PolyU Design

PhD

THESIS SERIES

CHIN KAH PETER CHUAH

Becoming a Reflective Communication Design Student:
Perceptions and Values of Reflection as a Learning Tool

2016

PhD

1999–2020 THESIS SHOWCASE

This study examines the perceptions of a learning journal as a tool to develop students' critical and reflective thinking of the recent graduates of the undergraduate communication design programme at a local university in Hong Kong. Utilising the findings from interviews, this study reveals several preconceptions and misconceptions about reflection and critical thinking, especially at the early stage of undergraduate education. The result suggests that critical reviews are harder to achieve due to the insufficient knowledge and skills results. It is recommended that reflection should be integrated into the entire curriculum as one of the major assessment components and should be formally introduced at the early stage of undergraduate study. In addition, appropriate scaffolding strategies could be introduced over time to ensure that students consistently receive guidance and feedback as part of their learning and development.

School of Design,
The Hong Kong Polytechnic University
PhD 2020.

Original copy: https://theses.lib.polyu.edu.hk/handle/200/8679

BECOMING A REFLECTIVE COMMUNICATION DESIGN STUDENT: PERCEPTIONS AND VALUES OF REFLECTION AS A LEARNING TOOL

CHIN KAH PETER CHUAH

Ph.D

The Hong Kong Polytechnic University

2016

The Hong Kong Polytechnic University

School of Design

Becoming a Reflective Communication Design Student: Perceptions and Values of Reflection as a Learning Tool

Chin Kah Peter Chuah

A thesis submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

November, 2013

CERTIFICATE OF ORIGINALITY

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no materials previously published or written, nor material that has been accepted for the award of any other degree or diploma, except where due acknowledgment has been made in the text.

_____ (Signed)

C. K. Peter CHUAH (Name of the Student)

Dedication

To mum and dad, who have always been there in all of my endeavors.

Abstract

This study examines the perceptions of learning journal as a tool to develop students' critical and reflective thinking from the recent graduates of the undergraduate communication design program at a local university in Hong Kong. The study uses qualitative research approach, and more specifically, interview and content analysis as the methods for data collection. The findings revealed a number of preconceptions and misconceptions about the reflection, reflective journal and critical thinking especially at the early stage of the undergraduate education. Although three participants in this study, in general, realized their transformation over time–as a result of critical reflection in various forms, including learning journal, discussions with peers and critiques–results also revealed that due to insufficient knowledge and skills, critical reflections are harder to achieve. It is recommended that reflection to be integrated into the entire curriculum as one of the major assessment components and should be formally introduced at the early stage of the undergraduate study. In addition, appropriate scaffolding strategies could be introduced over time to ensure students consistently receive guidance and feedback as part of their learning and development.

Keywords: Reflection, learning journal, critical thinking, and communication design education

Acknowledgement

This thesis could not be made possible with the following people:

First, I would like thank **Prof. Tim Jachna**, my chief supervisor for your advice and suggestions, not to mention all those last minutes vetting.

Second, to **Prof. Sharon Poggenpohl**, my former supervisor and mentor for her unconditional and continuous guidance since day one.

Third, to two closer friends, **Ronald Tay** and **Christine Tsin**, for being there and the countless reminders.

Fourth, to **Dr. Lay Leng Yeap**, for your constant encouragement and sharing of your wisdom.

And finally, special thanks to my **mum** and **dad**, again, for both your patience and continuous support.

Table of Contents

Dedication iv

Abstract v

Acknowledgment vi

List of Tables ix

List of Figures xi

Chapter 1 The use of learning journal to facilitate the development of reflective and critical thinking: An introduction **1**

Statement of the Problem 1

Purpose of the Study 6

Delimitations of the Study 6

Research Question and Sub-Questions 6

Definition of Terms 7

Significance of the Study 9

Organization of the Study 9

Summary of Chapter 1 10

Chapter 2 Review of literature **11**

Chapter Organization and Structure 11

1) The Landscape of Design Education in Transformation 12

2) A Conceptual Framework to Understand the Development of Reflective and Critical Thinking 16

3) Reflective Practice and Reflection 25

4) Critical Thinking 46

5) Learning Journal as a Tool to Develop Reflective and Critical Thinking 79

Summary of Chapter 2 87

Chapter 3 Methodology: Research Design and Methods **89**

Introduction 89

Research Methodology: An Overview 90

Framework to Situate my Study within the Qualitative Research Paradigm 94

Research Designs 98

Limitations of the Study 106

Summary of Chapter 3 107

Chapter 4 Data Analysis and Discussion on Findings **109**

Introduction 109

Discussion of Key Findings 111

a) What Does it Mean by Reflective and Critical Thinking to the Undergraduate Communication Design Students? 111

b) What is Their Perception of the Value of Learning Journal in Relation to the Facilitation and Development of Reflective and Critical Thinking? 120

c) What Do Students Usually Reflect on Their Learning Journal 122

d) Does the Quality of Learning Journals Support Students' Perception of the Value of Learning Journals 134

Summary of Chapter 4 139

Chapter 5 Summary, Conclusions, and Recommendations **141**

Introduction 141

Key Synthesis from the Literature 142

Triangulation–Better Understanding of the Issues 147

Recommendations 150

Recommendations for Future Study 152

Summary of Chapter 5 153

Appendices **155**

Appendix 1 Sample Interview Transcription–Participant 1/ Female 156

Appendix 2 Sample Coding–Participant 1/ Female 162

Appendix 3 Complete Learning Journal–Participant 1/ Female 172

Chapter 6 References **179**

List of Tables

2.1	A Summary of Attitudes, Skills and Knowledge (ASK) Model of design education	17
2.2	Pathological Dispositions of the Human Mind	19
2.3	Comparison of Better Thinking as Outcomes and Processes	20
2.4	Comparison of Dewey's and Rodgers' Phases of Reflection	32
2.5	Questions about Reflection	39
2.6	Models and Frameworks of Reflection	39
2.7	Four Levels of Reflection	44
2.8	Approaches to Define Critical Thinking	52
2.9	The Problem of Egocentric Thinking	54
2.10	The Taxonomy of Critical Thinking with Expansion	57
2.11	Cheung, Rudowkz, Kwan, & Yue's Components of Critical Thinking	62
2.12	Competency Standards of Critical Thinking	63
2.13	The Eight Elements of Thought–Template to Assess and Analyze Quality of Research	65
2.14	The Nine Intellectual Standards Essential to Reasoning Well	66
2.15	The Eight Essential Intellectual Traits	69
2.16	Critical Thinking VALUE Rubric	76
2.17	Types of Critiques	78
2.18	Classifications–Types and Formats–of Journal	80
3.1	Common Elements of Worldview and Implications for Practice	93
3.2	Framework to Situate my Study within the Constructivist/ Interpretivist Paradigm	96
3.3	Basic Participants' Information	99
3.4	Guidelines for a Successful Interview	101
3.5	The Design Intension and Interview Questions	102
4.1	Relationship Between Sub-Questions and Research Methods	110
4.2	Interpretation of the Meaning of Reflection from Three Participants	111
4.3	Unsorted Codes Generated from Three Learning Journals Using Content Analysis	125

4.4 Theme: Summary of Something 129
4.5 Theme: Realization of Something 130
4.6 Theme: Reaction to/ over Something 130
4.7 Theme: Idea Speculation and Possibility 131
4.8 Theme: Sources of Inspiration 131
4.9 Theme: Excitement and Anticipation 132
4.10 Theme: Tutor-related Matters 132
4.11 Self-Perceived Rating on Self as a Critical Thinker 134
4.12 Self-Perceived Rating on Criticality of One's Work 136
4.13 Comparison of Ratings 136
4.14 Assessment of Reflection Based on Kember et al. (2008) Four-Category Scheme 137

List of Figures

2.1	Distinction between Egocentricity and Rationality	18
2.2	Map of the Thinking Domain	20
2.3	Conceptual Framework to Understand the Development of Critical and Reflective Thinking	24
2.4	A Six-Layer Tower of Reflection	42
2.5	Paul-Elder Critical Thinking Framework	64
2.6	Design Process	73
2.7	Analysis-Synthesis Bridge Model	73
2.8	Seven Modes of the Design Innovation Process	74
2.9	Pual-Elder Critical Thinking Competency Standards	76
3.1	Crotty's (1998) Four Basic Elements of Research Process	92
3.2	Creswell's (2003) Three Elements of Inquiry	92
3.3	Highlighting Statement for Subsequent Coding	104
3.4	Preparation for Coding in Table Format	104
3.5	Grouping and Regrouping of Statements for Initial Interpretation	105
4.1	Selection Criteria for Data Analysis	110

This page is intentionally left blank.

1 The use of learning journal to facilitate the development of reflective and critical thinking: An introduction

Statement of the Problem

The Essential Skills for the 21st Century

In a recent report–*A Crosswalk of 21st Century Skills*–produced by Hanover Research (2011), which examined and compared six different frameworks–including *Partnership for 21st Century Skills* (P21), *Tony Wagner's Seven Survival Skills*, *enGauge*, *Iowa Essential Concepts and Skills*, *Connecticut Department of Education*, and *Assessment and Teaching of 21st Century Skills* (ATC21S)–on 21st century skills, four out of the 27 themes that appeared consistently in all frameworks are **(i) collaboration and teamwork**, **(ii) creativity and imagination**, **(iii) critical thinking** and **(iv) problem solving**. Furthermore, several education systems within the East Asia region–including China (in 2010), Hong Kong SAR (in 2000), Japan (in 2006), and Singapore (in 2010)–have developed frameworks to improve the skills, knowledge, and attitudes necessary for the success and survival in the 21st century (Saavedra & Opfer, 2012). Among all the different skillsets, **critical thinking** is one of the most highly valued and consistently mentioned skills among the frameworks. In fact, Casserly (2012) identifies **(i) critical thinking**, **(ii) complex problem solving** and **(iii) judgment and decision-making** as three of the top 10 skills that would get one hired in 2013.

In the context of design, the aim of education is to develop students to be 'scientifically oriented,' 'scholarly minded,' 'artistically endowed' and 'creatively active' (Denel, 1981, cited in Çubukcu & Gökçen Dündar, 2008). Although creative thinking–can be further divided into 'artistic creativity,' 'scientific and technological creativity' or 'hybrid creativity' as identified by MacKinnon (2005)–is highly valued, critical thinking is

perceived as an equally important and complementary element to creativity in design education and practice (Cennamo, Baum, Newbill & Finn, 2012; Combs, Cennamo, & Newbill, 2009; Finn, Baum & Newbill, 2013; Levick-Parkin, 2014). In many instances, designers utilize and switch between critical and creative thinking during the process of designing. For instance, when solving a problem, most designers would attempt to get a full understanding of the contexts (analytical and critical thinking) before they move into idea generation (creative thinking), follow by judgments and evaluation (critical thinking) to achieve the optimal solution and eventually communicate the outcome (creative thinking) to the intended audience (Alghafri & Hairul, 2014). In essence, both creative and critical thinking "need to work together in harmony to address perceived dilemmas, paradoxes, opportunities, challenges, or concerns" (Treffinger, Isaksen, & Stead-Dorval, 2006, p. 3). Moreover, scholars either posit that both critical and creative thinking have an intimate relationship (Elder & Paul, 2007; Paul, 1993; Paul & Elder, 2007; Paul & Elder, 2008), or argue that both capabilities represent the two sides of a coin that "one is of little use without the other" (Moore, McCann & McCann, 1985, p. 361) and "that neither can be effective without the other" (Nickerson, 1999, p. 398).

Ideally, from a learning and development perspective, students–and practitioners–should look back and evaluate their learning and performance on a regular basis, hoping that the experience from one incident, i.e., completion of a design project, can be transferred to the subsequent learning opportunities and challenges. In design education and many practice-led professions, **reflection**–in some cases, the use of **reflective learning journal**–is one of the metacognition strategies that support such transfer of learning (National Research Council, 2000). Unfortunately, the reflective journals that I have examined to date–from my five years of full-time teaching experiences in one of the local universities in Hong Kong–are mostly mere summary of incidents or expressions of one's emotions on what happened over a period of time, usually from the conception to the completion of a project. A reflective journal that clearly demonstrate confidence in critical (and creative) thinking is hard to come by. English (2009) points out that 'typical' design students are generally interested in making things and the 'typical' design educators are interested in assessing things that the 'typical' students made. Neither the typical students nor educators put much emphasis on the development of capabilities and self-awareness (English, 2009) at the end of a given creative design project.

When talking to students, although they claimed that they are aware of the term 'reflection' and able to provide an appropriate definition in their own terms, many seldom openly admit that they have little or no idea what that given term is really about beyond its definition. More specifically, the criteria, standards, and evidence of critical thinking are rarely mentioned in those conversations. In fact, this happens to many other commonly used terms in design, including divergent and convergent thinking, creativity, and innovation to name a few. Often, educators are complicit in this

lack of precision of terms used in the design classroom. Frascara (2007) rightly points out that,

> "[I]n the design environment, we suffer from the abuse of fuzzy words, such as 'intuition' and 'creativity' that help to hide the inability of some university instructors to articulate concepts and to deliver actual instruction, not being able to articulate empirical knowledge verbally leads to the acceptance of mediocrity in the university, and to the promotion of the designers as an illuminated magician in the practice" (p. 62).

Although there is a difference between conceptual knowledge ("knowing-that") and procedural knowledge ("knowing-how") in design, these two types of knowledge cannot be separated. Using an example, Poggenpohl (2009) illustrates the distinction and the complementary nature between "knowing-how" and "knowing-that," with the following example:

> "... compare a design practitioner who can intuitively select, size and position type for legibility to an educator who knows why the type is better perceptually and how the typographic variables interact with page or screen space, reading ease, and comprehension" (pp. 4-5).

The suggests that better design practitioners–also students and educators–should have the ability to articulate clearly and concisely their thinking behind their designs with appropriate knowledge and reasoning. However, the inability to explain other than own personal opinion the reason behind a form-giving activity–i.e., making something a little bigger or a bit more to the right–or rationale behind a design solution is common and has always been a challenge to many design students. One of the possible reasons could be due to the learning-by-doing nature of design education and the overly reliance on intuition and tacit knowledge to solve design problem (Dorst & Reymen, 2004; Frascara, 2007; Lawson & Dorst, 2009; Poggenpohl, 2009). In addition, failing to appreciate the value of conceptual and empirical knowledge could also be another factor, as "what can be made explicit [in design]–theory, method, or tool–is often either ignored or looked upon with suspicion" (Poggenpohl, 2009, p. 7).

Furthermore, personal teaching experience reveals that many design students tend to appreciate less or have difficulty applying theoretical knowledge to make better sense and provide better explanation of their design solution. A common scenario to support this observation is during critique, where students are generally able to articulate what they like or dislike about other's design, in many cases, they tend to find it challenging to explain why the solution could demonstrate potential contextual weakness or provide alternative for improvement. Students–and sometimes educators–seldom consciously and voluntarily use conceptual knowledge they have acquired in their explanations. For instance, instead of using the exact terms such as chunking, layering and separation, graphical cues, and visual hierarchy to reiterate what has learned or

what are needed to be done, a common reply is 'the contrast is weak' or 'the content is hard to read.' Reiteration or reinforcement is essential when more experienced tutors comment on students' works to demonstrate how one could analyze using appropriate conceptual knowledge, link analysis to professional knowledge and draw out new knowledge from an experience with supporting evidence (Thompson & Pascal, 2012).

Due to lack of reinforcement from educators and lack of practice, when it comes to reflect on one's awareness gained through the learning journey, it is no surprise that students will end up summarizing what happened, i.e., what they did in the project or what they have acquired during lectures, and expressing emotional aspects and frustration during their learning experience. When it comes to assessment, educators tend to devote more effort to students' design outcomes, i.e., form-making instead of documentation such as process book and learning journals. To worsen the situation, many–including both educators and students–have little clue about what makes a good documentation, including process book and learning journal; and, to a greater extent, what would be deemed satisfactory evidence of documentation. While seeking assistance in making and designing is fairly common, seeking help on producing a good quality documentation is usually not a common habit or learning attitude from design students. As a result, expecting students to reflect 'critically'–without formal introduction and demonstration–at the beginning of their (undergraduate) education is close to impossible. Consequently, and partly due to inadequate concrete feedback and guidance, students move on with their learning without substantial understanding and improvement of reflection and critical thinking.

A Call for Critical and Reflective Design Students

To be clear about one's thinking, both analysis and synthesis skills are crucial during the sense-making process. When solving a design problem, students are required to switch between analysis–an ability to "zoom in" to a problem, break the problem into small parts, pay greater attention to details, and look for patterns and anomalies–and synthesis–an ability to "zoom out" and put all the pieces from various sources together to form a new whole using appropriate methods and tools such as concept map, user journey (or experience) map, and actors (or stakeholder) map to name a few. All these, according to Kolko (2011), are essential in order for designers to make new meanings out of this process.

As a reflective profession–and due to the fundamental nature of design is predominantly learning by doing–maintaining consciousness during design process is necessary. More importantly, knowing how to articulate what they have learned or done with appropriate explanation is highly desirable. While the literature indicates that most design educators and scholars agree that design students need to be reflective in their learning, simply asking students to reflect without sufficient knowledge–and instructions–have been shown to be insufficient and not productive. As a result, the quality of work tends to be less than satisfactory, i.e., most students end up

focusing more on ‘what has been done’ instead of ‘how they were able to do it’ or true ‘understanding’ with appropriate justification. While the former may provide a ‘relatively rich’ descriptive account, it is the latter that produces detailed explanations or deeper understanding and insights of one’s learning that eventually lead to transformation.

Consequently, due to the mere descriptive outcome, not only this makes it harder for educators–and other interested readers (i.e., when the work is displayed for the public during the graduation show)–to fully understand the rationale behind one’s thinking, making and doing, but also makes it difficult for educators to appropriately assess one’s critical thinking and other higher order thinking skills including analysis and synthesis in reflection. And from the students’ standpoint, a reflective journal ends up becoming an undervalued piece of written work they need to complete to satisfy project requirements or, in some cases, to ‘make the tutor happy’ as some students have put it.

The development of critical and reflective thinking–among other higher-order thinking capabilities–has always been a key emphasis in higher education. In fact, many major universities around the world would include critical thinking as one of the core competencies for both undergraduates and postgraduates. While many educators tend to agree on the importance of critical and reflective thinking, not many educators openly share their thoughts on how they facilitate the development of these higher-order thinking skills. Ellmers (2014) points out that how critical thinking can be best formally introduced and developed in the context of communication design remains underexplored. Although some design educators may argue that the assessment of critical thinking is in place–where assessment components and learning objectives have been clearly spelt out in the syllabus or project brief–according to Paul, Elder & Bartell (1997), and more recently Mulnix (2010) and Nilson (2014), most educators do not have full understanding of what critical thinking means, let alone how to teach it–or whether it can be taught–and how to measure it. One possible explanation could be due to the widespread disagreement over the term or implicit nature of critical and reflective thinking. Many would also argue that those thinking skills including others related skills in design, such as creative thinking, logical thinking, and convergent and divergent thinking, are subsumed under a more generic umbrella commonly known as ‘creative problem solving’ or more recently, ‘design thinking’–“an exciting new paradigm for dealing with problems in many professions” (Dorst, 2010, p. 131). As a result, this problem has negatively impacted on design students and how they perceive and value the use of reflection as a potential learning tool that may eventually lead to the development of a holistic learner and designer–i.e., one that not only know how to think, make and do, but also is able to articulate and communicate design ideas and their rationale clearly in visual, oral and written forms.

Purpose of the Study

This study sought to examine the perception of the use of learning journal as a tool to develop critical and reflective thinking skills from recent graduates from the undergraduate communication design program at the School of Design, The Hong Kong Polytechnic University. The objectives of the study are as follows:

I. To determine students' perception of learning journal as a learning tool to develop critical and reflective thinking;

II. To provide explanation of the quality of learning journals to reflect students' critical and reflective thinking; and

III. To propose a framework for building the culture of critical and reflective thinking skills in the undergraduate communication design program.

Delimitations of the Study

I. This study focused on the use of reflective journal writing as a tool to develop student's critical and reflective thinking, the intention was to find out how the effectiveness of journal writing to the development of critical and reflective thinking. The development of creative thinking through writing is intentionally left out in this study;

II. Learning journal as one of the mandatory assessment components in undergraduate communication design education, this study has chosen to focus on students' perspectives on the value of reflective journal writing as a learning tool to develop their critical and reflective thinking. As such, educators' perspectives are beyond the scope of this study; and

III. Since the study is carried out at the end of students' final year project submission, this study only examined the last journals submitted for evaluation based on the assumption that such journals could be a source of evidence for accumulated knowledge and skills in relation to reflective journal writing and critical and reflective thinking.

Research Question and Sub-Questions

This study was guided by the following key research question:

> **How do undergraduate communication design students use learning journal as a tool to facilitate the development of critical and reflective thinking?**

From the key research question, the following sub-questions were devised:

a) What does it mean by reflective and critical thinking to the undergraduate communication design students?
b) What is their perception of the value of learning journal in relation to the facilitation and development of reflective and critical thinking?
c) What do students usually reflect on in the learning journal?
d) Does the quality of learning journals support students' perception of the value of learning journals?

