. These 4 steps through reading research articles encourage for critical thinking process. A deeper and broader perspective on learning to create Abstract, Proposal, and Chapter 1 to Chapter 5 using 4-steps research methodology as the dissertation creation process for the first trimester of 2017/2018 academic year. To facilitate collaborative learning process, a Facebook group was created for students to engage in this creation process. Five themes have emerged: creativity, problem-solving skills, communication skills, self-regulated learning and engagement. This study reveals that the creation process learning style can enrich the learning experience of students and can help them develop the design mind mapping skills. Information literacy was crucial in establishing a framework for research experience using secondary research through reading and gathering information. Most students needed the lecturers to guide in problem solving and to facilitate in their learning processes. The connection to theories and concepts gathered from secondary research was an exploratory creation process for students. When a "Design" approach is applied correctly, it becomes a valuable method for students to answer their own research question. The key elements for designing and implementing a secondary research dissertation required active learning and critical thinking skills. This study concluded the challenges in writing dissertation using Creative Cognitive framework in the creation process.

Keywords: Creativity, Creation process, Critical thinking, Creative Cognition, Design Research

1. Introduction

At university level, most undergraduate students are compulsory to produce dissertation as part of their bachelor degree requirements. Writing a decent dissertation required skills such as critical thinking, creative process, analyzing and writing skills. In DR class, reading and thinking skills are reflections on their ability to write and interpreting secondary data to produce a dissertation. As such, MMW3013 Design Research (DR) class at Faculty of Creative Multimedia (FCM), Multimedia University, Malaysia is a class for the final year design students to prepare them for their dissertation writing. Writing dissertations was a subject of analysis in DR class. There were 117 students from their final year studies taking this subject, which served as the research component for their Final Year Projects (FYPs). These students are from the major of Virtual Reality, Animation & Visual Effects, Interface Design, Media Arts and Advertising Design.

To investigate critical reading and critical thinking skills, the creation process behind the act of the research creation is acquired by students after being exposed to the way this course was presented and taught. Besides using a lecture-based model for most of the lectures, the lecturers

attempted to use active and multiple-ways method to transfer information that encouraged the benefits of discussion and inquiry and that can result in deep learning outcomes.

In the creation process, we encouraged asking questions to investigate research problems. The beauty of the Art of questioning originated from the ancient Greeks like Plato concentrating on metaphysical and epistemological questions such as asking "*what is the really Real as opposed to Appearance? What can I truly know? and How may I come to know the truth?"* (Pojman, 2001). DR class established students in asking research questions related to their Final Year Project. Indeed, reading research articles was an arduous task for FCM students because they are more inclined to be creative in producing their creative art works like producing animation with special effects, virtual reality project, media arts project, advertising project or product design project. Creative art works in the form of writing needed to be studied from different perspectives such as technology, behavioral and social psychology, cognitive science, philosophy, history and among other interdisciplinary fields. In spite of many consultations offered to students, defining a topic to research was like finding a definition of creativity related to their art work in Final Year Project (FYP). No standardized technique in regarding to the development process for a research title to be researched by students. The support in this intellectual act of creation was usually described as a procedure to understand the purpose of why do research.

Three examples on the review studies of Kordaki & Gousiou (2016), Leubner & Hinterberger (2017) and Genc-Nayebi, & Abran (2017) for reference modeling on the promotion of conducting research based on systematic literature reviews. To envisage a path from intention to realization, the creative act of a novice researcher is like the artist with his/her artwork. There is always the critic for the artist's work of art. The novice students' researchers in drafting out his/her intentions for research with a working title should read first prior to designing their research. This paper proposes a novel approach in designing research which is based on scaffolding students' development of creative design skills (Lee & Kolodner, 2011) and cognitive flexibility theory random access teaching method (Liang & Lixiao, 2013). Our major goal and design focus is to design and implement a practice that promotes creative thinking. It has proved that we achieved our teaching goal, which can provide a reference for teachers and researchers in DR. Within the context of "creativity", we promoted the communication, collaboration, flexibility and adaptability, self-monitoring, and systems thinking skills (Lee & Kolodner, 2011).