Definition of Terms

Analysis refers to the process of "breaking complex topics or issues into parts to gain a better understanding of them" (Association of American Colleges and University, 2010a, online) Analysis goes beyond mere reporting or reacting to the parts, i.e., like-dislike, agree-disagree responses, and "consider how these parts are related, both to each other and to the subject as a whole ... [instead of] leaving them broken and scattered ... When you analyze a subject you ask not just 'what is it made of?' but also 'how do these parts help me to understand the meaning of the subject as a whole?' A good analysis seeks to locate the life of its subject, the aims and ideas that energize it" (Rosenwasser & Stephen, 2015, pp. 3-4). According to Bloom (1969, cited in Areesophonpichet, 2013), an analysis may be classified into "**(1) Analysis of elements** is the ability to classify and analyze significant elements, i.e., to find a summary of content and to differentiate facts and opinions, similarities and differences and causes and effects; **(2) Analysis of relationships** is the ability to relate concepts and reasons, i.e., to compare and analyze consistent and/ or contrary or irrational information; and **(3) Analysis of organizational principles** is the ability to search for principles of relationship between elements of information, i.e., to identify key matters by taking into account relevant stories and being able to summarize the relevant information into one concept" (p. 3).

Analytical thinking refers to the process of "**identifying** key issues, **testing** hypothesis, **diagnosing** problems and opportunities, **making** sound inferences from available information and **drawing** logical conclusions. It includes applying deductive reasoning skills to problems often in a linear fashion (i.e., the process by which an individual makes conclusions based on previously known facts)" (Canada National Research Council, 2015, online) in order to "gain a better understanding of something by paying close attention to the parts that go to make up the whole" (Pohl, 2000, Section 1).

Creative thinking refers to the capacity to "combine or synthesize existing ideas, images, or expertise in original ways and the experience of thinking, reacting and working in an imaginative way characterized by a high degree of innovation, divergent

thinking, and risk taking (Association of American Colleges and University, 2010b, online) or the ability to make connections or see things in new and original ways and generate novel and unique ideas as a result (Duffy, 1998). The term creativity, at times, could be misinterpreted as 'the ability to imagine' or 'being unique and different' but many failed to recognize that being imaginative or unique does not necessarily mean that one is considered creative. As Robinson (2009) rightly points out that imagination itself "is not the same as creativity. Creativity takes the process of imagination to another level ... To be creative you actually have to do something. It involves putting your imagination to work to make something new, to come up with new solutions to problems, even to think of new problems or questions" (p. 114).

Critical thinking refers to "a habit of mind characterized by the comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating an opinion or conclusion" (Association of American Colleges and University, 2010b, online). Specifically, it is an umbrella concept that includes three major skills, i.e., analysis, synthesis and evaluation (Jessop, 2002; Combs, Cennamo, & Newbill, 2009) or a number of specific skills "evaluating alternatives, making judgements based on sound reasoning, or justifying a position, stance or point of view" (Pohl, 2000, Section 2). The term critical tends to denote negative criticism and finding faults (Lau, 2011; Brookfield, 2012) but such negative denotation may be reinterpreted as providing constructive criticism that meant for further and future improvement of one's work and performance under proper guidance.

Reflection refers to "the active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and further conclusions to which it leads" (Dewey, 1910, p. 6) and "turning a topic over in various aspects and in various light so that nothing significant about it shall be overlooked– almost as one might turn a stone over to see what its hidden side is like or what is covered by it" (Dewey, 1910, p. 57). The purpose of this deliberate process is to reach a reasonable conclusion or solution of a given problem or dilemma that lead to improvement (Hatton & Smith, 1994, cited in Blaschke & Brindley, p. 1).

Reflective practice refers to "an active process whereby the professional can gain an understanding of how historical, social, cultural, cognitive and personal experiences have contributed to professional knowledge acquisition and practice. An examination of such factors yields an opportunity to identify new potentials within practice, thus challenging the constraints of habituated thoughts and practices. The process of reflective practice can be guided by the use of a form of supervision. Through the exploration of individual and social behavior and experiences, there is scope to gain insights to challenge and guide professional practice" (Wilkinson, 1996, cited in Wilkinson, 1999, p. 36)

Reflective thinking refers to the process of arranging "understandable thoughts" (Burrows, 2012, p. 11) that are often influenced by and through reference to past and

present experiences (Bourner, 2003; Dewey, 1991), either before/ after the action, i.e., reflection-on action, or during the action, i.e., reflection-in-action (Schön, 1983). It is believed that an awareness of "what is known and what is needed are essential to bridging the gap between learning situations" (Sezer, 2008, cited in Burrows, 2012 p. 11). Such awareness involves questions that **(a) describe**, i.e., 'what do I do?' and **inform**, i.e., 'what does this mean?' (Smyth, 1989, cited in Burrows, 2012) and **(b) confront**, i.e., 'how did I come to be this way?' and **reconstruct**, i.e., 'how might I do things differently?' (Argyris & Schön, 1974, cited in Burrows, 2012).

Synthesis refers to an abductive sense-making process where designers manipulate, organize, prune, and filter the collected data into a cohesive structure to produce information and knowledge (Kolko, 2010a; 2010b) to form new and meaningful understandings that lead to the "creation of designed objects, products, services, environments, communications, etc. … or ideas or concepts that draw upon design analysis" (Payne, 2013, p. 5).

Significance of the Study

This research study was an initial attempt to investigate students' perceptions of reflective learning journal as a tool to develop critical and reflective thinking. The outcomes of this research study can enlighten design educators on:

I. Students' understanding of reflective thinking and reflection. More specifically, in addition to defining those terms, how–and possibly where–do students learn to write a reflection? Do they know what makes a reasonably good reflection? It is anticipated that such understandings may provide insight into how and when program administrators and more specifically design educators plan, introduce and develop reflective thinking and reflective practice across the curriculum or in selected subjects at different stages of the undergraduate design education.

II. Students' perception and conception of critical thinking in relation to reflective thinking and reflection. Again, in addition to judging one's or other's design work, do students have the ability to judge their own thinking? If submission of written work is essential, how do students perceive the value of writing reflection in relation to the development of critical thinking skill? The findings in this study will enable design educators to develop appropriate scaffolding strategies to introduce and enculturate critical thinking into the curriculum.

Organization of the Study

This study is organized into five chapters. **Chapter One**–the current chapter–provides a background and rationale for this study; **Chapter Two** examines 1) the landscape of design education in transformation, 2) the conceptual framework that underpins this

study, 3) reflective practice and reflection, 4) critical thinking, and 5) reflective learning journal; **Chapter Three** discusses the design of this study and its methods; **Chapter Four** reveals the results from data analysis using coding techniques and provides the findings to main research questions and sub-questions; and **Chapter Five** discusses the key findings and concludes this study and proposes a framework to introduce critical thinking and reflection into a given subject.

Summary of Chapter 1

This chapter begins with a discussion on a recent report–*A Crosswalk of 21st Century Skills*–produced by Hanover Research (2011) and reveals that **critical thinking** being one out of 27 themes of the 21st century skills. In fact, it is also one of the core skills that will get one hired in 2013 (Casserly, 2012). In design education, additional to getting students to solve complex problems and participate in critique and discussion sessions, **reflection**–or the use of **reflective learning journal**–is one of the teaching and learning strategies educators use to develop student's critical thinking skill.

This purpose of this study is to examine the perception of the use of reflective learning journal as a tool to develop critical and reflective thinking skills from the recent graduates from the undergraduate communication design program at the School of Design, The Hong Kong Polytechnic University. It is anticipated that if design is truly a discipline of reflective practice, then students need to be able to demonstrate this in their learning and one effective way to achieve this is to make their thinking visible through the use of learning journals–a common assessable component in many design subjects–that go beyond description of 'what has been done' and put more focus on the explanation of 'why and how they were able to do it' and most importantly, 'how could things be done differently' given the same or similar situation in the future.

2 Review of literature

"If you always do what you always did, then you'll always get what you always got."

Chapter Organization and Structure

Many attribute the abovementioned quote to thinkers such as Mark Twain, Henry Ford and Albert Einstein. Essentially, the quote suggests that if we want to change the result, we must change how we do things through our conscious thought. Kirby and Goodpaster (2007) posit that, "[Y]our thoughts become your words becomes your actions become your habits become your character became you" (p.4). This suggests that as practitioners of all kinds–be it caregivers, doctors, social workers, educators, lawyers and designers to name a few–we need to constantly find ways to refresh our practice and eventually get better at what we are doing, and this could not be achieved without 'consciousness' (Dewey, 1933) or merely knowing about the definitions or read a book on the given topic (Wilkinson, 1999).

This chapter provides a review of existing literature on our understanding of what we think we know and perhaps find ways to consciously improve what we are doing through such new understanding. Specifically, this chapter will focus on the following:

1) **The landscape of design education in transformation: An overview**–This section provides a brief overview of current landscape of design education and considers what it means for design to be considered as a discipline;
2) **A conceptual framework to understand the development of reflective and critical thinking**–This section establishes a framework that connects the

various concepts covered in this study and identifies two other important thinking skills–namely reflective thinking and critical thinking skill–as the complementary and essential components to design education;

3) **Reflective practice and reflection**–This section begins with the notion of 'designers as reflective practitioners' coined by Donald Schön and explains its role in learning and development and professional practice. The distinction of 'reflective practice' and 'critical reflective practice' was discussed and later contrasted to another term–reflection–that is more commonly known in design education;
4) **Critical thinking**–This section first points out the confusion of the term, then discusses the different approaches and frameworks to understand and potentially assess the components of critical thinking; and
5) **Reflective learning journal as a tool to develop critical and reflective thinking**–This section deals with the role and value of reflective learning journal in learning and development, and highlights its relevant in the context of design education.

1) The Landscape of Design Education in Transformation

Historically, design is perceived as a craft and trade activity and, in many instances, has been treated as a "downstream step in the development process" (Brown, 2008, p. 86) and has been very much mistaken for decoration (Zimmerman, Forlizzi, & Evenson, 2007). Over the years, due to the complexity of information and problems, impact of globalization, digitization and the emergence and advancement of information communication technology (ICT), these factors pose new challenges and made designers moving away from designing in isolation to cross boundaries and cross cultures in collaborative design.

Today, designers are expected to assume leadership and strategic roles in organizations (Brown, 2009; Burdick, 2007, Kolko, 2011) partly due to the working methods and designerly ways of thinking (Brown, 2008, 2009; Cross, 2006, 2011; Lockwood, 2010; Martin 2009; Mootee, 2013) are being cast as skills that everyone will need for the future (Pink, 2006). As a result, scholars argue that it is timely for design to take a critical look at itself beyond the notion of 'design as an object' and move away from craft to 'design as a discipline' that hoping to reach similar status of more established disciplines such as science, technology and economics (Cross, 2006; Jonas, 2001; Poggenpohl, 2009). Specifically, Jonas (2001) makes clear distinctions between design and other disciplines:

> "[Design with a capital D] is not art because it does not aim at individual expression, but instead to serve various stakeholders, even though there are all of those intuitive, creative, and individual components … is not technology because it deals with fuzzy, discursive criteria rather than

> objective criteria, even though design shares many functional objectives ... is not science because it does not offer new explanatory models of reality, but changes reality more or less purposefully, and yet the experimental process of research resembles the design process ... is a cross-discipline and integrates various expert fields, it cannot be basic to everything else [but] should be conceived as an expert discipline of a special kind: for integration, relation, and meaning" (pp. 65-66).

Meanwhile, the more traditional orientation of design–i.e., the master-apprenticeship model embedded in the design studio–has also long been "questioned with respect to its ability to prepare students cognitively to be able to do design" (Oxman, 2004). It is believed that in such model, design apprentice might only understand or follow what the master does or teaches. While students' ability to verbally articulate rationale is a desired outcome of design education, the opposite becomes the byproduct of the 'master-apprentice' model, where "[C]ontext and content are alien dimensions for design instructors who work simply as 'dog trainers,' [and] students are trained to please the masters through slavish imitation" (Frascara, 2007, p. 63). Such learning through observation could mislead students to only copy or imitate the style and patterns rather than truly understand the underlying principles (Frascara, 2007, p. 67). This is because, at times, the master may not perform the specific design task–in particular the thinking process–properly and systematically and certain steps may be simplified or skipped due to the reliance on educated/ informed intuition and tacit knowledge (Polanyi, 1967). As a result, what the apprentice gained from such learning may be incomplete or misunderstood.

In addition, Park (2009) concurs and argues that such pedagogical model may "restrict [communication design] students' creative and critical thinking which are vital to reach to professional standards" (p. 125). Similarly, Clune (2010) also points out that "[T]he master and apprentice model views the teacher as the client: students do their best to satisfy the client and are rewarded with grades" (p. 1). Hence, many students may end up relying more on their intuition, i.e., guess what the teacher wants rather than using (more of) their analytical mind to defend their work (Poggenpohl, 2004, 2009). Consequently, in many instances, students are unable to defend their work objectively and systematically with supporting evidence but with subjective personal opinion and limited knowledge and understanding of what they are dealing with. This inevitably makes their ideas less convincing (Polite, 2004).

The above arguments suggest the shortcoming of such master-apprenticeship approach to teaching and learning:

> "... strongly dependent on the personality, experience and cognitive style of both teacher and student ... the tutor's understanding of what has to be learned and what knowledge must be transferred is based on his personal experience and knowledge. The knowledge to be transferred

> may be implicit, and consequently, unarticulated in an explicit form. Each student acquires knowledge according to his own interpretation of the process through which he or she has passed" (Oxman, 2004, p. 66).

Hence, educators today need to differentiate between learning as a long-term, broad-based process related to development (i.e., life-long learning) and training as a timely, skill-specific process related to work performance (i.e., functional training). In relation to long-term learning and development, Frascara (2004) believes that the aim of [communication] design education should "foster the development of thinking, judging, collecting information, organizing it, managing resources, and producing visual communications that are effective and sensitive to users, contents and contexts" (p. 67). In addition, Frascara (2004) argues that education "cannot be reduced to the transmission of information ... [but] to persuade individuals to think on their own, to judge, and to make decisions on the basis of personal reflection ... to contribute to personal development" (p. 152).

The teaching or development of thinking–as "a conscious response to doubt or ignorance" (Baron, 1991, p.169)–may involve alteration of one's standards because "part of the discrepancy between people's thinking and ideal standards is that people's own standards different from the ideal. Thus, people who think poorly by ideal standards may reject those standards. They may think they are thinking well when they are actually thinking badly" (p. 169). To alter one's standard–or to enable students to become effective learners–according to Paul and Elder (2005), "teachers must learn what intellectual work looks like, how the mind functions when it is intellectually engaged, what it means to take idea seriously, [and] to take ownership of ideas" (p. 8) and to understand the important role of thinking in knowledge acquisition. Citing Pestalozzi (n. d., cited in Paul & Elder, 2005):

> "Thinking leads man to knowledge. He may see and hear and read and learn whatever he pleases, and as much as he pleases; he will never know anything of it, except that which he has thought over, that which by thinking he has made the property of his own mind" (p. 8).

Perkins and Ritchhart (2004) also point out that in addition to asking questions such as 'what is considered good thinking' and 'how good a thinker one is,' there is also a need to consider the activation and mobilization of thinking, i.e., 'when is good thinking?' All these questions have led to the three aspects of thinking:

> "**Sensitivity** concerns whether a person notices occasions in the ongoing flow of events that might call for thinking, as in noticing a possibly hasty causal inference, a sweeping generalization, a limiting assumption to be challenged, or a provocative problem to be solved. **Inclination** concerns whether a person is inclined to invest effort in thinking the matter through, because of curiosity, personal relevance, habits of mind, and so on. **Ability** concerns the capability to thinking effectively, about

> the matter in a sustained way, for instance, to generate alternative explanation for the supposed causal relationship" (pp. 358-359).

Furthermore, ability to thinking reflectively and critically–or more specific, making critical reflective thinking explicit in the context of design education–is increasingly gaining attention as one of the key competencies or attributes of university graduates. This opens up yet another challenge that design educators need to take into consideration when preparing design students to be the future designers–i.e., one that could play multiple roles including craft maker, cultural intermediary, opportunistic entrepreneur, skilled researcher, life-long learner, adept communicators and active citizen (Press and Cooper, 2003, pp. 6-7)–that are both 'thoughtful' and 'reflective' (Löwgren and Stolterman, 2004, p. 2; Schön, 1983). Being thoughtful and reflective, according Löwgren and Stolterman (2004), means:

> "use your critical mind to examine your role as a designer; ... examine the purpose, outcomes, and benefits of doing design in different ways, and using different methods, tools, guidelines, or theories. Being thoughtful is about caring for your own design ability, the designs you produce, and how the world will be changed by your design ideas and decisions. A thoughtful designer is someone who takes on design as a serious and important task and who tries to become a designer with the ability to create fascinating, authentic and useful artifacts. A thoughtful designer is part of a larger culture, which we call design as knowledge construction ... in which the main 'products' are not [only] artifacts, but knowledge. Design knowledge is primarily intended for other members of the knowledge construction culture–including not only designers, but also critics, clients, users, and so on–to share, debate, challenge, extend, reject, and use. This requires articulation, not necessarily in the form of written or spoken words, but in forms that can be appropriated and assessed by others" (p. 2).

The above challenges certainly demand a re-examination of teaching strategies and design practices to maintain the high quality of the future designers we are educating and preparing for advanced practice, lifelong learning and personal development. Perhaps the future of education "must re-think their focus and develop and implement curricula that will produce the necessary human capital to identify viable solution or these needs" (Shah, 2010, cited in Thompson, 2011, p. 1).

2) A Conceptual Framework to Understand the Development of Reflective and Critical Thinking

Learning in the 21st century is shifting from a supply-push model, building stocks of knowledge to a more demand-pull model, supporting flow of knowledge using learning ecologies (Brown, 2006). More so, students are drawn into a learning community that is:

> "built around a practice … passion-based … intrinsically motivated by either wanting to become a member of that community of practice [i.e., '**learning as belonging**' according to Wenger (1998)], just wanting to learn about a body of knowledge [i.e., '**learning as experience**'], or to perform something [i.e., '**learning as doing**']." All these are a process of identity formation [i.e., '**learning as becoming**']" (Brown, 2006; Wenger, 1998).

The above four components of learning community–i.e., 'learning as belonging,' 'learning as experience,' 'learning as doing' and 'learning as becoming'–encapsulate the essence of a typical design education experience. Most of the time, the learning of becoming a designer takes place in a studio environment, where design students get to "foster [their] ability to imagine, to externalize, to act socially, to construct and learn from experience" (Baynes, 2006, p. 8). It is through this learning and development experience, design students get to harness their '**design awareness**,' i.e., design knowledge and '**design ability**,' i.e., design skills (Baynes, 2006, p. 9) in order to question and challenge two essential themes in design education: "**(1) why are things the way they are?** i.e., understanding the past and present, and **(2) How can things be improved?** i.e., Speculating about the future" (Baynes, 2006, p. 9).

Similarly, building on Vinke's (2002, cited in Bakarman, 2005) definition of the competency as "the ability of an individual to select the use of knowledge, skills, and attitudes that are necessary for effective behavior in a specific professional social or learning situation" (p. 2), Bakarman (2005), maps out the various ingredients and their key characters, i.e., the attitude, skill and knowledge (ASK) model, in design education. Subsequently, in his study–drawing insights from the interviews with senior designers and managers from internationally recognized, design-lead organizations, including IDEO, Nissan Design, Philips Design and Wolff Olins–Michlewski (2008) has identified five themes, i.e., theoretical categories, characterizing design attitude. A summary of key characteristics of attitude, skill and knowledge is presented in ↘**Table 2.1** on the following page.

Table 2.1 **A Summary of Attitude, Skill and Knowledge (ASK) Model of Design Education**

Attitude	Skill	Knowledge
Lewis and Bonollo (2002, cited in Bakarman, 2005, p. 3), Cross (2004, cited in Bakarman, 2005, p. 3) and Bakarman (2005) offer the following list of behavior: 1. Cultivate expert behavior in dealing & handling the design problem; 2. Dedicate to motivate to be good designer; 3. Acquire & manage knowledge; Willingness to solve design problem & acquire experiences; 4. Expose to–and benefit the most from–a vast majority of design problems; 5. Take a solution-approach to design problem; 6. Gather the appropriate information to tackle design problem; 7. Negotiate and seek clarification with clients & team members; 8. Accept the responsibility for the outcome; 9. Work in a group; and 10. Manage project to meet schedule & performance. Michlewski (2008) also offers the following five themes: 1. Consolidating multidimensional meanings; 2. Creating, bringing to life; 3. Embracing discontinuity & open-endedness; 4. Embracing personal & commercial empathy; and 5. Engaging polysensorial aesthetics.	Yang et al. (2005, cited in Bakarman, 2005, p. 4) and Lewis & Bonollo (2002) offer the following list of common skills: 1. Design thinking skills & design process; 2. Visualization skills; 3. Design management–management skills, communication skills, etc.; 4. Task clarification; 5. Concept generation; 6. Evaluation & refinement; 7. Execution (detailing design); and 8. Communication skills.	Carrera et al (1994, cited in Bakarman, 2005, p. 4) suggest that design knowledge comprises the following kinds of knowledge: 1. Descriptive knowledge, i.e., representation of the designed object and its performance; 2. Normative knowledge, i.e., representation of goals & constraints a designed object has to achieve and fulfill; and 3. Operational knowledge, i.e., strategies used to (a) select or generate objects, (b) predict expected performance, & (c) evaluate outcome. Polany (1964, cited in Bakarman, 2005, p 4) also offer another viewpoint of design knowledge: 1. Tacit knowledge, i.e., those knowledge that is hard to articulate and "impeded in the knower and its acquisition tends to be staggered over time and rooted in experiences" (p. 4) and 2. Explicit knowledge, i.e., theoretical & academic knowledge that is coded and can be easily migrated from one knower to another.