DR class organization and management of the curriculum has shown knowledge building towards deeper learning and creativity. DR facilitates cognition-knowledge building by teaching information exchange and transmission. A teaching method that promotes a culture of innovation that involves knowledge building in collaborative supported learning (CSCL). This paper is organized as follows: Section 2 introduces an overview of creative cognition in design research. Section 3 presents a teaching resource library and virtual learning community. In Section 4, we conduct qualitative case study to show the effectiveness of the proposed method and Section 5 is the challenges in the creation process. Section 6 is Conclusion.

2. Creative Cognition in Design Research

Cognitive flexibility theory (Liang & Lixiao, 2013) is about teaching in random access. This teaching applies to the creation and emphasis on the results of the re-arrangement of teaching. The instructors repeatedly presented the same material from the conceptual point in order for students to understand knowledge from different levels. When teaching a research topic such as research methodology, the instructors may upload video, documents and voice to the Facebook Group (FB) and Multimedia Learning System (MMLS) as a library of teaching resources. The same learning content at different times is provided to students who are majoring in Virtual Reality, Animation & Visual Effects, Interface Design, Media Arts and Advertising Design. Computer aided teaching based on web (SAGE, 2017) provided a representative of exploring the research methods terrain, definitions of key terminology and discover content relevant to students' research method journey. The instructors in DR class provided consultations to students by guiding students in different views based on research articles. Students constructed their own multiple cognitive from a different perspective. Creative cognition approach using FB and MMLS is active learning with mental processes as the essence of

creative endeavor from learners. The creative cognition approach as described by Ward, Finke & Smith (2010) in the areas of problem solving, concept formation and thinking showed that creative ideas are produced incrementally. The researchers encourage the learners themselves to construct knowledge in a variety of ways in the learning process.

The strength of the creative cognition approach (Ward, Finke & Smith, 2010) begins with a new look at an ancient subject. Blended instruction enables the instructors to engage in educational opportunities never before possible. Students combine autonomous learning and collaborative learning to co-create with their research advisors on their research topic. Outcomes of students' research project were presented in a research proposal. Students followed a guideline to present their assignment in writing for abstract, proposal, chapter 1 to chapter 5 for their dissertation. The framework for the creative process involves identifying key words that are relevant to the assigned research theme by the program coordinator. Advertising Design students investigated in a Museum theme, Interface Design students investigated in an existing traditional product, Virtual Reality students investigated in an immersive experience in virtual reality, Animation Design and Media Art students were free to choose an area that interest them. The interplay between different constituents of creative reflection is at the case study design of students identifying and self-constructing in their own learning contexts. Reflective practice, personal and professional developments are considered as creative visualization in engaging the imagination of a novice researcher.

A description of the creative cognition framework in DR is illustrated in Figure 1.

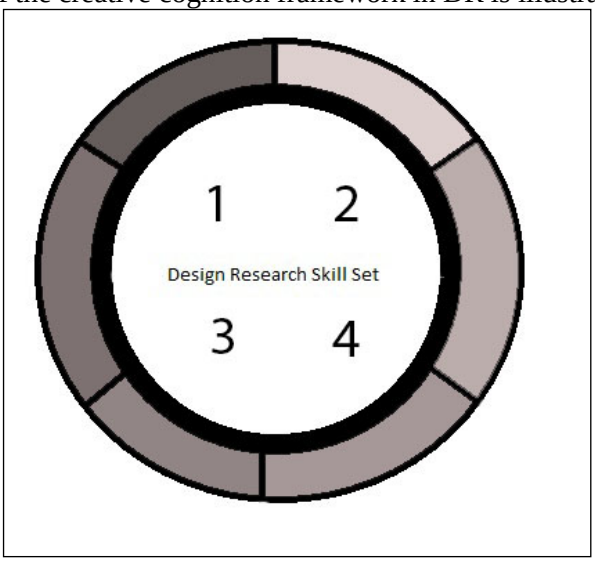

Figure 1. The Creative Cognition framework in Design Research.