Adapted from Bakerman (2005, pp. 3-4) and Michlewski (2008)

While the earlier paragraphs briefly deal with design education and its components, i.e., attitude, skill and knowledge in the context of design education, the remaining of this section will pay specific attention to the different types of thinking that are

frequently discussed–i.e., creative thinking and critical thinking–but have been replaced with an umbrella term that commonly known as 'design thinking' in recent design literature.

Thinking is the nature of human being. Elder and Paul (2004) point out that,

> "much of our thinking left to itself is biased, distorted, ill-founded, or prejudice ... leads to problem in our lives ... cruelty and injustice ... Our thinking shapes and determines how we fell and what we want. When we thinking well, we are motivated to do things that make sense and ... to act in ways that help rather than harm ourselves and others ... The key to understanding human thought then, is to understand its essential duality: its capacity for **egocentrism** (being trapped in self-delusion, myth, and illusion) and its capacity for **reasonability** (freeing itself from self-delusion, myth, and illusion)" (p. 3).

Accordingly, Elder and Paul (2004) make a distinction between egocentricity and rationality. This is summarized and represented visually in ↘**Figure 2.1** below.

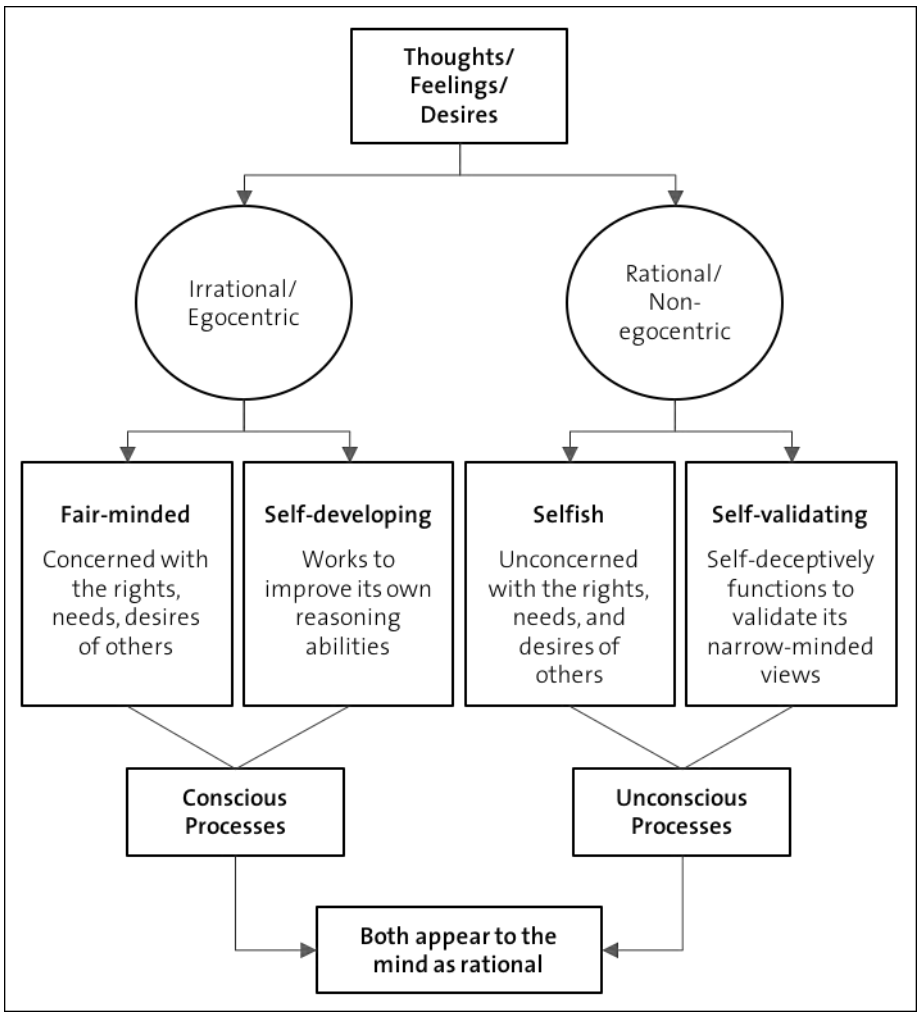

Figure 2.1 **Distinction between egocentricity and rationality** (Adopted form Elder & Paul, 2004, p. 14)

In addition, Elder and Paul (2004) also draw specific attention to "interrelated pathological dispositions [that] are inherent in native egocentric thought" (p. 21) that can either be more prominent to some or perhaps less problematic to those that are more rational. This is presented in ↘**Table 2.2** below.

Table 2.2 **Pathological Dispositions of the Human Mind**

Pathological disposition	Explanation
Egocentric memory	"the natural tendency to 'forget' evidence and information that do not support our thinking and 'remember' evidence and information that do" (p. 21).
Egocentric myopia	"the natural tendency to think in an absolutist way within an overly narrow point of view" (p. 21).
Egocentric righteousness	"the natural tendency to see ourselves in possession of 'The Truth'" (p. 21).
Egocentric hypocrisy	"the natural tendency to ignore flagrant inconsistencies–between what we profess to believe and the actual beliefs our behavior implies, or between the standards we apply to ourselves and those we apply to others" (p. 21).
Egocentric oversimplication	"the natural tendency to ignore real and important complexities in the world in favor of simplistic notions when consideration of those complexities would require us to modify our beliefs or values" (p. 21).
Egocentric blindness	"the natural tendency to not notice facts and evidence that contradict our favored beliefs or values" (p. 21).
Egocentric immediacy	"the natural tendency to over-generalize immediate feelings and experiences, so that when one, only only a few, events in our life seem highly favorable or unfavorable, all of life seems favorable or unfavorable to us" (p. 21).
Egocentric absurdity	"the natural tendency to fail to notice when our thinking has 'absurd' implications" (p. 21).

Adapted from Elder & Paul (2004), p 21.

Good thinking, according to Swartz and Perkins (1990),

> "involves the use of keen critical skills and open creative exploration in which we call up and gather relevant information that we bring to bear on the issues with which we are grappling ... motivated by the cast in a spirit of appropriate care and openness, on the one hand, and decisiveness on the other. The problem is that we do these things far less often than we can or should ... [we need to] discipline our thinking processes in certain ways so that we draw upon and use information well in thinking things through in whatever we are thinking about ... [including] thinking that usually blends a variety of content knowledge across disciplinary and more practical boundaries" (p. xvii).

In addition, Swartz and Perkins (1990) also differentiate better thinking outcome and processes (refer to ↘**Table 2.3**).

Table 2.3 **Comparison of Better Thinking as Outcomes and Processes**

Better Thinking as Outcomes	Better Thinking as Processes
More reliable conclusions,	Consider more possibilities,
Deeper insights,	Explore farther and wider,
Sounder decisions,	Exercises keener judgment,
More finely crafted products,	Marshal more data,
More creative inventions, and	Challenge assumptions,
Keener critical assessment.	Exercise precision,
	Check for errors, and
	Maintain objectivity and balance.

Adapted from Swartz & Perkins (1990, pp. 3-4).

Then, Swartz and Perkins (1990) take a step further and offer a schematic representation of the thinking process and classify thinking skills into three broad categories–namely, (1) **creative thinking**, (2) **retention and use of information**, and (3) **critical thinking**–and two goal oriented thinking processes–namely (1) **decision making** and (2) **problem solving**. This is visually presented in ↘**Figure 2.2**.

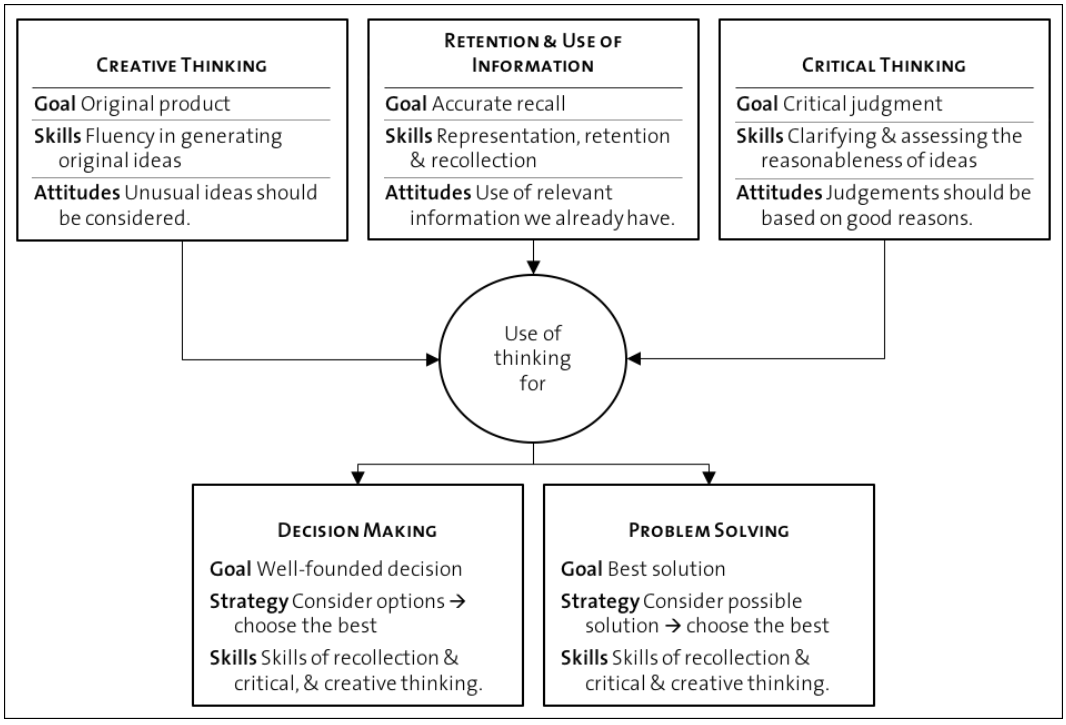

Figure 2.2 **Map of the Thinking Domain** (Adopted form Swartz & Perkins, 1990, p. 133)

Similarly, Sternberg and Williams (1996) argue that any forms of creative work require the application and balance of three abilities that can all be developed:

> "**Synthetic ability** [or **experiential intelligence**] is what we typically think of as creativity. It is the ability to generate novel and interesting ideas. Often the person we call creative is a particularly good synthetic thinker who makes connections between things that other people don't recognize spontaneously.
>
> **Analytic ability** [or **componential intelligence**] is typically considered to be critical thinking ability. A person with this skill analyzes and evaluates ideas. Everyone, even the most creative person you know, has better and worse ideas. Without well-developed analytic ability, the creative thinker is as likely to pursue bad ideas as to pursue good ones. The creative individual uses analytic ability to work out the implications of a creative idea and to test it.
>
> **Practical ability** [or **contextual intelligence**] is the ability to translate theory into practice and abstract ideas into practical accomplishments. An implication of the investment theory of creativity is that good ideas do not sell themselves. The creative person uses practical ability to convince other people that an idea is worthy. For example, every organization has a set of ideas that dictate how things, or at least some things, should be done. To propose a new procedure, you must sell it by convincing others that it is better than the old one. Practical ability is also used to recognize ideas that have a potential audience" (p. 3).

All the above abilities–as identified by Swartz and Perkins (1990) and Sternberg and Williams (1996)–are related to the 'fundamental identity' of being a normal human (Holyoak & Morrison, 2005) that sets us apart from other species. The ability to think and reason, commonly known as thinking skills, according to Fischer (2007), refers to "the mental capacities we use to investigate the world, to solve problems and make judgments" (p. 72). These mental capacities–including questioning and inquiry, concept formation, planning, rationalization, imagination, analysis, synthesis, and evaluation, to name a few–all play important roles in design. For instance, in the context of interaction design, Löwgren and Stolterman (2004) offer a set of concepts–which also equally applicable to other design professions, including communication design, interior design and product design to name a few–that can be used to frame the abilities of interaction designers: "

- **Creating and shaping** demands creative and analytical ability;
- **Deciding** demands critical judgment;
- **Working with a client** demands rationality and ability to communicate;

- **Design of structural qualities** demands knowledge of technology and material;
- **Design of functional qualities** demands knowledge of technology (or more broadly, context of) use;
- **Design of ethical qualities** demands knowledge of relevant values and ideals;
- **Design of aesthetic qualities** demands an ability to appreciate and compose" (p. 45).

In the context of design education and practice, designers in most instances have always been known for their ability to think creatively and innovatively and their aesthetic sensitivity. Rarely, designers are associated with or known for their abilities to think analytically, critically and/ or rationally. Due to cultural stereotypes, the latter set of abilities have always been either used to describe non-design professions such as science and accounting or "wrongly represented as given to fault-finding, as skeptical, negative, captious, severe and hypercritical; as focused on trivial faults, either unduly exacting or perversely hard to please; lacking in spontaneity, imagination and emotion" (Paul & Elder, 2008, p. 3). In addition, they are also superficially perceived as the 'enemies' of design (Löwgren and Stolterman, p 51).

Unknowing to many, especially inexperienced designers, all these abilities are crucial to designers, where "[C]reativity masters a process of making or producing, criticality a process of assessing or judging ... When engaged in high-quality thought, the mind must simultaneously produce and assess, both generate and judge the products it fabricates ... sound thinking requires both imagination and intellectual standards" (Paul & Elder, 2008, p. 4) and "[C]reativity without criticality is mere novelty. Criticality without creativity is bare negativity" (Paul & Elder, 2008, p. 19). Hence, it is fair to conjecture that better designers not only need to rely on their **intuition** and **creativity**–two most commonly used terms to associate with or describe designers–but must also be **mindfully critical**–a less visible but equally important attribute of designers–when solving complex and wicked problems.

Then the core of design education needs to be about a process of transformation and identity formation. The process of transformation, in the context of this discussion, cannot be more than merely moving students from having less knowledge and skills to more knowledge and skills. Instead, it is a process in which students are guided 'systematically'–loosely defined as disciplined and conscious act–to develop their own (1) design knowledge and skills; (2) consciousness about thinking, making and doing; and most importantly, (3) 'way of being' a designer. This 'way of being' is what Johns (2004) referred to as mindful practice–"[B]eing aware of self within the unfolding moment with the intention of realizing desirable practice (however desirable is defined)" (p. 2). Being mindful of what one is doing is the optimum level or even the most ideal way of reflection. Mindful designing also suggests that, during the process of

transformation–in the forms of dialogue and negotiation–one must keep an open mind, consciously taking note of what one is thinking, doing and making when developing one's own design intelligence, and eventually become more conscious about changing one's 'designerly way of thinking' to be a mindful practitioner (identity formation).

For a student to become a mindful practitioner–including learning to be critical and creative; and learning to think and write reflectively to name a few–one not only needs to be given the opportunity for meaning making and practice, but also needs an environment or a community of likeminded individuals a venue for interaction. This opportunity for interaction, according to Vygotsky (1978), awakens a variety of internal developmental processes and once these processes get internalized, they become one's "independent developmental achievement" (p. 90). The internal developmental processes are referred to as what student can do without any assistance. However, there are also processes that students cannot do independently but with appropriate assistance and guidance from an educator using appropriate scaffolding strategies, might be able to do. Hence, "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" is referred to as the zone of proximal development (Vygotsky, 1978, p. 86).

Using Wenger's (1998) social theory of learning and community of practice and Combs, Cennamo and Newbill's (2009) conceptual model of critical and creative thinking processes as the underpinning assumptions, this study will examine students' perception of using one of the pedagogical methods commonly referred to as reflective learning journal as a tool to develop reflective and critical thinking. The conceptual framework is visually presented in ↘**Figure 2.3** on the following page.

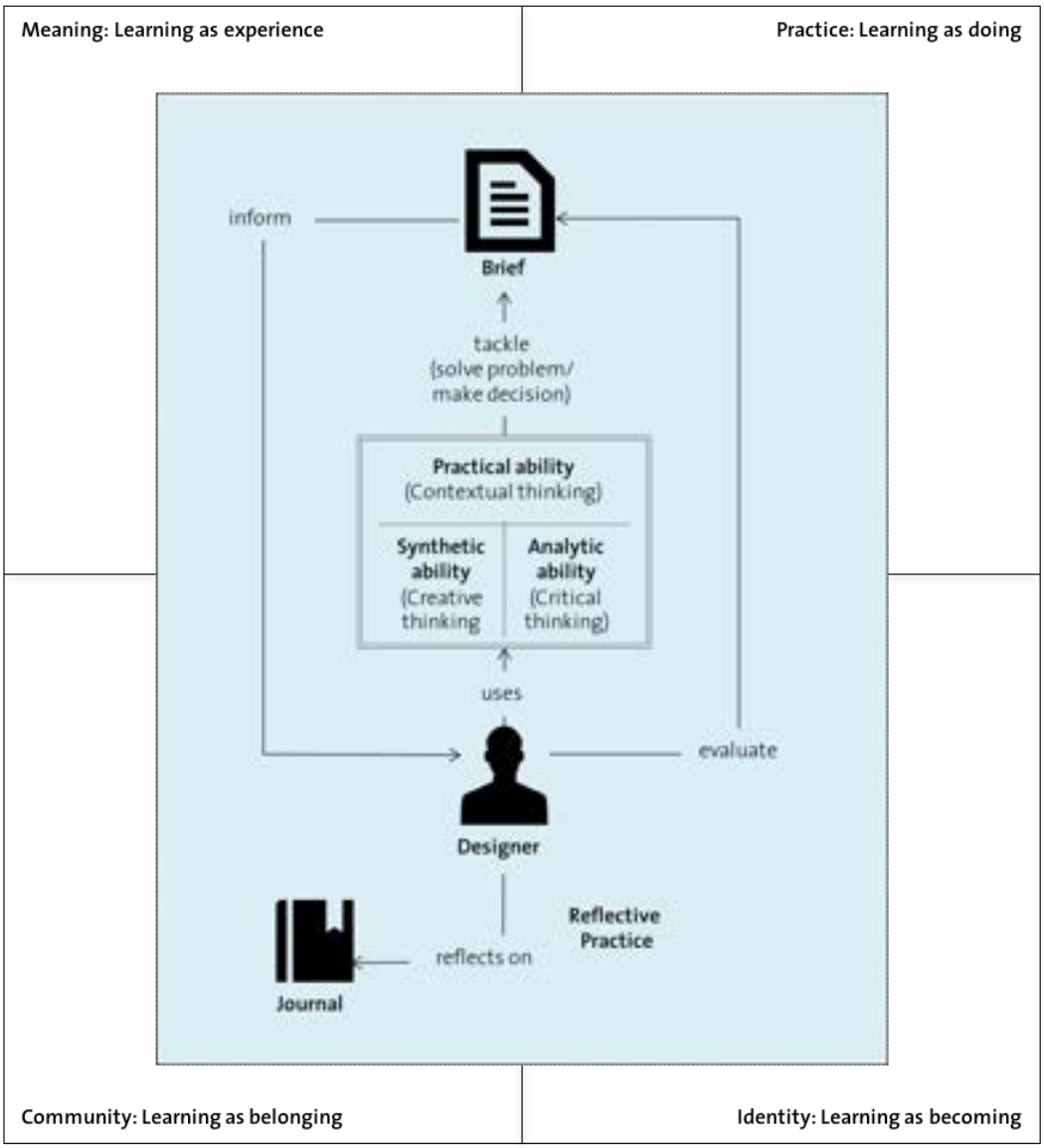

Figure 2.3 Conceptual Framework to Understand the Development of Critical and Reflective Thinking
(Adapted from Allan, 1998; Wenger, 1998; Combs, Moon, 2006, Seepersad, Schmidt, & Green, 2006; Cennamo, & Newbill, 2009; Blaschke & Brindley, 2010; Cennamo, Baum, Newbill & Finn, 2012; Hoadley, 2012; Finn, Baum & Newbill, 2013)

3) Reflective Practice and Reflection

The notion of 'designers as reflective practitioners' was first coined and introduced by Donald Schön (1983) as a critique of the technical rationality or the positivist philosophy that was promoted by the French philosopher, Auguste Comte. According to Schön (1983), there are two kinds of knowledge, namely 'technical rationality' and 'tacit' knowledge, where the latter was originally coined by Polanyi (1967). Essentially, Schön (1983) and many others are critical of the misguided attempt of technical rationality to use engineering-type of problem solving approaches to human-related problem, where he points out that,

> "Technical Rationality is the Positivist epistemology of practice. It became institutionalized in the modern university, founded in the late nineteenth century when Positivism was at its height, and in the professional schools which secured their place in the university in the early decades of the twentieth century" (p. 31).

In addition to Schön (1983), Rolfe, Freshwater and Jasper (2001) also argue against the rigidity of technical rationality, which they point out that it "reduces practitioners to the level of technicians whose only role is to implement the research findings and theoretical models of the scientists, researchers and theoreticians" (p. 7). As a result, according to Thompson and Pascal (2012), this "not only takes away the 'artistry' involved in professional practice, but also dehumanizes and, in effect, demeans professional practitioners, by relegating them to the status of unthinking followers of instructions and procedures" (p. 313).

While technical rationality is associated with the empirical science and the application of scientific theory and technique to solve problem, Schön (1983) considers tacit knowledge as a way of experiencing and understanding that cannot be well articulated but the knowing is

> "implicit in our patterns of action and in our feel for the stuff with which we are dealing ... [or] our knowing is in our action ... [and] even when he makes conscious use of research-based theories and techniques, he is dependent on tacit recognitions, judgments, and skillful performances" (pp. 49-50).