The white inner circle is the four steps process in Design Research: 1. Ask Question, 2. The Problem, 3. The Method, 4. The Practice. These steps through Reading research articles offered evidence for Critical Thinking. The Design Council (2010) points out that the skills that are increasingly valued by companies in all sectors include Creativity, Flexibility, Adaptability, Communication Skills, Negotiation Skills, and Management and Leadership Skills. Muratovski (2016) illustrated the six skills as Design Skill Set that can guarantee good innovation performance in all circumstances. The six skills are the six sections in the outer circle with different color shades. The inner circle of the four steps process and the outer circle are linking with a darker circle which is combined with the strength of the creative cognition approach (Ward, Finke & Smith, 2010). From a design perspective, students who are the designers of their research are trained and educated under these five themes: Creativity, Problem-solving skills, Communication skills, Self-regulated learning and Engagement. Problem solving skills are helping students developed creative thinking skills (Lee & Kolodner, 2011). Flexibility and Adaptability (The Design Council, 2010) in changing research title, or at least willingness to be adjusted the research topic according to the secondary research evidences. Students who are a novice researcher can learn to work in a cross-disciplinary fashion. Communication Skills at Facebook and MMLS are teaching resources to form Self-regulated learning and Engagement with peers and instructors.

3. Teaching Resource Library (TRL) and Virtual Learning Community (VLC)

Teaching resource library (TRL) consists of databases from the MMU Siti Hasmah Digital Library. A lecture on information literacy was given in establishing a frame for research experience using secondary research through reading and gathering information from using databases such as ProQuest Dissertations & Theses Global, Emerald Insight, Science Direct, Springer Link, Scopus, ACM Digital Library, IEEEXplore and online journals collections. Facebook posts and MMLS content uploaded by lecturers are Virtual Learning Community (VLC) to enrich the learning experiences of students. Figure 2 is a Facebook post to engage students and figure 3 is Multimedia Learning System (MMLS) for the class.

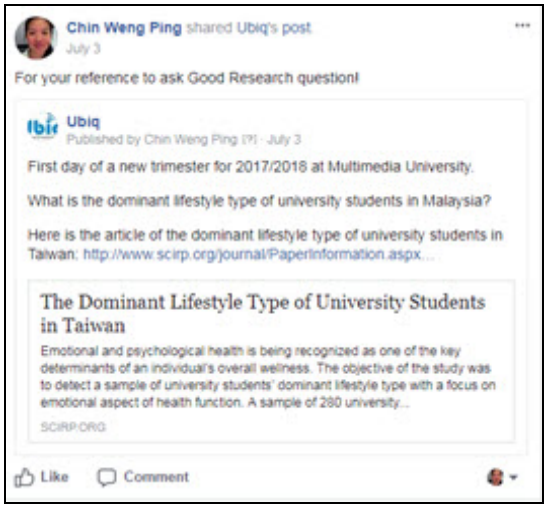

Figure 2. Facebook Post for Design Research Class.

Figure 3. Multimedia Learning System (MMLS) for Design Research Class.

Many students preferred using Google search engines to find what interest them. They could obtain research articles from Google Scholar. They were recommended to read top-cited research. The aim of this paper is to discuss the creation process using Creative Cognition framework in writing dissertation. Based on this research aim, the strategic solutions to finding research problems began

with targeted key words searched. Students were encouraged to use Mendeley library to organize their references. They could connect with peers and keep up with trending research. They could discover datasets and follow researchers in their research field. Through using Mendeley, they could stay up to date by connecting with other researchers in their research network. Based on references added at the students' Mendeley library, Mendeley could further suggest articles accordingly.

4. Qualitative Case Study

Qualitative case study methodology provides tools for researchers to study complex phenomena (Baxter & Jack, 2008). A constructivist paradigm claimed that the truth is relative and it is dependent on one's perspective. This paradigm recognizes the importance of the subjective human creation of meaning and the advantages of this approach is the close collaboration between the researchers and the participants. It enables the participants to tell their stories. The participants are able to describe their views of reality and it enables the researchers to better understand the participants' actions.

The focus of our study is to answer "how" and "why" questions. In this study, we intended to find out the following:

1. How students gathered theories and concepts from secondary research?
2. How the four steps process can guide students in creating a research proposal?
3. Why students design their research topic using mind mapping?

As researchers, we did not manipulate the behavior of our students. We guided our students to discover, define and solve problems based on their research questions. We covered contextual conditions because we believe they are relevant to the phenomenon under study. The boundaries were the types of decisions made by DR students and the factors that influenced their validity of their research claims. Design research is a special kind of research with methods appropriate to the applied, constructive nature of design (Muratovski, 2016). A case study was chosen because our research was dealing with the decisions making of multimedia students in the context of the schools of design.