At times, the knowing–or thinking about what one is doing and making–happens after the completion of task; other times the knowing happens while working on the task. Schön (1983) refers to the former as 'reflection-on-action' and the latter as 'reflection-in-action.'

For years, the tendency towards reflective thinking and/ or learning is becoming de rigueur among many professions. Reflective practice is a term used to refer to putting reflection into a context of a specific profession. The term–and similar to other terms

covered in this chapter–is open to many different interpretations. Bolton (2005) states that it can "take us out of our narrow range of experience and help us to perceive experiences from a range of viewpoints" (p. 4). In addition, it is also perceived as an effective tool in resolving unique and complex problems that arise in practice. However, Bolton (2005) cautious that "reflective practice can fall into the trap of becoming only confession" (p.5) and instead of critically examining practice, can become a conforming mechanism.

Over the years, there have been many attempts to define reflective practice, but some may argue that it either has no precise definition (Hickson, 2011), or that it "conveys meanings that range from the questioning of presuppositions and assumptions, through to more explicit engagement in the process of critical and creative thinking in order to make connections between experience and learning in practice and practical action" (Higgins, 2011, p. 583). Additionally, it also carries multiple meanings that,

> "range from the idea of a professional engaging in solitary introspection to that of engaging in critical dialogue with others. Practitioners may embrace it occasionally in formal, explicit ways or use it more fluidly in ongoing, tacit ways. For some, reflective practice simply refers to the adopting a thinking approach to practice. Others see it as self-indulgent navel gazing. For other still, it involves carefully structured and crafted approaches towards being reflective about one's experiences in in practice" (Finlay, 2008, p. 2).

Wilkinson (1996, cited in Wilkinson, 1999) takes a more holistic approach to explain reflective practice as:

> "an active process whereby the professional can gain an understanding of how historical, social, cultural, cognitive and personal experiences have contributed to professional knowledge acquisition and practice. An examination of such factors yields an opportunity to identify new potentials within practice, thus challenging the constraints of habituated thoughts and practices. The process of reflective practice can be guided by the use of a form of supervision. Through the exploration of individual and social behavior and experiences, there is scope to gain insights to challenge and guide professional practice" (p. 36).

More recently, Moon (2006) takes a more practical approach to define reflective practice as "a set of abilities and skills, to indicate the taking of a critical stance, an orientation to problem solving or state of mind" (p. 75). In essence, at a more practical level, when one speaks of reflective practice, one is referring to the stepping back recapturing process of studying and evaluating one's own learning and working experiences–taken into consideration the strengths, weaknesses and areas for improvement and development. This is a crucial component for personal and professional growth (Sempowicz & Hudson, 2012), and a very common act in many

servicing professionals or practice-based disciplines, including nursing and healthcare, social work, law, education, and design to name a few. While Moon's (2006) definition is easier to understand, it may, however, give the impression that reflective practice can be used interchangeably with reflection, which will be discussed later in this Chapter.

Vernava (2002) draws a distinction between individuals who reflect on what they have done and the more formalized 'reflective practice.' While the former are usually private and personal, the latter could be used as a tool for supporting learning and development, where one is required to produce evidence of his or her learning in the form of a learning log, diary, personal development portfolio, critical incident journal or a video diary. According to Vernava (2002), those who engaged in the "structured, evidence-based activity may be described as 'reflective practitioners'" (p. 2). In relation to reflective practice, this so-called 'structured' and 'evidence-based activity' may be further elaborated by the Australian Physiotherapy Council (2006) as:

> "an intentional and skilled activity in which a person analyses and describes his or her thoughts, actions, feelings, and behaviors and makes judgements about their effectiveness. It requires a conscious attempt to reflect on the process and outcomes of the situation with the aim of producing an improvement in practice" (p. 79).

From the brief argument above, it is reasonable to believe and conjecture that reflective practice–as a concept–is a great way to increase confidence and become a more proactive and qualified professional. Engaging in reflective practice could also close the gap between theory and practice. As a result, and for clarity sake, this study will adopt Wilkinson's (1996) conception of reflective practice to encapsulate the essence of reflective practice in a holistic and broader sense.

Critical Reflective Practice

Being critical is widely acknowledged as an essential learning element for personal development and professional practice. Meizirow (1990, cited in Hickson, 2011) "contemplated reflective practice and identified that there was more to reflect than simply thinking about experiences, suggesting that critical reflection involves a critique on the assumptions on which our beliefs and values have developed" (p. 831). Similarly, Brookfield (1995) argues that reflection by itself is not enough, and Fook (2002, cited in Hickson, 2011) posits,

> "critical reflection involves thinking about one's practice and critically deconstructing how we have developed these skills and responses with a view to developing new theories of practice for the future" (p. 831).

Christenson (2001) makes an essential point about the importance of criticality and posits that,

> "[A]ny society that values creativity also needs to enable criticism. If we cannot question the way we are doing things and thinking about things at present it will not occur to us that they could be thought of or done differently" (p. 37).

Similarly, Adams (2002) points out that,

> "[C]ritical practice is not just reflective practice, because the critical practitioner does not take the world for granted and does not automatically accept the world as it is. Reflective practice contributes to critical, transforming practice. ... Critical practice involves reflectiveness but transcends it" (p. 87).

In response to the above, Thompson and Thompson (2008) highlight two crucial dimensions of criticality: depth and breadth. The former refers to the ability to look for deeper meaning of a given situation, including taken-for-granted assumptions, thoughts, feelings and values; while the latter takes into consideration the broader context of power relations, discrimination and oppression (Thompson & Pascal, 2012). In addition, Thompson and Pascal (2012) also cite the work of Murray and Kujundzic (2005) and Brechin, Brown and Eby (2000) to further elaborate the aspects of depth and breadth respectively:

> "Critical thinking has practical relevance; it can increase our intellectual independence, increase our tolerance for different points of view, and free us from the snares of dogmatism. We may agree with what our parents, out pastors, our friends, our teachers, our politicians and our scientists tell us, but surely not merely on the basis of their telling us. They may be wrong, after all, however well-intentioned. This is the appeal of being autonomous. Critical thinking invites us to call the bluff of accepted dogmas" (p. 4, cited in Thompson & Pascal, 2012, p. 321).

> "The term 'critical' is used to conceptualize practice as an open-minded, reflexive process, built on a sound skills and knowledge base, but taking account of different perspectives, experiences, assumptions and power relations. Critical practice draws on an awareness of wider ethical dilemmas, strategic issues, policy frameworks and socio-political contexts. It acknowledges that there may be no straightforward 'right' answers and that powerful, established voices will often hold sway over newer, alternative ways of seeing things (p. xi, cited in Thompson & Pascal, 2012, p. 322).

Through critical reflection, it is believed that the writer or thinker not only will examine how he or she constructs the meaning and makes connections between experiences and the learning concepts; but also go beyond the individualistic level and consider the cultural and structural factors that are equally important in shaping

professional practice in the socio-political context as what Thompson and Pascal (2012) point out, which may also include the need to: “

- Incorporate issues of forethought or planning: reflection-for-practice;
- Take greater account of the central role of language, meaning and narrative as key elements in the process of meaning making;
- Go beyond individualism or ‘atomism’ to appreciate the significance of the wider social context;
- Take greater account of the emotional dimension of reflection;
- Incorporate a greater understanding of the important role of power;
- Be clear about the differences between reflection and reflexivity and understand the relationship between the two;
- Take account of time considerations, at both individual and organizational levels, and crucially;
- Develop a critical approach that addresses the depth and breadth aspects of criticality and the interrelationships between the two” (p. 322).

It would be ideal if anyone could achieve the level of criticality through reflective practice, and in essence, the basic attribute of any practitioner is the ability to reflect, a mental capacity or metacognitive act that requires conscious effort to critically evaluate knowledge and experiences acquired (or learned) to achieve deeper meaning and understanding with a view to improve our practice in the future (Schön, 1983; 1987). However, Rodgers (2002) clearly points out the complexity of reflection and amount of time needs to be invested to do it right, let alone what were mentioned in previous paragraphs.

In fact, the practice of reflective thinking has become widespread and defining features of competence for professional growth (Sempowicz & Hudson, 2012; Taylor, 2010) and has even been adopted inappropriately and unreflectively to ‘rationalize existing practice’ over the last few decades throughout various disciplines and fields of professional practice and education (Finlay, 2008). This is partly because many believe that reflective practice has “an allure that is seductive in nature [and] it rings true for most people as something useful and informing” (Loughran, 2002). In addition, how the term ‘reflective practice’ was understood varies considerably among different disciplines, which further complicates the matter (Fook, White & Gardner, 2006).

Therefore, it is the intention of this review to switch the focus on reflection, which is what this study has originally set forth to explore, i.e., reflection–more specifically reflective learning journal–as a learning tool to develop reflective and critical thinking.

What is Reflection?

The term 'reflection' was initially theorized by John Dewey in *How We Think*, first published in 1910 and subsequently developed by Donald Schön (1983; 1987). Certainly, Dewey is not the only scholar who has written on the importance of reflective thinking or reflection (Boud, Cohen & Walker, 1993; Drucker, 1967; Findlay, 2008; Fook et al, 2006; King & Kitchner, 1981; Kolb, 1984; Loughran, 2002; Magolda, 2001; McDrury & Alterio, 2002; Moon, 2013; Rau, 2012; Schön 1983; Wilkinson, 1999).

Simply put, reflection, can be perceived as a capacity or "ability to critically analyze knowledge and experience to achieve deeper meaning and understanding" (Walling, Shapiro & Ast, 2013, p. 7) or defined as "a way to think about and understand our experiences with a view to improve our practice in the future" (Fook & Gardner, 2007, cited in Hickson, 2012, p. 33). In addition, usage of the word also implies "a form of mental processing with a purpose and/ or an anticipated outcome that is applied to relatively complicated or unstructured ideas for which there is not an obvious solution. This suggests close association with, or involvement in, learning and the representation of learning" (Moon, 2004, p. 4). Furthermore, it is also a metacognitive act that "fosters skepticism, rigor, and control" (Weaver, 1998, p. 145, cited in Jung, 2011). According to Francis (1995, cited in Francis & Ingram-Starrs, 2005), in Dewey's notion of reflection,

> "[T]hree key ideas of modern rhetoric (of reflection) can be identified: direct experience, careful consideration of beliefs, values or existing knowledge, and the suspension of immediate action to permit systematic contemplation" (p. 542).

From the perspective of learning, reflection requires a conscious effort to look at and think about our actions, feelings and responses in a direct learning experience and then analyze or interpret those actions, feelings and responses in order to gain insights and learn from them (Atkins & Murphy, 1994; Boud, Keogh & Walker, 1985). It is through the on-going and conscious effort that, "[T]heory emerges from an analytical perspective that seeks to identify patterns found in an activity or phenomenon" (Poggenpohl, 2009, p. 7). As a result, being able to reflect critically not only enables us to make tacit activities explicit but also make our thinking more visible. Furthermore, it also allows us to develop appropriate theory, methods or tools to improve design performance and explain our design decisions (Frascara, 2007; Poggenpohl, 2009). This distinguishes a competent practitioner–one that not only 'knows-how' but also 'knows-that' (Cross, 2006; Habermas 1998, cited in Poggenpohl, 2009)–from an amateur or a less competent practitioner.

The definitions in previous paragraphs may seem fairly easy to understand at the surface, but Francis and Ingram-Starrs (2005) argue that "any thinking about practice can be labeled 'reflective,' but ... It is in the unexamined taken for granted that embodied beliefs, values, personal biographies, culture and gender are most likely to lead to practitioners constructing events as 'normal'. This normalizing acts as a barrier

to rethinking beyond existing repertoires of practice" (pp. 542-543). Additionally, Rodgers (2002) points out that reflection is a "complex, rigorous, intellectual and emotional enterprise that takes time to do well" (p. 845) and posits that:

> "[A]lthough [the work of Dewey on reflection] is frequently cited, with many teacher education programs claiming to turn out reflective practitioners, and although many curricula claim to be inquiry based, a thorough exploration of the process and purpose of reflection as he outlined it is scant or missing altogether" (p. 844).

While Rodgers (2002) may be focusing on teacher education in the above quote, the same argument is equally applicable to any form of education and learning and development program, including design education. Rodgers (2002) then goes further to identify four reasons why reflection is difficult to accomplish: "

1. It is unclear how systematic reflection is different from other types of thought;
2. It is difficult to assess a skill that is vaguely defined;
3. Without a clear picture of what reflection looks like, it has lost its ability to be seen and therefore has begun to lose its value; and
4. Without a clear definition, it is difficult to research the effects" (p. 842)

Rodgers (2002) then continues and provides a summary followed by a detailed and insightful discussion on Dewey's (1910/ 1933) four criteria for reflection: "

1. Reflection is a meaning-making process that moves a learner from one experience into the next with deeper understanding of its relationships with and connections to other experiences and ideas. It is the thread that makes continuity of learning possible, and ensures the progress of the individual and, ultimately, society. It is a means to essentially moral ends.
2. Reflection is a systematic, rigorous, disciplined way of thinking with its roots in scientific inquiry.
3. Reflection needs to happen in community in interaction with others.
4. Reflection requires attitudes that value the personal and intellectual growth of oneself and of others" (p. 845).

In the **first criterion**, Rodgers (2002) explains his interpretation of experience and function of reflection, then succinctly state that "experience is what happens to you; what you do with what happens to you is directly dependent on the meaning that you make of it. And though the experiences that befall us may be out of our control, the meaning that we make of them is not" (p. 849). In the **second criterion**, Rodgers (2002) points out that Dewey uses at least 30 different specialized terms to describe the complexity of reflection. Specifically, Dewey distinguishes three kinds of thought from

reflection–i.e., cannot be counted as equivalent but can be perceived as a subset of reflection–namely (i) stream of consciousness, (ii) invention, and (iii) belief, with appropriate explanations (see pp. 849-850 of Rodgers, 2002). Using the example of apple fallen on Newton's head, Rodgers (2002) highlights the quality of "being present to the nature of the experience and an openness to its potential meanings" (p. 850) as an essential component of reflective thinker where, according to Dewey (1916/1944, cited in Rodgers, 2002), it "moves the learner from a disturbing state of perplexity (also referred to by [Dewey] as disequilibrium) to a harmonious state of settledness (equilibrium)" (p. 850). Another quality of reflective thinker is curiosity as the source of motivation: "[U]ntil we understand, we are, if we have curiosity, troubled, baffled, and hence moved to inquire" (Dewey, 1933, p. 132, cited in Rodgers, 2002, p. 851), we are unlikely to move into a reflective thinking mode. Regrettably, according to Rodgers (2002), Dewey wasn't able to clearly and consistently identify the different phases of reflection–i.e., he provides different versions of reflection process in both *How We Think* (1933) and *Democracy and Education* (1944)–and based on his interpretation of Dewey's works, Rodgers (2002) offers his own version that collapse Dewey's six phases into four. A comparison between the two is presented in ↘**Table 2.4**.

Table 2.4 **Comparison of Dewey's and Rodgers' Phases of Reflection**

Dewey's Six Phases		Rodger's Four Phases	
1.	An experience	1.	Presence to experience
2.	Spontaneous interpretation of the experience	2.	Description of experience (implies holding at bay spontaneous interpretations–Dewey's phase two–until analysis, where they can be more closely examined in light of the data gathered; see Himley & Carini (2000) for the profound possibilities of this step)
3.	Naming the problem(s) or the question(s) that arises out of the experience	-	
4.	Generating possible explanations for the problem(s) or question(s) posed	3.	Analysis of experience (which subsumes Dewey's phases four and five)
5.	Ramifying the explanations into full-blown hypotheses		
6.	Experimenting or testing the selected hypothesis	4.	Intelligent action/ experimentation (Dewey's phase six)

Source: Adapted from Rodgers (2002).

In the **third criterion**, Citing Dewey, Rodgers (2002) points out the importance of expression or communication:

> "[T]he experience has to be formulated in order to be communicated … To formulate requires getting outside of [the experience], seeing it as

> another would see it, considering what points of contact it has with the life of another so that it may be got into such form that he can appreciate its meaning … One has to assimilate, imaginatively, something of another's experience in order to tell him intelligently of one's own experience … A man really living alone (alone mentally as well as physically) would have little or no occasion to reflect upon his past experience to extract its net meaning" (Dewey, 1944, p. 6, cited in Rodgers, 2002, p. 856).

Additional to merely stating the importance of sharing, Rodgers (2002) highlight the three benefits of collaborative reflection based on his experience as a teacher educator and facilitator of reflective professional development: "1) affirmation of the value of one's experience: In isolation what matters can be too easily dismissed as unimportant; 2) seeing things "newly": Others offer alternative meanings, broadening the field of understanding; 3) support to engage in the process of inquiry: The self-discipline required for the kind of reflection that Dewey advocates, especially given the overwhelming demands of a teacher's day, is difficult to sustain alone. When one is accountable to a group, one feels a responsibility toward others that is more compelling than the responsibility toward others that is more compelling than the responsibility we feel to only ourselves" (p. 857). The three benefits clearly reiterate the importance of community of practice (Lave & Wenger, 1991) and the uses of the community–i.e., a studio, a discipline or the entire school, in the context of design education–to share effective and less effective practices and to enculturate the process of knowledge generation, application and reproduction (Hoadley, 2012).

Finally, in the **fourth criterion**, Rodgers (2002) talks about Dewey's (1933) belief on the importance and awareness of one's attitudes and emotions–as part of the work of good thinker–in relation to the act of reflection. Specifically, Dewey (1933) believes that "reflection that is guided by whole-heartedness, directness, open-mindedness and responsibility … stands a much better chance of broadening one's field of knowledge and awareness. Of course, one is seldom wholly open-minded, whole-hearted, and so forth, or wholly fearful or needy. We are usually a combination of many of these" (Rodgers, 2002, p. 858). Briefly, the following summarizes Dewey's four attitudes–comprise the vital constituents of what Dewey calls readiness for someone to get involved in reflection–through Rodgers' (2002) interpretation:

1. **Whole-heartedness**–Also referred to as 'single-mindedness in Dewey's (1944) *Democracy and Education*. It "indicates a genuine, no hold barred enthusiasm about one's subject matter … [and without it] there exists indifference, and the energy to observe and gather information [about the subject matter" (Rodgers, 2002, pp. 858-859).
2. **Directness**–Dewey distinguishes this from "self-consciousness, distractedness, or constant preoccupation with how others perceive one's performance … means being free of self-absorption … an attitude

of trust in the validity of one's own experience without spending a lot of time worrying about the judgment of others ... [but] does not preclude observing oneself in a more detached way ... An attitude of directness is a prerequisite to reflection [and unless one is able to focus on content, context and self altogether], reflection risks getting stuck on the level of self" (Rodgers, 2002, pp. 859-861).

3. **Open-mindedness**–Dewey points out that being open-minded is being 'hospitable' and doesn't mean blindly accept all idea with 'intelligent critique' but "willingness to entertain different perspectives, coupled with an acceptance of the 'possibility of error even in the beliefs that are dearest to us' (Dewey, 1933, p. 30), and acknowledgement of the limitations of one's own perspective" (Rodgers, 2002, p. 861). In addition to being 'hospitable', Dewey also suggests that we being 'playful'–i.e., "not clinging too tightly to our ideas but releasing the mind to play over and around them" (Rodgers, 2002, p. 861).
4. **Responsibility**–This is the attitude that ties the previous three attitudes together, not only it serves as 'reality check' or question on 'the implications of the thinking' in reality; but also implies how the train of thoughts should 'lead to action'. Dewey (1933) posited that to be intellectually responsible "is to consider the consequences of a projected steps.

Reflection and Performance Improvement

Reflection, according to Hinett (2002), is both an approach and a method for improving learning and a way of thinking about learning–in terms of what, how and why they learn–to get us "from experience to understanding" (¶ 1). This is particularly true in the context of design where learning is usually taking place through experiencing, i.e., doing, making and thinking. While frequency of practice certainly may lead to mastery of skills and knowledge eventually, it is the conscious and active thinking about what worked (successful), what doesn't work (less successful) and what could be done differently (improvement) to effect future change–i.e., the process and outcome of our thinking, doing and making–that transforms one from a novice to an expert. In fact, Leise (2010) points out that to become more proficient in any learning skill,

> "one must actively engage, assess practice, and reflect on how performance growth has been achieved thus far ... Growth in performance must be correlated with growth in assessment and reflection skills because these are the main processes that facilitate conscious changes in an individual's sense of empowerment ... quality of reflection cannot improve unless the quality of self-assessment moves to a critical level of quality and accuracy that will support self-efficacy, i.e., the continual and conscious improvement in performance expectations" (pp. 65-67).

Since academic or professional reflection–unlike personal reflection–is linked to assessment or professional development, it needs to show evidence of learning and a growing professional knowledge (Ryan & Ryan, 2013). The importance and value of reflection are supported by a recent empirical study–using a mixed method experimental design that combines the precision of laboratory experiments with a field study–conducted by Di Stefano, Gino, Pisano, and Staats (2014).

According to Di Stefano et al. (2014), there are two types of learning that are based on experiences, namely **(1) direct learning**, i.e., 'learning-by-doing'; and **(2) indirect learning**, i.e., 'learning-by-thinking'. The latter is commonly known as reflection or the articulation of the key lessons learned from one's experience. Furthermore, they also point that learning from direct experience, can be more effective if accompanied by reflection, that is "the intentional attempt to synthesize, abstract and articulate the key lessons taught by experience" (p. 4).

In addition, Di Stefano et al. (2014) also believe that "the boost in learning generated by reflection is induced by the impact of reflection on self-efficacy" (p. 4). Their study reveals that "individuals perform significantly better on subsequent tasks when they think about what they learned from the task they completed" (p. 5). Moreover, their findings also support the argument on the codification of tacit knowledge, where the codification process requires a 'cognitive investment' that generates a deeper understanding of knowledge (p. 5).

However, the study did not observe an additional boost in performance when individuals share the insights from their reflection effects with others. As a result, the study claims a novel contribution to the literature in several ways:

> "First, our research adds to previous work on learning by proposing a dual-process model showing that the automatic, unconscious process of learning generated by 'doing' becomes more effective if deliberately coupled with the controlled, conscious attempt at learning by 'thinking.' In doing so, we extend literature claiming that the capacity to reflect on action is necessary for practitioners to learn (Schön, 1983), and provide, to the best of our knowledge, the first empirical test of the effect of reflective practice. Second, by uncovering the role of self-efficacy as the mechanism behind the effect of reflection on learning, we shed light on 'the process of knowing' (Cook and Brown, 1999, p. 281). Our results show that by reflecting on and articulating the key lessons learned from experienced, a person boosts her self-efficacy, which in turn has a positive effect on learning. In this respect, we answer the call for more research on knowledge creation as a fundamental step in the learning process (Argote, 2011). Finally, the finding that reflection aids learning outcomes supports the argument put forward by literature on the codification of tacit knowledge (Cowan, David, and Foray, 2000; Nonaka,

> 1994; Nonaka and Von Krogh, 2009), according to which the process of transform tacit into codified knowledge requires a cognitive investment that generates a deeper understanding of this knowledge. We contribute to this literature by providing empirical evidence of the benefits associated with knowledge codification and uncovering the mechanisms behind them. Our findings suggest that the benefits of codification are not affected by whether its purpose is self-reflection or sharing know-how with others" (pp. 5-6).

From the above key findings by Di Stefano et al. (2014), it is appropriate to conjecture the close relationship between and the arguments put forth by Dewey (1933) on reflective thinking and reflection as:

> "the kind of thinking that consists in turning a subject over in the mind and giving it serious and consecutive consideration … Reflection involves not simply a sequence of ideas, but a con-sequence–a consecutive ordering in such a way that each determines the next as its proper outcome, which each in tern leans back on its predecessors. The successive portions of the reflective thought grow out of the one another and support one another; they do not come and go in a medley. Each phase is a step from something to something–technically speaking; it is a term of thought. Each term leaves a deposit, which is utilized in the next term. The stream or flow becomes a train or chain" (pp. 3-5).

He then took a step further to identify what constitute reflective thoughts:

> "[A]ctive, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends" (p. 9); and the elements involve in every reflective operation, include: "(1) a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates, and; and (2) an act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and dispose of the perplexity" (p. 12).

Challenges of Reflection

Reflection is an important practice and many scholars believe that students should be encouraged to integrate this practice into their daily lives (Rau, 2012; McDrury & Alterio, 2002; Magolda, 2001; Boud, Cohen, & Walker, 1993; King & Kitchener, 1981). Vernava (2002) identifies the advantages of reflection, where it helps students to: "

- Understand what they already know (**learning is individual**)
- Identify what they need to know in order to advance understanding of the subject (**learning is contextual**)

- Make sense of new information and feedback in the context of their own experience (**learning is relational**)
- Guide choices for further learning (**learning is developmental**)" (pp. 1-2).

To elaborate on Vernava's (2002) suggestion, as human beings, we all are capable of drawing on both our cognitive skills (prior knowledge, reasoning, analysis and synthesis) and metacognitive skills (self-awareness, self-regulation, and intuition) when we construct our own meaning about a given learning point. This puts us in a situation of assessing what we already know and what we need to know. When we experience something new, i.e., new learning, we try to make a connection into the existing cognitive or metacognitive network of ideas. In other words, we try to make sense of new information by fitting it into the existing knowledge and experience. Along the way, we make the necessary adjustment to our understanding as a result of new learning. As a result, this makes us realize our strengths and shortcomings and the need to take necessary action for further learning.

While many scholars have written about the need to reflect (Drucker, 1967), on improving learning through reflection (Hinett, 2002) and the importance of being a 'reflective practitioner' (Schön, 1983), Rau (2012) points out that there is no clear indication showing sufficient attention has been given to understand whether individuals have natural tendencies towards reflection. This certainly reiterate Francis and Ingram-Starrs (2005) and Rodgers (2002) earlier arguments on the difficulties and challenges of reflection mentioned in the earlier paragraphs. Similarly, Wilkinson (1999) argues, "reflection does not occur simply as a result of knowing about it" (p. 36). In addition, Moon (2004) also points out the complication to the discussion of reflection and cognitive activities that arises from problems of vocabulary:

> "The ability to be precise in academic reasoning on cognitive activities, such as knowledge, knowing, teaching and learning–and reflection–is itself marred by a vocabulary that is either overly extensive or not extensive enough. For example, the following words can apparently be synonymous with reflection–reasoning, thinking, reviewing, problem solving, inquiry, reflective judgment, reflective thinking, critical reflection, [and] reflective practice (Kitchener, 1983). A term such as 'critical thinking' may either be allied with reflection or reflective thinking (Barnett, 1997; Dewey, 1933) or defined separately as in King and Kitchener (1994). The problem may be rooted in the relatively few efforts of those engaged in these studies to move outside their disciplines to see how others have applied the terms" (p. viii).

In addition, while both Griffin (2003) and Hamlin (2004) concur that the analysis of critical incidents improves students' levels of reflection, Cox (2005) points out that the identification of what might be considered as key incidents might be problematic, as

some students may feel that the given experience may be “too small, insignificant and routine’ (p. 470). Biggs and Tang (2007) points out that reflection is a misleading word, as a reflection in the mirror is the exact replica of what is; whereas transformative reflection–a better term according to Biggs–“is rather like the mirror in Snow White: it tells you what you might become. This mirror uses theory to enable the transformation from the unsatisfactory what-is to the more effective what-might-be” (p. 43).

Essentially, reflection is less about summarizing what was done, what happened or how one felt about the experience–although these may be included to set the context–but more about the rationale, beliefs and values (why), the concrete and specific evidence (as oppose to vague or generic statements), and the process of transformation, i.e., who and how we might become as a result of the learning experience. Ultimately, there must be evidence of personal development and in some cases, of changing of behavior and practice (Hinett, 2002).

However, Bain, Balantyne, Mills & Nestor (2002) argue that although deep reflective skills can be taught, this requires development and practice over time. The practices of reflection, according to Higgins (2011), suggest a method of inquiry characterized by

> “engagement, pondering alternatives, drawing inferences and taking diverse perspectives, especially in situations which are complex and novel, calling for situational awareness and understanding ... [but reflection itself] is seen as much more than simply understanding ... [as] it involves the inclusion of a process into one’s cognitive structures, relating these to other forms of experience and understanding. ... [This suggests that] learning could be enhanced through reflection by surfacing and critiquing tacit understanding or taken-for-granted mental structure” (p. 583).

Race (2006) identifies some of the questions–refer to **↘Table 2.5**–on which many inexperienced educators and students may need to seek immediate clarification when the term reflection is first introduced to them, if reflection is to help us to “make sense of what we’ve learned, why we learned it, and how that particular increment of learning took place ... Linking one increment of learning to the wider perspective of learning–heading towards seeing the bigger picture” (p. 2). Giving a blank sheet of paper and expecting someone–especially a novice student–to write something reflective without prompts or questions is unlikely to prove successful (Cox, 2005; Moon, 2013). In addition, Race (2006) also points out that while many people reflect, that does not mean they have the necessary experience or training in providing evidence of their reflection on professional practice. Among the advantages of providing evidence of reflection is that it enables dialogues between the appraisers (i.e., teacher) and the appraises (i.e., student).

Table 2.5 **Questions about Reflection**

Level	Question
Beginner	• How can I reflect? • What do you mean by reflection? • How will I know when I have reflected well?
Advanced	• How can I show that I've reflected successfully? • What will be deemed satisfactory evidence of my reflection?

Adapted from Race (2006).

There have been variations of models and frameworks developed by many others over time including Atkins and Murphy (1994), Gibbs (1988), Johns (1994), Kolb (1984), and Smyth (1989), to name a few (refer to ↘**Table 2.6** for a compilation of **Models and Frameworks of Reflection**). These models and frameworks of reflection present a list that might help to develop prompts for reflection, which may vary from one discipline to another. Most of the models tend to get the person performing the reflection to revisit the incidents–some require listing out the sequence of key events before narrowing down to one or two significant events; while others zoom into a specific event–and get connected to the personal feelings before conducting analysis using a series of prompts. All tend to end with conclusions and some kind of action plans.

Table 2.6 **Models and Frameworks of Reflection**

Author(s)	Components
Bortons (1970)	1. What? Focuses on description and self-awareness, i.e., what happened? What did I do? What was I trying to achieve? What was good or bad about the experiences? 2. So what? Focuses on the analysis and evaluation when we look deeper, i.e., so what is the importance of this? So what more do I need to know about this? So what have I learned about this? 3. Now what? Focuses on the synthesis and build on questions from previous levels to consider alternative courses of action and choose the appropriate direction, i.e., Now what could I do? Now what do I need to do? Now what might I do? Now what might be the consequences of this action?
Carper (1978)	1. Aesthetics–the art of what we do, our own experiences. 2. Personal–self-awareness. 3. Ethics–moral knowledge. 4. Empirics–scientific.

Author(s)	Components
Boud, Keogh & Walker (1985)	1. Returning to experience. 2. Attending to (or connecting with) feelings. 3. Evaluating experience.
Gibbs (1988)	1. Description–What happened? 2. Feelings–What were you thinking and feeling? 3. Evaluation–What was good and bad about the experience? 4. Analysis–What sense can you make of the situation? 5. Conclusion (synthesis)–What else could you have done? 6. Action plan–If it arose again, what would you do?
Smyth (1989)	1. Describe–What did I do? 2. Inform (analysis)–What does this mean? 3. Confront (self-awareness)–How did I come to be like this? 4. Reconstruct (evaluation & synthesis): a. What do my practices say about my assumptions, values and beliefs? b. Where did these ideas come from? c. What social practices are expressed in these ideas? d. What is it that causes me to maintain my theories? e. What views of power do they embody? f. Whose interests seem to be served by my practices? g. What is it that acts to constrain my views of what is possible in my practice?
Atkins & Murphy (1994)	1. Identify any learning which has occurred. 2. Awareness of uncomfortable feelings and thoughts. 3. Describe the situation including thoughts and feelings–i.e., salient events and key features. 4. Analyze feelings and knowledge relevant to the situation–Identify knowledge, challenge assumptions, imagine and explore alternatives. 5. Evaluate the relevance of knowledge–Does it help to explain/ solve problems? How complete was your use of knowledge?

Author(s)	Components
Johns (1994)	1. Description of experience a. Phenomenon–describe the here and now experience b. Casual–what essential factors contributed to this experience? c. Context–what are the significant background factors to this experience? d. Clarifying–what are the key processes for reflection in this experience? 2. Reflection a. What was I trying to achieve? b. Why did I intervene as I did? c. What were the consequences of my action? d. How did I feel about this experience when it was happening? e. How did (the patient) feel about it? f. How do I know how (the patient) felt about it? 3. Influencing factors a. What internal/ external factors influenced my decision-making? b. What sources of knowledge did/ should have influenced my decision-making? 4. Evaluation a. What other choices did I have? b. What would be the consequences of these choices? 5. Learning a. How do I now feel about this experience? b. How have I made sense of this experience in light of past experiences and future practice? c. How has this experience changed my way of knowing? • Empirics–scientific • Ethics–moral knowledge • Personal–self-awareness • Aesthetics–the art of what we do, our own experiences

Classifying the Levels of Reflection

While guiding questions are essential and useful, it is the 'depth' of reflection that makes it more meaningful. Researchers and scholars agree that there are different classifications or levels of reflection. In Johns' (2004) Layers of reflection, he points out that a reflective practitioner should move from 'doing reflection' towards reflection as a 'way of being' within everyday practice. According to Johns (2004), there are five layers of reflection, namely:

1. Reflection-on-experience;
2. Reflection-in-action, based on Schön's (1983) work;
3. The internal supervisor, based on Casement's (1985, cited in Johns, 2004) work on learning from the Patient;
4. Reflection-within-the-moment; and
5. Mindful practice.

Singh and Minsky (2004) suggest a six-layer tower of reflection depicted in ↘**Figure 2.4**. The lowest two layers are mostly reactive based on instinctive reflexes (or **innate reaction**), and experience (or **learned reaction**). The **deliberate thinking** is activated when one is facing with a difficult problem, i.e., one may think about ways to improve a solution through "various types of mental deliberation, for example, prediction, explanation, planning, diagnosis, generalization, and so on" (p. 320). On the other hand, when one is facing difficulty to make progress, one may need **reflective thinking** to question the strengths and weakness of existing knowledge, techniques and experiences. The **self-reflective thinking** takes a step further to examine one's physical and cognitive abilities and knowledge and "look for highly entrenched long-standing deficiencies and weaknesses in our knowledge and methods and suggest significant courses of actions" (p. 321) to deal with future problems. **Self-conscious thinking** looks outward at a more social level by imagining what others, especially those we respect, might think of us. More specifically, this layer is concerned with "the relationship between one's mind and those of others and performs self-appraisals by comparing one's abilities and goals with those of others" (p. 322).

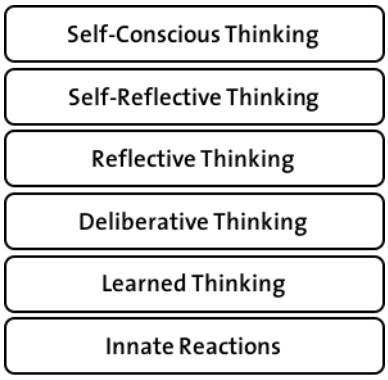

Figure 2.4 A six-layer tower of reflection (Adapted from Singh and Minsky, 2004).

While works of Johns (2004) and Singh and Minsky (2004) are useful to inform or guide practitioners and students to navigate around different stages of reflection, the work of Hatton and Smith (1995) provides clearer description that can be used to evaluate the depth and breadth of reflection:

1. **Non-reflective description (or Descriptive writing)**–refers to as mere summary and reporting of facts;

2. **Descriptive reflection**–includes limited consideration of multiple alternatives, or in general lacks alternative viewpoints, usually based on personal and subjective rationales;
3. **Dialogic reflection**–refers to as "an approach that aims to establish relations between different factors in order to justify possible alternatives for hypothesizing and elaborating phenomena" (Hutson, Ristic & Tregloan, 2013, p. 159); and
4. **Critical reflection**–refers to "a broader understanding of context, via logical elaboration of actors and actions on the basis of theory and practice" (Hutson, Ristic & Tregloan, 2013, p. 159).

Using the work of Hatton and Smith (1995) as the foundation of their arguments, Hutson, Ristic and Tregloan (2013) point out that,

> "[the first two levels of reflection] predominantly involve translation of work's spatial and material qualities into another medium such as written, spoken or graphic language ... [while] critical reflection includes reconstruction or imagining the coherence between different aspects of a project in order to produce a new and more complete view that may not be observed in the project itself, and the repositioning or assessment of the project by situating it among others kinds" (p. 159).

Similar to Hatton and Smith (1995), Kember, McKay, Sinclair and Wong (2008) offer a four-category scheme for coding and assessing the level of reflection in written work after extensively reviewed the existing works, and their own attempts to develop suitable scheme for assessing the level of reflection built upon works of other scholars, and eventually led them to develop a questionnaire–with confirmatory factor analysis and empirical evidence that tested successfully for reliability and validity–that determines the four-category scheme for determining levels of reflection in written work, namely habitual action/ non-reflection, understanding, reflection, and critical reflection. The summary of the four categories is presented in **↘Table 2.7** and elaborated accordingly.

Habitual action/ non-reflection refers to following procedure routinely without much thought about the action. "Habitual action or non-reflection occurs when a student responds to an academic task by providing an answer without attempting to reach an understanding of the concept or theory that underpins the topic ... Non-reflective writing occurs when students search for materials on a set topic and place it into an essay without thinking about it, trying to understand it, or forming a view" (Kember et al., 2008, p. 373). This is probably similar to Hatton and Smith's (1995) non-reflective description.

Table 2.7 **Four Levels of Reflection**

Non-reflection
The answer shows no evidence of the student attempting to reach an understanding of the concept or theory, which underpins the topic.
Material has been placed into an essay without the student thinking seriously about it, trying to interpret the material, or forming a view.
Largely reproduction, with or without adaptation, of the work of others.
Understanding
Evidence of understanding of a concept or topic.
Material is confined to theory.
Reliance upon what was in the textbook or the lecture notes.
Theory is not related to personal experiences, real-life applications or practical situations.
Reflection
Theory is applied to practical situations.
Situations uncounted in practice will be considered and successfully discussed in relationship to what has been taught. There will be personal insights, which go beyond book theory.
Critical reflection
Evidence of a change in perspective over a fundamental belief of the understanding of a key concept or phenomenon.
Critical reflection is unlikely to occur frequently.

Adapted from Kember, McKay, Sinclair & Wong (2006).

Understanding refers to deep approach to learning as a way to distinguish from the habitual action. However, according Kember et al. (2008) that this category "doesn't imply reflection ... [or] the understanding is somewhat truncated ... [due to the absence of] real-life application" (p. 373). Ip (2003) points out that students tend to mistakenly treat 'knowing' something, i.e., the definition of critical thinking, as 'understanding' of something. Similarly, Perkins (1998) also posits "understanding is the ability to think and act flexibly with what one knows" (p. 40). This usually happens to students with limited knowledge or who lack experience to make connection between theory and application. The writing is usually a regurgitation of codified knowledge or lack of examples to relate theory to a practical situation (Kember et al., 2008).

Reflection, according to Kember et al. (2008), can be "delineated from the understanding category because the process of reflection takes a concept and considers it in relation to personal experiences. Theory is applied to practical applications ... [In writing] concepts will be interpreted in relationship to personal experiences. Situations uncounted in practice will be considered and successfully discussed in relationship to

what has been taught. There will be personal insights that go beyond book theory" (pp. 373-374).

Critical reflection, according to Kember et al. (2001), "necessitates a change to deep-seated, and often unconscious, beliefs and leads to new belief structures … new perspectives … [and] transformation" (p. 174, cited in Kember et al., 2008, p. 370). However, Kember et al. (2001) also point out that making changes to deep-seated beliefs about phenomena can be challenging. Citing the works of Nussbaum and Novick (1982) and West (1998), Kember et al. (2008) suggest a three-phrase process for perspective transformation: "

1. A process for diagnosing existing conceptual frameworks and revealing them to the student.
2. A period of disequilibrium and conceptual conflict, which makes students dissatisfied with existing conceptions.
3. A reconstruction or reforming phase in which a new conceptual framework is formed" (pp. 374-375).

Reflection in Design and Design Education

The essence of experiential learning, according to Rogers (1951), places more emphasis on student and more specifically the actions that student does. This suggests students' experiences and perceptions influence how they approaches learning and what they learned (Gelmez & Bagli, 2015). As a result, reflection is particularly critical in design education and many practice-led professions (Gelmez & Bagli, 2015). Reymen and Hammer (2000) point out the need for designers to be more aware of the design situation at various important points of the design process. To them, design process, context and 'product' are closely linked to each other at certain moments, and these moments determine the 'design situation' (p. 325). Similarly, Geis and Birkhofer (2009) also argue the need for critical analysis of process, context and product to "reveal important measures which can be raised and implemented to methodically improve designing" (p. 159) so that designers can frame and reframe the problems and make appropriate changes along the process of designing (Schön, 1983) when tackling problems that are wicked and ambiguous (Buchanan, 1992; Rittel & Webber, 1973).

Unfortunately, according to Reymen and Hammer (2000), designers are often not aware of the design process and context but tend to focus on the 'product' they are designing during practice. Reymen and Hammer (2000) go further and state four reasons why awareness–through intermittent reflections during the design process without interrupting the creative process–of the design situation is important: "

1. making a design situation explicit creates a more profound base for decisions;

2. the design situation influences the next action to be taken in the design process. Being aware of the situation can be of strategic importance;
3. to improve the current design process, it is important to relate it with the state of the product being designed and with the design context at that moment; [and]
4. awareness of the design process is also important to learn from the current and to improve design skills for future design processes" (p. 325).

Dorst (1997, cited in Reymen & Hammer, 2000) also observes that–when the designer gets thrown into a situation "one is not always in the position to consider the process critically and rationally" (p. 326). This is partly because "reflection on the design situations is not a real topic" in current design education (Reymen & Hammer, 2000, p. 326) and "designers usually don't reflect on their actions and neglect documenting them as well" (Geis and Birkhofer, 2009, p. 159).

Hence, it is imperative that design practitioners and future designer to be to acquire the appropriate skills, knowledge and attitude of mind for reflection, as Schön (1983) rightly puts it:

> "Through reflection, [practitioner] can surface and criticize the tacit undersatandings that have grown up around the repetitive experiences of a specialized practice, and can make new sense of the situations of uncertainty or uniqueness which he [or she] may allow himself [or herself] to experience" (p. 61).