The classroom setting is in two trimesters for DR with the first trimester in 14 weeks to inspire and engage students into familiarizing research method and the second trimester to practice writing and revising their final year project dissertation. Muratovski (2016) argued that design "is transforming from 'problem-solving' to 'problem-finding' – something every company, from startups to multinationals, needs in today's hyper-connected and fast-changing world". Muratovski (2016) provided the context and more importantly, the implications of the rise of design as a powerful competitive advantage. Students discovered the role of design in the past, present and where design is headed through reading published research articles. They developed their decisions making skills to becoming a 'design-driven' researcher. Students utilized their references which they gathered to create a suitable working title for their own research. We were interested to analyze the creation process, not the individual and the subject itself. Table 1 showed the developing of our case study research questions.

Table 1: Developing case study research questions.

Case Study	Research Questions
1. The decision making process of students in secondary research.	1. How students gathered theories and concepts from secondary research?
2. The experiences of students following 4 steps process in creating their research proposal.	2. How the four steps process can guide students in creating a research proposal?
3. The decision making process (related to	3. Why students design their research

mind mapping) of students attending DR class.	topic using mind mapping?

The researchers binding the case to ensure that our study remains reasonable in scope. The establishment of boundaries is the inclusion and exclusion criteria for sample selection. There were a total of 117 students in the beginning of the trimester. At the end of trimester, there were 114 students. A collective case study allowed the researchers to analyze within each setting and across settings for different majoring in virtual reality, advertising design, media arts, animation design and interface design. In a collective case study, we were examining several cases to understand the similarities and differences between the cases.

Our proposition came from the literatures and professional experience. One proposition included in this study on the development of DR students' decision making in secondary research setting was stated by Gough, Oliver & Thomas (2017) in the role of research reviews that "we develop theories and concepts and gather data to develop insights and answer a vast breadth of research questions related to a rich array of disciplines, interests and perspectives of academics, policy makers, professional practitioners, societal groups and individuals". This proposition was based on the literature found on the topic of decisions made in life through reviewing some of the key issues. The interface design students began their product research by relying first on what other researchers have written. Students gain access to a wide range of ideas from other researchers. Their 'decision question' drives what they are doing. They made decisions based on the need to answer their research questions. They were faced with many different possible answers. For the advertising design students, they could read about the museum advertisements from last ten years in Malaysia, a specific museum and optional extras of museum advocacy in Malaysia. For virtual reality students, they conducted a review on immersive experience in a virtual environment. Without a review of previous research, the need for new primary research is unknown. Gough, Oliver & Thomas (2017) stated that "when a need for new primary research has been established, having a comprehensive picture of what is already known can help us to understand its meaning and how it might be used".

Students could choose to use mind mapping approach on concept mapping and use a graphical representation to describe the scope in their research. According to Johannes & Jacqueline (2009), "new approaches to data collection might offer another means to explore reflexive analysis within qualitative research". Stephens (2017) focus on how cognitive dissonance is ameliorated in the face of cheating, particularly academic dishonesty. Stephens (2017) explored on two good theories namely (a) attribution theory and the related constructs of responsibility judgments and moral disengagement; and (b) social norms theory and the power of the situation that might be useful in guiding the development of interventions aimed at promoting academic integrity. Each theory highlights a unique dimension or aspect of how students might reduce or avoid dissonance related to cheating behavior. Concept mapping can help students to better frame their experience (Johannes & Jacqueline, 2009) and be honest in constructing a powerful explanatory framework for their research. Johannes & Jacqueline (2009) stated that the use of maps in data collection assists research participants in framing their experience in more unsolicited ways. Brain research (Ruggiero, 2015) showed that the right hemisphere was learned, governs nonverbal, symbolic, and intuitive responses and the left hemisphere of the brain governs the use of language, logical reasoning, analysis, and the performance of sequential tasks. According to Ruggiero (2015), the mind has two distinct phases – the *production* phase and the *judgment* phase – that complement each other during problem solving and decision making. Ruggiero (2015) mentioned that proficiency in thinking requires the mastery of all approaches appropriate to each phase and skill in moving back and forth between them. Students design their research using mind mapping or concept mapping are in the Production Phase which is most closely associated with creative thinking. The mind of students produces various conceptions of the problem or issue, various ways of dealing with it, and possible solutions or responses to it. Good thinkers produce both more ideas and better ideas. They become more adept in using a variety of invention techniques, enabling them to discover idea. More specifically, students who are good thinkers tend to see the problem from many perspectives before choosing any one, to consider many different investigative approaches, and to produce many ideas before turning to judgment. Students

are more willing to take intellectual risks, to be adventurous and consider unusual ideas, and to use their imaginations.