Most of the work reviewed thus far all point to the need for criticality or the importance of critical stance–i.e., the "comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating an opinion or conclusion" (Rhodes, 2010, cited in Colley, Bilics & Lerch, 2012, p. 1)–when one reflects about their thinking and making process and outcome. The next section, will shift the attention the conception of critical thinking.

4) Critical Thinking

Teach students to think critically is a common phrase or "most often-repeated aspirations" (Stead, 2003, p. 3) in many disciplines, including design. Often, critical thinking is perceived as an essential graduate attribute in the 21st century (Barnett, 2000; Halpern, 1999; Mason, 2007; Phillips & Bond, 2004, Reed & Kromrey, 2001; Thomas, 2011;) but such thinking skill has been "insufficiently met" (Willingham, 2007). In addition, some also believe that critical thinking is foundational to higher learning or undergraduates are expected to master during their education, regardless of one's

discipline (Greenlaw & DeLoach, 2003, cited in Çavdar & Doe, 2012) and a "prerequisite for both reflective and evidence-based practice" (Tilbury, Osmond, & Scott, 2010, p. 32) and "fundamental to being an active and engaged citizen in the world" (Moore, 2004, p.3). Furthermore, scholars believe that critical thinking is a necessary to prepare students for the workforce (Lai, 2011) and the most important skills for "problem solving, inquiry and discovery" (Thompson, 2011) or what Thomas (2011) puts it as "important for a well-educated person to be able to **make well-informed judgements**, be able to **explain their reasoning** and be able to **solve unknown problems**" (p. 26). In fact, Paul (1993) and Nickerson (1987) even believe that critical thinking is the antidote for irrational human behavior.

Dressel and Mayhew (1954, cited in Renaud & Murray, 2008) offer four reasons why critical thinking is valuable:

> "**First**, ... foster other important goals of attending college such as the development of moral and spiritual values, the transmission of knowledge, and the preparation of individuals for adult life. **Second**, ... provide a purpose for acquiring knowledge. Otherwise, [it] simply becomes a jumble of facts ... the development of critical thinking ... helps make the acquisition of knowledge more meaningful. **Third**, ... applicable to most activities and problems we encounter. **Finally**, while the subject matter knowledge may be soon forgotten, critical thinking ability is a long lasting skill" (p. 85).

As a result, many higher learning institutions either require their students to study critical thinking as a compulsory or elective subject or make critical thinking as an expected transferable skill that students need to acquire and develop in their undergraduate education (Halpern, 1998; Ku, 2009; Macalister, 1999, cited in Cheung, Rudowicz, Kwan, & Yue, 2002). It is no surprising and, certainly, not difficult to spot similar terms including critical thinking, reflect critically, critically evaluate, etc. in many syllabi and assessment criteria. However, Moore (2004) points out that:

> "despite the importance attached to the skill of critical thinking, and despite assurances by many universities that it is imparted to students as a matter of course, a number of unresolved questions remain. Central to these is the issue of whether critical thinking is in fact a universal 'generic skill' able to be applied invariably to the situation at hand, or ... is best conceived as on a loose category taking in diverse modes of thought. And related to this conceptual issue is a central pedagogical question: is it best for our undergraduate students to be taught about critical thinking as a subject of study in itself, or should it be handled within the context of students' study in the disciplines?" (p. 4).

Similarly, Jones (2007) also states that the increasingly importance of critical thinking is clear, but

> "the nature of [critical thinking skill] is unclear, as is the relationship between [critical thinking] and the disciplinary context in which the skills are learnt. There is an implicit assumption that generic skills are independent of disciplinary contexts even though they are taught within them. This leads to a more overt expectation that generic skills will be transferable between disciplines and beyond the university into the workforce" (p. 84).

On whether critical thinking is or isn't discipline-specific and can it be taught independently, Davies (2013) points out that such matter has long been "subject to a debate between the '**generalists**' and the **specifists**'" (p. 2) and cites two key proponents from both camps:

> "**Robert Ennis** (1989, cited in Davies, 2013) describes [critical thinking] as an approach that 'attempts to teach critical thinking abilities and dispositions separately from the presentation of the content of existing subject-matter offerings' (p. 4) ... [While] **John McPeck** (1981, cited in Davies, 2013), [argues that] '[T]hinking by definition, is always thinking about something and that something can never be 'everything in general' but must be something in particular' (p.4)" (p.2).

Recently, according to Willingham (2007),

> "the **ability** to think critically **depends on having adequate content knowledge**; **you can't think critically about topics you know little about or solve problems that you don't know well enough to recognize and execute the type of solutions they call for** ... knowing that one should think critically is not the same as being able to do so. That requires domain knowledge and practice" (pp. 12-13).

Willingham (2007) goes on further–using the example of scientific thinking or more specifically, thinking like scientist–and makes the following three concluding remarks why teaching critical thinking can be difficult:

> "**First**, critical thinking (as well as scientific thinking and other domain-based thinking) is not a skill. There is not a set of critical thinking skills that can be acquired and deployed regardless of context. **Second**, there are metacognitive strategies that, once learned, make critical thinking more likely. **Third**, the ability to think critically (to actually do what the metacognitive strategies call for) depends on domain knowledge and practice" (p. 17).

In addition, Çavdar & Doe (2012) point out that acquisition of critical thinking skills needs intellectual self-discipline. Furthermore, Goodwin (2014), citing a study conducted by Nobel Prize-winning psychologist Daniel Kahneman's (2011, cited in Goodwin, 2014) work on the two mental systems that made up human thinking–points out that,

> "**System 1** engages in automatic (fast) thinking; … helps us read and write words effortlessly, gauge the distance of objects and answer simple math problems. **System 2** entails more effortful (slow) thinking, such as focusing on a conversation in a noisy room, comparing products when making a purchase, and determining the validity of a complex argument. The trouble is our brains are–in a word–lazy, says Kahneman. We default to System 1, and only with effort power up System 2. In short, critical thinking requires effort and doesn't spring automatically from a pen moving across paper" (pp. 78-79).

Kahneman (2011, cited in Goodwin, 2014) isn't the only one that discusses on mental systems. Paul and Elder (2006) refer such mental systems as **first-order thinking**–i.e., "spontaneous and non-reflective. It contains insight, prejudice, truth and error, good and bad reasoning, indiscriminately combined (p. xxv)–and **second-order thinking**–i.e., "first-order thinking raised to the level of conscious realization (analyzed, assessed, and reconstructed)" (p. xxv)–respectively. While the value of critical thinking is indisputable, how it is introduced and integrated into the curricula remains questionable due to the confusion of the term itself.

The Confusion of the term 'Critical Thinking'

In the existing literature, although the term has been widely discussed, it is yet to find an agreed definition to date (Cheung, Rudowicz, Kwan, & Yue, 2002; Gibbs & Simpson, 2004). Mason (2008) provides a brief yet succinct summary of the following critical thinking perspectives:

> "Some argue that critical thinking is constituted by particular **skills**, such as the ability to assess reasons properly, or to weigh relevant evidence, or to identify fallacious arguments. Others argue that it is most importantly a critical **attitude** or **disposition**, such as the tendency to ask probing questions, or a critical orientation, or some such attribute intrinsic to character. Or, if critical thinking is constituted by **dispositional knowledge**, some suggest that this would be in the sense of a moral perspective or set of values that motivates critical thinking. Still others argue that it is constituted by **substantial knowledge** of particular content. Some mean by this, knowledge about concepts in critical thinking such as premises, assumptions or valid arguments. And other means deep and wide knowledge of a particular discipline and its

> epistemological structure, so that one is a critical thinker only within the discipline" (p. 2).

Similarly, Thompson, Irmer, and Tang (2012) also point out that critical thinking can be viewed from different perspectives (refer to ↘**Table 2.8**) but "differing perspectives contribute to the difficulty of framing the concept usefully. It is ill defined, difficult to teach, difficult to assess, difficult to apply consistently, requires discipline specific factual knowledge to support, requires general knowledge and skill to support" (pp. 1-2). Ironically, Atkinson (1997) points out that "academics normally considered masters of precise definition seem almost unwilling or unable to define critical thinking. Rather they often appear to take the concept on faith perhaps as a self-evident foundation of Western thought–such as freedom of speech" (p. 74, cited in Moore, 2013, p. 507). One possible reason, according to Paul, Elder and Bartell (1997), could be due to lack of substantive concept of critical thinking among educators. As a result, they "are not sure how to deeply connect critical thinking concepts to the concepts within their discipline" (Paul, 2005, p. 34). By substantive, Elder and Paul (2007) refer that as concept that,

> "highlights the essential components, ... one that has clear implications for **how we should understand** [the concept] and **how we should design the process**. Many popular concepts of education are non-substantive ... they are vague and fragmented, and therefore superficial and misleading. They do not highlight the **common dimensions** of the various disciplines. They do not illuminate essential **intellectual standards**. The do not define essential **intellectual traits** (the personal characteristics that, when acquired, direct the right use of the mind). Instead, they lead to instruction that mainly trains, indoctrinates, or socializes rather than educates the individual. They produce "counterfeits" of educated persons because they ignore essential **abilities**, **standards**, and **traits** in the instructional process" (p. 6).

Furthermore, it has long been identified by Fox (1994) that "because it is learned intuitively, critical thinking is easy [for faculty] to recognize, like a face or a personality, but it is not so easily defined and it is not at all simple to explain" (p. 125, cited in Moore, 2013, p. 507). This not only makes it more challenging for faculty who are trying to integrate and assess critical thinking in teaching and learning, but also imposes additional challenges to acquiring and developing a clear understanding of critical thinking. Barnett (1997) suggests the problem was due to a lack of 'conscious reflection' and concludes that "[H]igher education, which prides itself on critical thought, has done no adequate thinking about critical thinking" (p. 3, cited in Moore, 2013, p. 507).

In fact, Richard Paul posed a question in 2004 regarding the state of critical thinking in higher education and revealed three disturbing facts below: “

1. Most college faculty at all levels lack a substantive [understanding of the] concept of critical thinking.
2. Most college faculty don’t realize that they lack a substantive concept of critical thinking, believe that they sufficiently understand it, and assume that they are already teaching [it to] students.
3. Lectures, rote memorization, and (largely ineffective) short-term study habits are still the norm in college instruction and learning today” (¶ 1).

The above facts according to Paul (2004) are three serious obstacles to the long-term institutional change and unless administrative and faculty leaders do something–i.e., understand the nature, both positive and negative implications of critical thinking–they are very unlikely to plan for effective professional development and, as a result, students do not improve their skills (Abrami, Bernard, Borokhovski, Wade, Surkes, Tamin, & Zhang, 2008). Moreover, Elder and Paul (2010) reiterate that “[M]uch lip service is given to the notion that students are learning to think critically … though faculty say that critical thinking is important to their instruction, they have difficulty articulating a clear conception of it and demonstrating how they foster it” (p. 38).

All these confusions–i.e., different use of concepts, terms, comments and different perspectives–were the results of diverse backgrounds and different approaches to define critical thinking. Broadly, according to Lewis & Smith (1993) and Sternberg (1986), there are three approaches to the understanding of–focuses on and interpretations of–critical thinking. This is presented in **↘Table 2.8** on the following page. Among the three approaches, the education approach–dominated by Bloom and Krathwohl (1956) and other proponents of Bloom’s taxonomy–is highly criticized for its shortcomings. For instance, Ennis (1985) points out that if “[higher-order thinking and Bloom’s taxonomy] could do the job for us, there would be less reason to be interested in critical thinking” (p. 45). Similarly, Paul (1993) also critiques on Bloom’s model and concludes that:

> “Bloom’s Taxonomy, all of the above notwithstanding is a remarkable tour de force, a ground-breaking work filled with seminal insights into cognitive processes and their interrelations. Nevertheless, attempt to remain neutral with respect to all educational values and philosophical issues is a one-sided hierarchical analysis of cognitive processes that limits our insight into the nature of critical thinking” (p. 526).

Table 2.8 **Approaches to Define Critical Thinking**

Approach	Definition & Quote
The philosophical approach	Focus on the **characteristic of the ideal thinker** (Facione, 1990, cited in Geertsen, 2013), for examples: "The propensity and skill to engage in an activity with reflective skepticism (McPeck, 1981, p. 8); "Reflective and reasonable thinking that is focused on deciding what to do believe or do" (Ennis, 1985, p. 45); "Skillful, responsible thinking that facilitates good judgment because it 1) relies upon criteria, 2) is self-correcting, and 3) is sensitive to context" (Lipman, 1988, p. 39); "Purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or conceptual considerations upon which that judgment is based" (Facione, 1990, p. 3); "Disciplined, self-directed thinking that exemplifies the perfections of thinking appropriate to a particular mode or domain of thought" (Paul, 1992, p. 9); "The art of thinking about your thinking while you are thinking in order to make your thinking better: more clear, more accurate, more defensible" (Paul & Elders, 2002).
The cognitive/ psychological approach	Focus on **what the thinkers typically do** when assessing a situation (Lewis & Smith, 1993, cited in Geertsen, 2013), for examples: "The mental processes, strategies, and representations people use to solve problems, make decisions, and learn new concepts" (Sternberg, 1986, p. 3); "Reflective thinking involved in the evaluation of evidence relevant to a claim so that a sound conclusion can be drawn from the evidence (Bensley, 1998, cited in Bensley, Buckner & Allman, 2010, p. 91); "The use of those cognitive skills or strategies that increase the probability of a desirable outcome" (Halpern, 1998, p. 450); "Seeing both sides of an issue, being open to new evidence that disconfirms your ideas, reasoning dispassionately, demanding that claims be backed by evidence, deducing and inferring conclusions from available facts, solving problems, and so forth" (Willingham, 2007, p. 8).
The education approach	Focus on **information processing skills** such as analysis and synthesis (Kennedy et al., 1991, cited in Geertsen, 2013), for examples: "In the educational tradition of theorizing are leading figures such as Bloom (1956), Gagne (1965), Perkins (1981), and Renzulli (1976), whose theorizing seems directly responsive to the skills needed by children in the classroom for problem solving, decision and concept learning" (Sternberg, 1986, p. 7).

Could this be one of the reasons that led to the revision of the taxonomy by a group of scholars? Krothwohl (2002), one of the scholars involved in the revision, explains some of the changes made but also briefly points out that:

> "Problem solving and critical thinking were two other terms commonly used by teachers that were also considered for inclusion in the revision. But unlike understand, there seemed to be no popular usage that could be matched to a single category. Therefore, to be categorized in the Taxonomy, one must determine the intended specific meaning of problem solving and critical thinking from the context in which they are being used" (p. 218).

The existing literature rarely make clear and explicit connection between the original Bloom's taxonomy and critical thinking but implicitly suggest that three of the so-called higher order thinking skills–i.e., analysis, synthesis and evaluation–in the (old) taxonomy are related to critical thinking as seen in earlier discussions. Additional to Krothwohl's (2002) attempt to make connection between the revised taxonomy, Mayer (2002), another scholar involves in the revision, argues the need to go beyond remembering factual information and suggests the use of checking and critiquing–both classified under Evaluation in the revised Taxonomy–to foster and assess meaningful learning as critique "lies at the core of what has been called critical thinking" (p. 231). This is probably the most explicit attempt to link critical thinking to critique in the revised taxonomy.

So... What, then, is Critical Thinking?

In a layperson's term–probably many educators and students would agree on–critical thinking refers the following:

> "being able to pursue one's questions through self-directed search and interrogation of knowledge, a sense that knowledge is contestable, and being able to present evidence to support one's arguments" (Pithers & Soden, 2000, p. 239, cited in Thompson, 2011, p. 1); or

> "ask pertinent questions, recognize and define problems, identify arguments on all side of an issue, search for and use relevant data and arrive in the end at carefully reasoned judgments" (Bok, 2006, p. 109); or

> "accept ideas and seek for their meaning, to look at them a little bit skeptical, compare with opposite views, to create credible systems to justify them and build on these structures" (Penkauskienė, 2010); or

> "systematic approach or skillfully evaluating information to arrive at the most feasible solution to a variety of structured and ill-structured problems" (Thompson, 2011, p. 1); or

While all the elements may be essential to students to develop one's critical thinking ability, however, those elements are "intellectual 'virtues' that don't come easily to people and must be cultivated" (Nilson, 2014, ¶ 2) and students must get appropriate

feedback on their responses so that they could improve their thinking (Nilson, 2014). In relation to the improvement of thinking, Paul and Elder (2007) point the danger of self-centered/ egocentric psychological standards in our thinking (presented in ↘**Table 2.9** on the following page) and how quality of our thinking may affect the quality of our life and "that of what we produce, make, or build" (p. 4).

Table 2.9 **The Problem of Egocentric Thinking**

Self-centered psychological standard	Most commonly used phrase
Innate egocentrism	"It's true because I believe it."
	"I assume that what I believe is true even though I have never questioned the basis for many of my beliefs" (Elder & Paul, 2004, p. 11).
Innate sociocentrism	"It's true because we believe it."
	"I assume that the dominant beliefs within the groups to which I belong are true even though I have never questioned the basis for many of these beliefs" (Elder & Paul, 2004, p. 11).
Innate wish fulfillment	"It's true because I want to believe it."
	"I believe in, for example, account of behavior that put me (or the groups to which I belong) in a positive rather than a negative account. I believe what "feels good," what support my other beliefs, what does not require me to change my thinking in any significant way, what does not require me to admit I have been wrong" (Elder & Paul, 2004, p. 11).
Innate self-validation	"It's true because I have always believed it."
	"I have a strong desire to maintain beliefs that I have long held, even though I have not seriously considered the extent to which those beliefs are justified, given the evidence" (Elder & Paul, 2004, p. 11).
Innate selfishness	"It's true because it is in my selfish interest to believe it."
	"I hold fast to beliefs that justify my getting more power, money, or personal advantage even though these beliefs are not grounded in sound reasoning or evidence" (Elder & Paul, 2004, p. 11).

Adopted from Paul & Elder (2004); Paul & Elder (2007).

Edward Glaser (1941) identified and listed the following basic critical thinking skills:

> "(a) to recognize problems, (b) to find workable means for meeting those problems, (c) to gather and marshal pertinent information, (d) to recognize unstated assumptions and values, (e) to comprehend and use language with accuracy, clarity and discrimination, (f) to interpret data, (g) to appraise evidence and evaluate statements, (h) to recognize the existence of logical relationships between propositions, (i) to draw warranted conclusions and generalizations, (j) to put to test the generalizations and conclusions at which one arrives, (k) to reconstruct

> one's patterns of beliefs on the basis of wider experience, and (l) to render accurate judgements about specific things and qualities in everyday life" (p. 6).

Pascarella & Terenzini (1991) state that critical thinking normally involves one's ability to do some or all of the following:

> "**identify** central issues and assumptions in an argument, **recognize** important relationships, **make** correct inferences from data, **deduce** conclusions from information or data provided, **interpret** whether conclusions are warranted on the basis of the data given, and **evaluate** evidence or authority" (p. 118).

Similarly, Gorzycki (n.d.) also provides a similar list in relation to the demonstration of cognitive ability as evidence of critical thinking: "

- **Evaluating** the strength of evidence for claims in various reports, studies or editorials;
- **Identifying** the implication of assertions or actions;
- **Detecting** the bias of assertions and evaluating the merit of alternative point of view;
- **Review** one's or one's peer's composition to critique the clarity, logic, and organization of text;
- **Comparing** and **contrasting** two or more sources addressing the same idea, event, or issue; and
- **Identifying** and **testing** the assumptions embedded in certain beliefs or attitudes related to civic or personal life (p. 4).

Furthermore, Paul and Elder (2007) suggest that a well cultivated critical thinker is one who can: "

- **Raises** vital questions and problems, **formulating** them clearly and precisely;
- **Gathers** and **assesses** relevant information, using abstract ideas to interpret it effectively;
- **Comes** to well-reasoned conclusions and solutions, testing them against relevant criteria and standards;
- Thinks open-mindedly within alternative systems of thought, **recognizing** and **assessing**, as need be, their assumptions, implications, and practical consequences; and

- **Communicates** effectively with others in figuring out solutions to complex problems" (p. 4).

Instead of listing skills, some scholars describe the key characteristics of quality critical thinking. According to Zhang (2003),

> "[T]he ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgements, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances the inquiry permit" (p. 1, cited in Thompson, 2011, p. 2).

In addition, Paul (2005) points out that a critical thinker will:

> "painstakingly study how humans can better ground, develop and apply thought ... [that is to] study thinking for strengths and weaknesses ... [and] improve it as a result ... A critical thinker says: 'My thinking, and that of most people, is often flawed. The flaws that exist commonly in thinking frequently lead to significant problems in human life. It is foolish ever to take thinking for granted. If we want to think well, we must regularly analyze, assess and reconstruct it'" (p. 28).

Furthermore, Moore (2013) also identifies seven definitional strands–from seventeen academics from a range of disciplines: history, philosophy and literary/ cultural studies–namely critical thinking: (i) 'as judgment'; (ii) 'as a skeptical and provisional view of knowledge'; (iii) 'as a simple originality'; (iv) 'as a careful and sensitive reading of text'; (v) 'as rationality'; (vi) 'as the adopting of an ethical and activist stance'; and (vii) 'as self-reflexivity'.

More recently, the Cambridge Assessment (Black, 2008) offers a taxonomy of critical thinking (refer to **↘Table 2.10** on the following page) and defines critical thinking as:

> "the analytical thinking which underlines all rational discourse and enquiry. It is characterized by a meticulous and rigorous approach.
>
> As an academic discipline, it is unique in that it explicitly focuses on the processes involved in being rational.
>
> These processes include:
>
> - **Analyzing** arguments
> - **Judging** the relevance and significance of information

- **Evaluating** claims, inferences arguments and explanations
- **Constructing** clear and coherent arguments
- **Forming** well-reasoned judgments and decisions.