5. Challenges in Design Research Creation Process

This study reveals that the creation process learning style can enrich the learning experience of students. However, there are challenges in strengths and weaknesses due to students' reading, thinking and writing ability. Students who were poor readers and thinkers tend to see the problem from a limited or single narrow perspective. Taking into consideration from Muratovski's (2016) to move research students from studying research skills and methods to practicing effective research for advanced design practice. The four steps creation process framework offers a framework in the design field. It helps research student in generating the methods of inquiry to solve research problems by first learning to ask question. Asking research questions are closely associated with critical thinking. Students are required to examine and evaluate their research questions.

Muratovski (2016) explained that a great deal of design research involves useful individual learning to solve situated problems for specific clients. Designers often make a distinction between 'knowing that' and 'knowing how', as though design research involves knowing how to do something practical rather than describing something in the world as scientists do. In design, the researchers need to examine or explain issues and show others how the researchers showed the results whether that result is a process, a product, or a system. Muratovski (2016) described design research means offering an explanation that makes sense so that others can use the concepts and ideas, the methods, or the results to further their work. Faculty of Creative Multimedia students are required to conduct their final year project. Hence, DR class helped to examine or explain issue that related to their final year project. They had to evaluate what they produced, made its judgments, and where appropriate, refine their ideas. Good thinker students handle judgment phase of their research with care where the poor thinker students had the tendency to take the first approach that occurs to them, to judge each idea immediately, and to settle for only a few ideas. Good thinker students made decisions by basing their conclusions on evidence from literature reviews. They double-check the logic of their thinking and refining their ideas with their advisers. Poor thinker students ignoring the gathering of evidences from literature reviews and they trust their judgment implicitly. They ignore the possibility of flaws in their thinking. Unconsciously, poor thinker students tend to conform to the common, familiar and expected ideas. The difficulty of improving students' thinking skill depends on the habits and attitudes they have. Students must have the desire to improve their research skill and the willingness to apply what they learn. We believe the realities of the interaction at the Facebook group can help students to reflect on what they have learned during lectures and to keep students engaged in reflective thinking.

Based on James & Brookfield (2014, p.15) and the solutions provided by (Lee & Kolodner, 2011) in helping students to become a creative and reflective thinker, reflective thinking happens when students do one or more of these things:

1. Check the assumptions that inform their actions and judgments.
2. Seek to open themselves to new and unfamiliar perspectives.
3. Attempt to understand how another researcher develops the design mind mapping skills.
4. General communication and collaboration skills in the context of answering research questions.
5. Evaluate and refine their own reasoning by looking for blind spots and omissions in their thinking.
6. Become progressively more expert in reasoning across different contexts.
7. Identify what is justified and well grounded in their thinking.
8. Accept and experiment with multiple learning modalities.
9. Become more aware of their habitual epistemic cognition – the typical ways they judge something to be true.
10. Apply reflective protocols in contextually appropriate ways.

6. Conclusion

In summary, we concluded that information literacy skill was crucial in establishing research experience using secondary research through reading and gathering information. To enhance research writing for dissertation to undergraduate students, Creative Cognitive framework can be utilized by using the four steps framework. In order to designing and implementing a secondary research dissertation, the thought process behind design research is in the connection to theories and concepts gathered from secondary research. The key elements for designing and implementing a secondary research dissertation required active learning and critical thinking skills, creativity, problem-solving skills, communication skills, self-regulated learning and engagement in becoming a reflective thinker.

Our next steps are to look at approaches and particular activities that facilitate collaborative learning process. We want to explore alternative approaches to engaging student reflection. We hope that the decision making process of students in secondary research, the experiences of students following 4 steps process in creating their research proposal and the decision making process (related to mind mapping) of students writing their dissertation can promote a deeper learning. We hope that DR students can broaden and deepen their understanding of knowledge and open their minds to becoming a lifelong learner in the creation process in design research.

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