Being rational also requires an open-minded yet critical approach to one's own thinking as well as that of others" (p. 7).

Table 2.10 **The Taxonomy of Critical Thinking with Expansion**

Skill/ process	Sub-skills/ processes	Expansion
1) Analysis	A. Recognizing & using the basic terminology of reasoning.	"E.g., argument, reasons, conclusions, analogy, inference, assumptions, flaws. This skill underpins most critical thinking skills" (Black, 2008, p. 9).
	B. Recognizing arguments and explanations.	"Recognizing argument is a fundamental sub-skill in Critical Thinking. (An argument is defined as one or more reasons offered in support of a conclusion). Being able to distinguish between argument and non-argument as well as between argument and explanation" (Black, 2008, p. 9).
	C. Recognizing different types of reasoning.	"Recognizing that arguments use different types of reasons, e.g., common knowledge, statistics, conditional statements, scientific data, ethical principles etc. More advanced recognition will include recognizing different forms of argument, e.g., deductive proof, hypothetical reasoning, reductio ad absurdum" (Black, 2008, p. 9).
	D. Dissecting an argument.	"Extracting and separating the relevant material from the less relevant (e.g., rhetoric, background). Identifying the key claims which might form parts of the argument" (Black, 2008, p. 9).
	E. Categorizing the component parts of an argument and identifying its structure.	"Recognizing the parts of an argument and the function they play. E.g., evidence, examples, reasons. While 'dissecting an argument' and 'categorizing components parts' often co-occur and work together iteratively , they are separate sub-skills" (Black, 2008, p. 9).
	F. Identifying unstated assumptions.	"Looking for things (e.g., facts, beliefs, principles) which are essential to the argument but have not been explicitly presented" (Black, 2008, p. 9).
	G. Clarifying meaning.	"Detecting, avoiding and removing ambiguity for the purposes of reasoning soundly or judging the soundness of reasoning. Removing confusion over the meanings of words, phrases or expression of ideas that might alter the thrust of efficacy of the argument" ((Black, 2008, p. 9).

Skill/ process	Sub-skills/ processes	Expansion
2) Evaluation	A. Judging relevance.	"This process is more than simply judging relevant versus irrelevant. It entails judging the degree of relevance of a claim or piece of evidence to a particular interpretation or conclusion" (Black, 2008, p. 9).
	B. Judging sufficiency.	"Determining whether there is enough evidence to support a conclusion. Recognizing the difference between necessary and sufficient conditions" (Black, 2008, p. 9).
	C. Judging significance.	"This entails judging the degree of importance of evidence in relation to conclusions and arguments" (Black, 2008, p. 9).
	D. Assessing credibility.	"Assessing the credibility of sources of evidence in relation to such criteria as expertise, corroboration or conflict, reputation, bias, factors that might interfere with accuracy of observation, judgement or reporting" (Black, 2008, p. 9).
	E. Assessing plausibility.	"In relation to claims, assessing the likelihood that a claim could be true, i.e., 'is this the sort of thing which is likely to happen?' In relation to explanation, assessing the likelihood that the explanation given is the correct one (e.g., by considering alternative explanations). This can often play an important role in assessing arguments" (Black, 2008, p. 9).
	F. Assessing analogies.	"Judging whether two things being compared are sufficiently alike for the comparison to be useful (i.e., in clarifying and strengthening an argument)" (Black, 2008, p. 9).
	G. Detecting errors in reasoning.	"Detecting errors in reasoning includes flaws in arguments, some common fallacies, incorrect inferences/ deductions from information contained in a variety of sources (e.g., verbal, numerical, pictorial, graphical), as well as unfair maneuvers such as irrelevant appeals, e.g., to popularity" (Black, 2008, p. 10).
	H. Assessing the soundness of reasoning within an argument.	"Making an overall judgment as to how well the conclusion has been supported or justified by the argument as a whole. This will include considering the truth or plausibility of any of the individual claims or reasons, as well as the validity of reasoning (the degree to which the reasons support the conclusion). The manner of assessment should be appropriate to the type of argument being assessed, e.g., deductive proof, causal reasoning, attempting to prove beyond reasonable doubt, attempting to establish likelihood based on balance of evidence" (Black, 2008, p. 10).
	I. Considering the impact of further evidence upon an argument.	"Judging the extent to which further evidence strengthens or weakens an argument. It may challenge, support, complement or conflict with evidence, reasons or unstated assumptions" (Black, 2008, p. 10).

Skill/ process	Sub-skills/ processes	Expansion
3) Inference	A. Considering the implications of claims, points of view, principles, hypotheses & suppositions.	"This requires looking at a wider implications of the components of the argument, including its overall conclusion. This will include checking for consistency and corroboration between the claims within an argument. Principles may be ethical principles" (Black, 2008, p. 10).
	B. Drawing appropriate conclusions.	"This involves ensuring the conclusions one draws is justified" (Black, 2008, p. 10).
4) Synthesis/ Construction	A. Selecting material relevant to an argument.	"Gathering and collating appropriate and sufficient evidence" (Black, 2008, p. 10).
	B. Constructing a coherent & relevant argument or counter-arguments.	"Using one's knowledge of argument structure to construct one's own argument" (Black, 2008, p. 10).
	C. Take argument further.	"Extending an existing argument. Constructing new lines of reasoning which advance the argument" (Black, 2008, p. 10).
	D. Forming well-reasoned judgements–wider than conclusion, can mean a response or a decision.	"Arriving at carefully considered and more accurate judgements in situations where there is insufficient evidence to allow certainty. (This involves applying all the relevant critical thinking skills)" (Black, 2008, p. 10).
	E. Responding to dilemmas.	"This skill is applied in a situation where some action has to be taken in response to a problem, but any action taken will have undesirable consequences. It involves recognition of the consequences of competing courses of action, and an attempt to judge between them" (Black, 2008, p. 10).
	F. Making & justifying rational decision.	"Deciding upon the best course of action once a conclusion has been drawn having applied the relevant Critical Thinking skills" (Black, 2008, p. 10).
5) Self-reflection & self-correction	A. Questioning one's own preconceptions.	"Gaining awareness of, examining & evaluating one's own pre-conceptions & being prepared to set them aside" (Black, 2008, p. 10).
	B. Careful & persistent evaluation of one's own reasoning.	"Applying all of the above to oneself, with the aim of greater accuracy in one's own reasoning" (Black, 2008, p. 10).

Adopted from Black (2008).

Hence, the idea of critical thinking, when stripped to its essentials, can be expressed as,

> "the art of thinking about thinking in an intellectually disciplined manner. Critical thinkers explicitly focus on thinking in three

> interrelated phases ... **analyze** thinking ... **assess** thinking, and ... **improve** thinking (as a result)" (Paul, 2005, p. 28).

In short, a critical thinker not only try to see both side of an issue, but also "open to new evidence that disconfirms [our] ideas, reasoning dispassionately, demanding that claims be backed by evidence, deducing and inferring conclusions from available facts, solving problems and so forth" (Willingham, 2007, p. 8).

However, many scholars believe that critical thinking comprises of more than just a set of skills one needs to acquire to improve thinking. Instead, it also requires **dispositions** or **habits of mind** to use those skills. For instance, Wade and Travis (1987, cited in Wade, 1995) identified 'skills' (or 'the ability') and 'dispositions' (or 'the willingness') as two key components of critical thinking. In an earlier study, Ennis (1996, p. 165)–citing examples from numerous scholars including Baron, 1985; Dewey, 1930; Ennis, 1987, 1991; Facione & Facione, 1992; Martin, 1992; McPeck, 1991; Norris, 1992; Norris & Ennis, 1989; Passmore, 1967; Paul, 1990; Perkins, Jay, & Tishman, 1993; Resnick, 1987; Siegel, 1988; and Taube, 1993 (refer to original paper for the relevant citations)–argues that critical thinking ability may not be sufficient and specifies the importance of critical thinking dispositions. **Disposition**, according to Ennis (1996) refers to "a tendency to do something, given certain conditions" (p. 166). These dispositions usually do not change in the short term, i.e., weeks, and according to a study by Giancarlo and Facione (2001, cited in Quitadamo and Kurtz, 2007), undergraduate critical thinking disposition changed significantly after two years. As a result, while critical thinking skills can be changed over weeks, changes in undergraduate critical thinking disposition can only be measured in years as per Giancarlo and Facione's (2001, cited in Quitadamo and Kurtz, 2007) findings.

In addition, Ennis (1996) also points out that these dispositions, such as 'open to alternatives', are hidden qualities of critical thinking and are not usually "obvious by inspection" (p. 166). This suggests that something must happen in order for a specific disposition of critical to be revealed, which in turn makes assessment of those dispositions challenging (Ennis, 1996). Furthermore, Ennis (1996) also critiques the works of other scholars–including Norris (1992), Siegel (1988), Facione, Sanchez, & Facione, (1994) and Perkins, Jay & Tishman (1993)–on their lack of sufficient guidance, incompleteness, vagueness of certain dispositions, and relative size and comprehensives of the list respectively, and offers a simpler set of dispositions–hoping to compensate the shortcomings of earlier mentioned system–that describes ideal critical thinkers: "

1. **Care that their beliefs be true, and that their decisions be justified**; that is care to 'get it right' to the extent possible, or at least care to do the best they can. This includes the interrelated dispositions to do the following:

    a. Seek alternatives (hypotheses, explanations, conclusions, plans, sources), and be open to them;
    b. Endorse a position to the extent that, but only to the extent that, it is justified by the information that is available;
    c. Be well-informed; and
    d. Seriously consider points of view other than their own.
2. **Represent a position honestly and clearly** (theirs as well as others'). This includes the dispositions to do the following:
    a. Be clear about the intended meaning of what is said, written, or otherwise communicated, seeking as much precision as the situation requires;
    b. Determine, and maintain focus on, the conclusion or questions;
    c. Seek and offer reasons;
    d. Take into account the total situation; and
    e. Be reflectively aware of their own basic beliefs.
3. **Care about the dignity and worth of every person**. This includes the dispositions to:
    a. Discover and listen to others' view and reasons;
    b. Take into account others' feelings and level of understanding, avoiding intimidating or confusing others with their critical thinking prowess; and
    c. Be concerned about others' welfare." (p. 171).

Similarly, consolidating findings from appropriate literatures, Cheung et al. (2002) also argue that,

> "many previous conceptualizations [of critical thinking] tend to focus exclusively on thinking and neglect its essential qualifier, critical. Thus, they overemphasize thinking skills and downplay critical elements. An adequate conceptualization of critical thinking should combine cognitive thinking skills, motivational dispositions, behavioral habits, and ideological beliefs."

In addition, Cheung et al. (2002) take a step further to provide a list of concepts–some were briefly elaborated while others were merely listing–to clarify skills involves in the four components that made up the conceptualization of critical thinking. The list is summarized and presented in **↘Table 2.11**.

More recently, Elder & Paul (2010) believe that in order for students to learn critical thinking, educators need to have developed a worldview that "fosters a reasonable, rational, multilogical worldview" (p. 38) before they could 'explicitly' and intentionally teach it through 'focused instruction' with appropriate standards.

Table 2.11 **Cheung, Rudowicz, Kwan, & Yue's Components of Critical Thinking**

Component	Relevant Concepts
Cognitive thinking skills	Interpretation (categorization, decoding, significance, clarifying meaning); Analysis (examining ideas, identifying arguments, analyze arguments); Evaluation (assessing claims, assessing arguments); Inference (querying evidence, conjecturing alternatives, drawing conclusions); Explanation (stating results, justifying procedures, presenting arguments); Self-regulation (self-examination, self-correction); Deduction (analogic reasoning, using analogies, formulating hypotheses, extension of arguments, ability to build knowledge, modeling, prediction, adaptive reasoning); and Integration (put all of the above together).
Motivational dispositions	Inquisitiveness, concern for being well-informed, alertness to opportunities, trust in the processes of reasoned inquiry, self-confidence in own ability to reason, open-mindedness, flexibility, understanding of opinions of others, fair-mindedness, honesty in facing biases, prudence, willingness to reconsider, clarity, orderliness, diligence, reasonableness, care in focusing attention, persistence, and precision.
Behavioral habits	Requires the practice of critical thinking to become a habit or life style for the students to exercise the abovementioned cognitive thinking skills.
Ideological beliefs	This concern has lent support for critical beliefs that knowledge is not absolute and emancipated people from the oppression of unreasonable structure and ideology. This suggests not only it would support the endorsement to the scientific world-view–which dictates the need for understanding how the world operates, with reference to a set of general principles for pursuing truth–but also appreciate the paranormal belief and absolutist belief that oversimplify reality and hinders an appreciation of the complexity of social life in a pluralistic society.

Source: Adapted from Cheung, Rudowicz, Kwan, & Yue (2002).

As a result, over a series of articles, Paul and Elder (2011a, 2011b) and Elder and Paul (2012), outline the 11 competency standards (refer to ↘**Table 2.12**), where each standard is accompanied with the relevant principles, performance indicators and dispositions, and outcomes.

In addition, Paul and Elder (2005) also provides a more comprehensive framework, which is made up of four foundational sets of concepts in critical thinking–namely 1) **elements of thought**, 2) **universal intellectual standards**, 3) **intellectual traits or virtues (or dispositions)** and 4) **natural predispositions of the mind: egocentrism and sociocentrism**–that "those who teach must command if they are to foster critical thinking competencies" (p. 54). The overall framework is presented in ↘**Figure 2.5**.

The first three foundational sets of concepts are presented in ↘**Table 2.13-2.15** with appropriate explanation–drawn from the authors–accordingly, while the last foundational set of concepts was presented earlier in ↘**Table 2.9**.

Table 2.12 **Competency Standards of Critical Thinking**

No	Standard	Description
1	**Purposes, goals, and objectives**	Students who think critically recognize that all thinking has a purpose, objectives, goal or function.
2	**Questions, problems and issues**	Students who think critically recognize that all thinking is an attempt to figure something out, to settle some question or solve some problem.
3	**Information, data, evidence and experience**	Students who think critically recognize that all thinking is based on some data, information, evidence, experience, or research.
4	**Inferences and interpretation**	Students who think critically recognize that all thinking contains inferences, which are used to draw conclusions and give meaning to data and situations.
5	**Assumptions and presuppositions**	Students who think critically recognize that all thinking is based on assumptions: beliefs we take for granted.
6	**Concepts, theories, principles, definitions, law and axioms**	Students who think critically recognize that all thinking expressed through, and shaped by, concepts and ideas.
7	**Points of view and frames of reference**	Students who think critically recognize that all thinking occurs with some point of view.
8	**Fairmindedness**	Students who think critically strive to be fairminded.
9	**Intellectual humility**	Students who think critically routinely strike to apply intellectual humility.
10	**Intellectual courage**	Students who think critically exhibit intellectual courage.
11	**Intellectual empathy**	Students who think critically develop the capacity to sympathetically enter into points of view that differ from their own; they articulate those views in an intelligent, insightful and fairminded way.

Source: Adapted from Paul and Elder (2011a, 2011b) and Elder and Paul (2012).

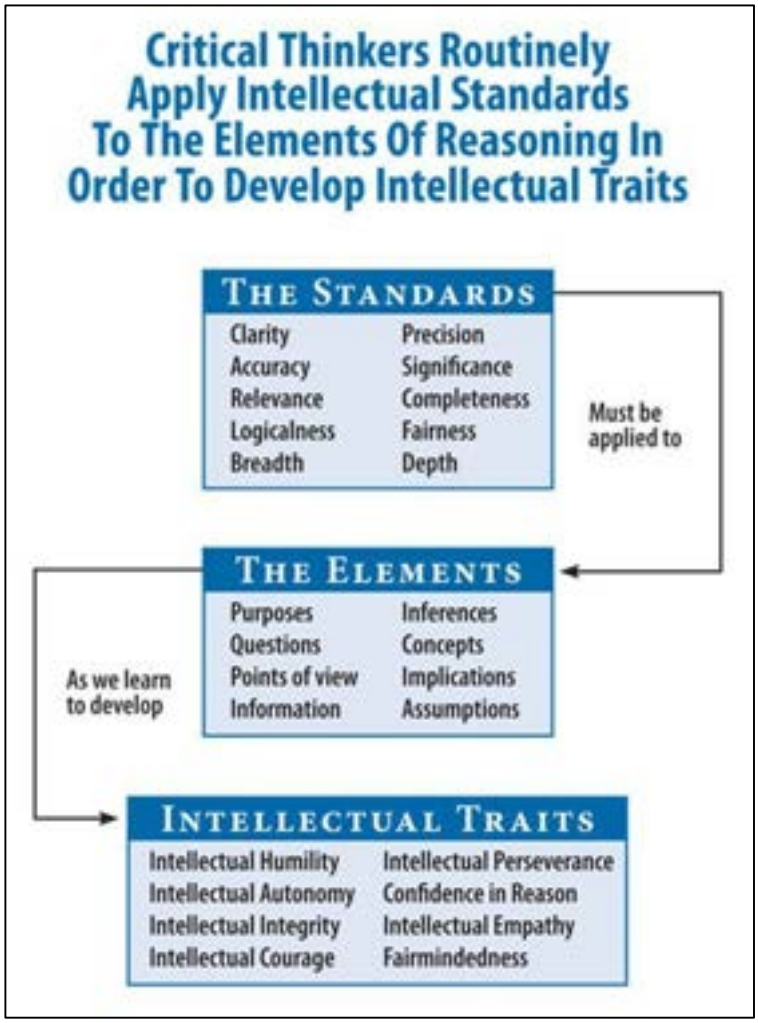

Figure 2.5 **Paul-Elder critical thinking framework** (Source: http://www.criticalthinking.org).

Table 2.13 **The Eight Elements of Thought—Template to Assess and Analyze Quality of Research**

Element	Description
1) Purposes	All research has a fundamental PURPOSES and goals. • Research purposes and goals should be clearly stated. • Related purposes should be explicitly distinguished. • All segments of the research should be relevant to the purpose. • All research purposes should be realistic and significant.
2) Questions	All research addresses a fundamental QUESTION, problem or issue. • The fundamental question at issue should be clearly and precisely stated. • Related questions should be articulated and distinguished. • All segments of the research should be relevant to the central question. • All research questions should be realistic and significant. • All research questions should define clearly stated intellectual tasks that, being fulfilled settle the questions.
3) Information	All research identifies data, INFORMATION, and evidence relevant to its fundamental question and purpose. • All information used should be clear, accurate, and relevant to the fundamental question at issue. • Information gathered must be sufficient to settle the question at issue. • Information contrary to the main conclusions of the research should be explained.
4) Inferences	All research contains INFERENCES or interpretations by which conclusions are drawn. • All conclusions should be clear, accurate, and relevant to the key question at issue. • Conclusions drawn should not go beyond what the data imply. • Conclusions should be consistent and reconcile discrepancies in the data. • Conclusions should explain how the key questions at issue have been settled.
5) Point of view	All research is conducted from some POINT OF VIEW or frame of reference. • All points of view in the research should be identified. • Objections from competing point of view should be identified and fairly address.
6) Assumptions	All research is based on ASSUMPTIONS. • Clearly identify and assess major assumption in the research. • Explain how the assumptions shape the research point of view.
7) Concepts	All research is expressed through, and shaped by, CONCEPTS and ideas. • Assess for clarity the key concepts in the research. • Assess the significance of the key concepts in the research.

Element	Description
8) Implications	All research leads somewhere (i.e., have IMPLICATIONS and consequences). • Trance the implications and consequences that follow from the research. • Search for negative as well as positive implications. • Consider all significant implications and consequences.

Source: Paul, R., & Elder, L. (2007). The miniature guide to critical thinking: Concepts and tools. USA: The Foundational for Critical Thinking, p. 21.

Table 2.14 **The Nine Intellectual Standards Essential to Reasoning Well**

Standard	Description
1) Clarity	"Understandable, the meaning can be grasped, to free from confusion or ambiguity, to remove obscurities. If a statement is unclear, one cannot determine whether it is accurate or relevant ... impossible to tell anything about a statement without knowing what it is saying ... It is helpful to assume that one does not fully understand a thought ... [unless] he or she can elaborate, illustrate, and exemplify it. • Could you elaborate on that point? Or do I need to elaborate on that point? • Could you express that point in another way? Can I express that point differently? • Could you give me an illustration? Or should I give an illustration? • Could you give me an example? Or should I provide an example? • Let me state in my own words what I think you just said. Am I clear about your meaning? • I hear you saying "_____." Am I hearing you correctly, or have I misunderstood you?" (p. 32).
2) Accuracy	"Free from errors, mistakes or distortions; true, correct. A statement can be clear but not accurate ... It is useful to assume that a statement's accuracy has not been fully assessed except to the extent that one has checked to determine whether it represents things as they really are. • How could I check that to see if it is true? • How could I verify these alleged facts? • Can I trust the accuracy of these data given the source from which they come?" (p. 32).
3) Precision	"Exact to the necessary level of details, specific. A statement can be both clear and accurate, but not precise ... It is likely that one does not fully understand a statement ... [unless] he or she can specify it in detail. • Could you give me more details about that? • Could you be more specific? • Could you specify your allegations more fully?" (p. 32).

Standard	Description
4) Relevance	"Bearing upon or relating to the matter at hand; implies a close logical relationship with, and importance to, the matter under consideration. A statement can be clear, accurate, and precise but not relevant to the question at issue ... It is useful to assume individuals have not fully assessed thinking ... [unless] they have considered all issues, concepts, and information relevant to it. • I don't' see how what you said bears on the question. Could you show me how it is relevant? • Could you explain the connection between your question and the question we are addressing? • How does this fact bear upon the issue? • How does this idea relate to this other idea? • How does your question relate to the issue at hand?" (p. 32).
5) Depth	"Containing complexities and multiple interrelationships, implies thoroughness in thinking through the many variables in the situation, context, idea, or question. A statement can be clear, accurate, precise, and relevant, but superficial (i.e., lack depth) ... A line of thinking is not fully assessed ... [unless] one has fully considered all the important complexities inherent in it. • Is this question simple or complex? Is it easy or difficult to answer well and truly? • What makes this a complex question? • How am I dealing with the complexities inherent in the question?" (pp. 32-33).
6) Breadth	"Encompassing multiple viewpoints, comprehensive in view, wide-ranging and broadminded in perspective. A line of reasoning may be clear, accurate, precise, relevant, and deep but lack breadth (as in an argument from either the conservative or liberal standpoints which details the complexities in an issue, but only recognizes insights from one perspective) ... breadth of thinking requires the thinker to reason insightfully within more than one point of view or frame of reference. One has not fully assessed a line of thinking ... [unless] that individual has determined how much breadth of thinking is required to understand it. • What points of view are relevant to the issue? • What relevant points of view have I ignored thus far? • Am I failing to consider this issue from an opposing perspective because I am not open to changing my view? • I have looked at the question from an economic viewpoint. What is my ethical responsibility? • I have considered a liberal position on the issue. What would conservatives say?" (p. 33).

Standard	Description
7) Logic	"The parts make sense together, no contradictions, in keeping with the principles of sound judgment and responsibility. When one thinks, a person brings a variety of thoughts together into some order. When the combination of thoughts is mutually supporting and makes sense in combination, the thinking is logical ... Thinking can be consistent and integrated. It can make sense together or be contradictory or conflicting. • Does all this fit together logically? • Doe this really make sense? • Does that follow from what you said? • Does what you say follow from the evidence? • Before you implied this and now you are saying that, I don't see how both can be true. What exactly is your position?" (p. 33).
8) Significance	"Having importance, being of consequence; having considerable or substantial meaning. When reasoning through an issue, one should concentrate on the most important information (relevant to the issue) and take into account the most important ideas of concepts ... though many ideas may be relevant to an issue, they may not be equally important ... thinker may fail to ask the most important questions and instead become mired in superficial questions ... of little weight ... [Thinking] can focus on what is most substantive, what is of the highest consequence, what has the most important implications. • What is the most significant information needed to address this issue? • How is that fact important in context? • Which of these questions is the most significant? • Which of these ideas or concepts is the most important?" (pp. 33 & 36).
9) Fairness	"Free from bias, dishonesty, favoritism, selfish-interest, deception or injustice. Fairness implies the treating of all relevant viewpoints alike without reference to one's own feelings or interests. Because everyone tends to be biased in favor of their own viewpoint, it is important to keep the intellectual standard of fairness at the forefront of thinking ... [especially when] examine things that are difficult to see or give something up. Whenever more than one point of view is relevant to the situation or in the context, the thinker is obligated to consider those relevant viewpoints in good faith. • Does a particular group have some vested interest in this issue that causes them to distort other relevant viewpoints? • Am I sympathetically representing the viewpoints of others? • Is the problem addressed in a fair manner, or is personal vested interest interfering with considering the problem from alternative viewpoints? • Are concepts being used justifiably (by this or that group)? Or is some group using concepts unfairly in order to manipulate (and thereby maintain power, control, etc.)?" (p. 36).

Source: Paul, R., & Elder, L. (2013). Critical thinking: Intellectual standards essential to reasoning well within every domain of human thought, part two. Journal of Developmental Education, 37(1): pp: 32-33, 36.

Table 2.15 **The Eight Essential Intellectual Traits**

Element	Performance indicators & dispositions
1) Intellectual Humility	"Students who think critically routinely strive to distinguish what they know from what they don't know. ... is the development of knowledge of one's ignorance ... involves a consciousness of the limits of one's knowledge, including a sensitivity to circumstances in which one's native egocentrism is likely to function self-deceptively ... entails being aware of one's biases, one's prejudices, the limitations of one's viewpoint, and ... one's lack of knowledge ... one should not claim more than one actually knows. It does not imply spinelessness or submissiveness. It implies the lack of intellectual pretentiousness, boastfulness, or conceit, combined with insight into the logical foundations, or lack of such foundations, of one's believes" (p. 32).
2) Intellectual Courage	"Students who think critically are willing to challenge popular beliefs. ... is the consciousness of the need to face and fairly address ideas, beliefs, or viewpoints toward which one has strong negative emotions and to which one has not given serious hearing ... entails the willingness to face the disapproval of the group in expressing and unpopular idea or challenging a popular one. Humans are in many ways natural conformists. They live in social groups and unreflectively accept the dominant beliefs of the groups that exercise control over them. Intellectual courage is connected to the recognition that ideas considered dangerous or absurd within a society are sometimes rationally justified (in whole or in part). Conclusions and beliefs inculcated in people are sometimes false or misleading ... courage is required when approval may be withdrawn for non-conformity" (pp. 33-34).
3) Intellectual Empathy	"Students who think critically develop the capacity to sympathetically enter into point of view that differ from their own and articulate those views in an intelligent and insightful way. ... is an awareness of the need to imaginatively put oneself in the place of others so as to genuinely understand them ... [and] routinely reconstruct (accurately) the viewpoints and reasoning of others ... routinely reason from premises, assumptions, and ideas other than their own. They are predisposed to remember occasions when they were wrong in the past despite an intense conviction of being right (and they are therefore guided by the fact that they may be wrong in the present situation) ... continue to grow and develop, modifying their thinking by seriously considering widely different viewpoints over time" (pp. 34-35).
4) Intellectual Autonomy	"Students who think critically learn to take responsibility for their own thinking, beliefs, and values. ... it the trait one acquires as one learns to take responsibility for the authorship of one's thinking and one's life ... opposite of becoming dependent on others for the direction and control of the decisions of one's life ... [determine] what to believe and what to reject. Recognizing that most of the beliefs they old have not been analyzed and assessed for quality, they continually seek to identify their beliefs and then to assess them using applicable standards ... think through situations, issues and problems for themselves and do not fear rejection from any group (including their family, their religion, their country) ... examine information for themselves and reject unjustified authorities, which recognizing the contributions of reasonable authorities" (pp. 38-39).

Element	Performance indicators & dispositions
5) Intellectual Integrity	"Students hold themselves to the same standards they expect others to meet. ... is manifested in the commitment to hold oneself to the same standards of evidence and proof one expects others to meet (especially one's antagonists) ... [those who think critically] gain insight into themselves by identifying their own most basic inconsistencies of thought, word, and deed. They can identify and honestly admit, discrepancies and inconsistencies in their own thoughts and actions ... recognize that the mind is naturally prone to hold others to higher standards than then standards it is imposes on itself" (p. 35).
6) Intellectual Perseverance	"Students who think critically learn to work through complexities and frustration without giving up. ... is the disposition to work one's way through intellectual complexities despite frustrations inherent in an intellectual task ... develop intellectual strength and self-confidence by working through to the solution (or completion) of a complex and challenging problem (or tasks) ... recognize that some intellectual problems are complex and cannot be easily solved ... have a realistic sense of the need to struggle with confusion and unsettled questions over an extended time to achieve understanding or insight" (p. 36).
7) Confidence in Reason	"Students who think critically recognize that good reasoning is the key to living a rational life, and to creating a fairer and just world. ... is based on the belief that, in the long run, one's own higher interests and those of humankind at large are best served by giving the freest play to reason, by encouraging people to come to their own conclusions, by developing , as far as possible, the rational faculties of everyone living in the society ... develop confidence in reason by using their reason to successfully figure out solutions to problems and tasks ... [understand that] with proper encouragement and cultivation, people can learn to think for themselves; form insightful viewpoints; draw reasonable conclusions; think clearly, accurately, relevantly, and logically; persuade each other by appeal to good reason and sound evidence, and become reasonable persons, despite the deep-seated obstacles in human nature and social life ... reasonability is the centerpiece in their live (both being reasonable themselves, and holding others to the standard of reasonability) ... use good reasoning as the fundamental criterion for accepting or rejecting any belief or position" (p. 37).
8) Fair-mindedness	"Students who think critically strive to be fair-minded. ... seek to treat all viewpoints with equality, without reference to one's own [and others'] feelings or selfish interests ... adhere to intellectual standards uninfluenced by one's own advantage or the advantage of one's group" (p. 31).

Source: Paul, R., & Elder, L. (2005). A guide for educators to critical thinking competency standards: Standards, principles, performance indicators, and outcomes with a critical thinking master rubric. USA: The Foundational for Critical Thinking, pp. 31-39.

Among the three frameworks presented in the previous pages, it seems that the list from Cheung et al. (2002) is the only one that takes into consideration of ideological beliefs that embrace knowledge in broadest sense. However, in terms of comprehensiveness, the work of Richard Paul and Linda Elder stands out due to its

competency standards, principles, performance indicators and outcomes that not only may be useful for educators when it comes to designing and infusing critical thinking into the curriculum, but also provide common vocabulary for those who want to discuss, evaluate or teach critical thinking (Ralston & Bays, 2013).

The findings thus far suggest that critical thinking–similar to many other thinking skills–is an ability that can be acquired and develop over time with effort invested from both ends of teaching and learning, and require appropriate feedback in order to improve and excel. This also suggests that critical thinking requires us to (1) ask question purposefully, (2) consider an issue from multiple perspectives, including conflicting ideas and evidence, to form arguments that are grounded with substantial evidence, and (3) think independently, i.e., with a point of view, and creatively, i.e., with reference to but not relying on past experiences, when making decision or solving problem. Addition to ability, one must also be inclined to or have developed habits of mind to use those skills. All these are crucial in the context of design as the essence of design is about creation of value (Heskett, 2008) or improving existing conditions into preferred ones (Simon, 1996).

Critical Thinking in the Context of Design

In the context of design, Tippey (2008) also points out that critical thinking is the ways designers observe, learn, analyze challenges and make sound and logical decisions when proposing desirable, feasible and viable solutions. As a result, it is reasonable to conjecture that the ability to think critically–about what is being learnt, and at the same time interpreting and making connections–becomes the essence of the learning process (Paul & Elder, 2005). As a result, it can be argued that critical designers need to constantly analyze, evaluate and improve their thinking about (a) what they are thinking about, i.e., process and performance; and (b) what they are making, i.e., the artifact. In addition, Paul (2005) also states that creative thinking is:

> "a natural by-product of critical thinking, precisely because analyzing and assessing thinking enables one to raise it to a higher level–to recreate it, as it were" (p. 28). It is believed that new and better thinking is the consequence of healthy critical thought (Paul and Elder, 2004, cited in Paul, 2005, p. 28).

In many design disciplines, educators, scholars and practitioners highly emphasize the importance of critical thinking and believe that critical thinking is discipline-specific. For instance, a closer examination of Tippey's (2008) paper entitled *Critical thinking is not discipline-specific: Teaching critical thinking to the beginning design student* supports the argument and reveals that the term 'discipline'–in the context of his paper–was, in fact, referring to all the sub-disciplines of design–including communication design, interior design, industrial and product design, urban design and to a greater extent architecture and engineering–and argues that critical thinking should be introduced across all design sub-disciplines as one of the core learning

components to design students. Furthermore, although no clear mentioned of whether critical thinking is discipline-specific, Stead (2003) stresses the importance of critical thinking in architectural education and reflected on the possibility to teach critical thinking in a manner specific to architecture (p. 3) that "must be folded throughout design education, and not just serve as the icing on the cake" (p. 12). Also, according to Piotrowski (2011), among the essential components of a design education–i.e., acquiring the skills for the profession, appreciating the art of design, and learning all the technical design knowledge–ability to think critically "expands the designer's value to clients, improves business performance, and indeed makes a better citizen" (p. 9).

In the realm of design practice–if that matters–designers and design firms have also expressed their views on the lacking and importance of critical thinking in recent years. For instance, Barratt (2009), president and CEO of Teague, argues that the design industry lacks "careful and deliberate analysis that's intended to identify genuine existing conditions, rather than the conditions that those with vested interests may want us to believe are true ... critical thinking in design, whether from historians, educators, authors or journalists, is largely absent" (¶ 1). In addition, Zmijewski (2010), founder and chief instigator of Zurb, points out that critical thinking doesn't get enough attention in most design companies but it is a vital component that should not be overlooked when it comes to the overall success of a design project. Furthermore, Glicksman (2013) also points out that critical thinking is an essential element of becoming a better designer and links application of critical thinking to design critiques. Coincidently, in their upcoming book, *Discussing Design* (to be released in June/ July 2015), designers Adam Connor and Aaron Irizarry argue the need for critical thinking in feedback and improving design, where,

> "[C]ritical thinking is the process of taking a statement and determining if it is true or false. When we're designing something, we're doing so to meet or achieve some set of objectives. When looking for feedback on our creations, what we should be working to understand is whether we think it's true or not that what has been created and the method in which it's been created will work to achieve those objectives. We're looking for a form of analysis to take place" (cited in Treseler, 2015, ¶ 17).

Having said all that, where then is critical thinking situated in design and how do we teach critical thinking in the context of design education? In his book *How Designers Think: The Design Process Demystified*, Lawson (2006), presents a simplified map of design process (refer to **↘Figure 2.6**) that shows the design process as a negotiation between problem and solution, where each is perceived as the reflection of the other. Throughout the negotiation process, three activities–namely, **analysis**, **synthesis** and **evaluation**–are repeated rapidly and iteratively until the entire negotiation is completed (Lawson, 2005). Although not clearly spelt out by Lawson (2006), the three activities can be considered as the higher order thinking–on Bloom's taxonomy (Bloom

& Krathwohl, 1956)–that closely associated with critical thinking as mentioned in the earlier discussion.

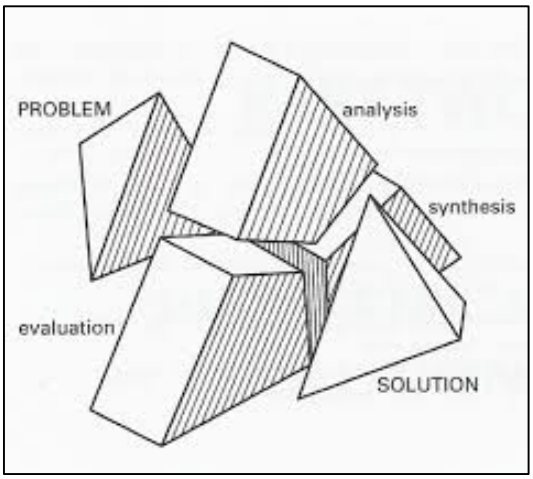

Figure 2.6 **Design process** (Lawson, 2005, p.49)

In addition, Duberly, Evenson & Robinson (2008) also present an **Analysis-Synthesis Bridge Model** (refer to **↘Figure 2.7**) and explains that:

> "The left column represents **analysis** (the problem, current situation, research, constituent needs, context). The right column represents **synthesis** (the solution, preferred future, concept, proposed response, form). The bottom row represents the concrete world we inhabit or could inhabit. The top row represents abstractions, models of what is or what could be, which we imagine and share with others" (p. 57).

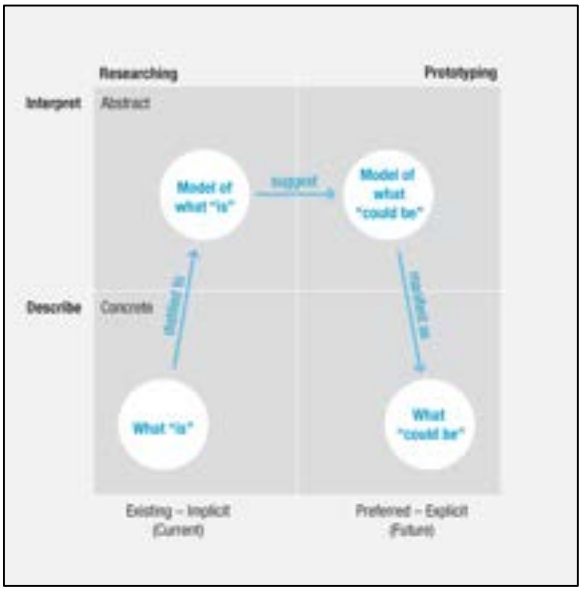

Figure 2.7 **Analysis-Synthesis Bridge Model** (Duberly, Evenson & Robinson, 2008)

In Duberly, Evenson & Robinson's (2008) model, two of the three activities shown in Lawson's (2005) model–i.e., analysis and synthesis–have been separated and treated as the pre-requisite of the other in design, i.e., the design of prototype is informed by the research findings.

Similarly, Kumar (2012)–building on his earlier works at IIT Institute of Design–also shares similar components, where analysis and synthesis are again treated as two distinct quadrants in the two-by-two matrix of his seven modes of the design innovation process (refer to ↘**Figure 2.8**).

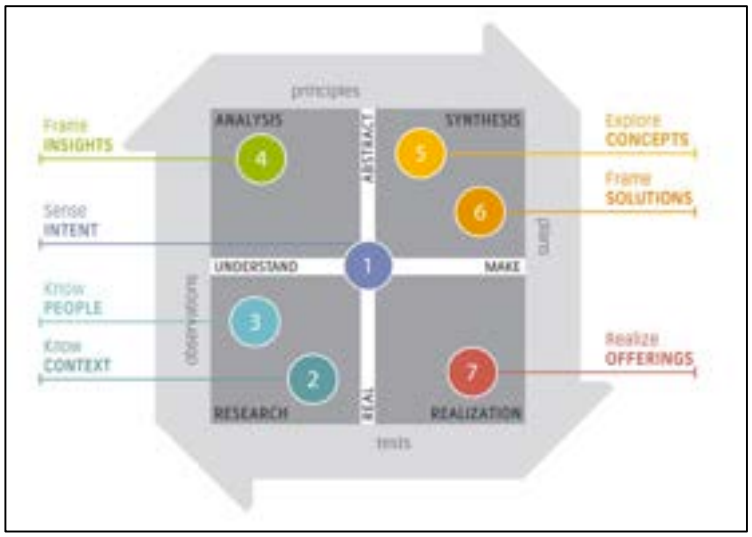

Figure 2.8 **Seven Modes of the Design Innovation Process** (Kumar, 2012)

While analysis and synthesis exist in all three models, what makes Lawson's (2005) model different from Duberly, Evenson & Robinson's (2008) and Kumar's (2012) is that Lawson (2005) treats analysis and synthesis as interrelated components in every iteration, i.e., when something is being analyzed and broken apart, all the parts will subsequently be synthesized or put together to re-establish and form a new whole. This is what Paul & Elder (2006) refer to three interwoven phases of critical thinking, where it first focuses on **analyzing thinking** "by focusing on the parts of thinking in any situation–its purpose, question, information inferences, assumptions, concepts, implications and point of view" (p. xvii); then it **evaluates thinking** "by figuring out its strengths and weaknesses: the extent to which it is clear, accurate, precise, relevant, deep, broad, logical, significant, and fair" (p. xvii); and finally it **improves thinking** "by building on its strengths while reducing its weaknesses" (p. xvii). To illustrate, Lawson (2005) uses the thoughts of a chess player as an example to illustrate how the functions of analysis, synthesis and evaluation are related when the player makes a (chess) move.

The notion of design moves is coined by Schön (1983) to look at design work as sequences of 'seeing-moving-seeing' (e.g., Schön and Wiggins, 1992). A move takes place when the designer evaluates–which requires one to pass a judgment that can be done effectively with the ability to analyze and synthesize–a situation. For every move,

it will give "the situation new meanings. The situation talks back, the practitioner listens, and as he appreciates what he hears, he reframes the situation once again" (Schön, 1983, pp. 131-132).

The above arguments from Lawson (2005) and Schön (1983) suggest that it makes less sense to separate analysis and synthesis as two discrete components. Same argument is applicable to the complementary role of divergent thinking and convergent thinking in any creative endeavor. Rarely, one would not claim the completion of any creative exercise until one has generated–through divergent thinking–and evaluated–through convergent thinking–the ideas, before one moves on to the next iteration within the design process. Moreover, according to Scriven (1991)–who developed one of the earliest definitions of evaluation–defines evaluation as:

> "the process of determining the merit, worth or value of something, or the product of that process. Terms used to refer to the process or part of it include: appraise, analyze, assess, critique, examine, grade, inspect, judge, rate, rank review, study, test, ... The evaluation process normally involves some identification of relevant standards of merit, worth, or values; some investigation of the performance of evaluands on these standards; and some integration or synthesis of the results to achieve an overall evaluation or set of associated evaluations" (p. 139).

Scriven's (1991) definition of evaluation suggests that analysis and synthesis are interrelated and will exist throughout the entire design process. For examples, analysis and synthesis are required during research when one attempts to understand the contexts; and analysis and synthesis are equally important in the development of prototype when one tries to evaluate the prototype through user testing, where one seeks feedback from users, analyze and synthesize the feedbacks to inform the modification of prototype for subsequent testing.

The arguments thus far show that not only creative thinking is needed in the design process, critical thinking–"thinking oriented toward consideration, evaluation and the synthesis of information, resulting in a decision" (Plotrowski, 2011, p. 3)–plays an equally important role to ensure a closure before one's next design moves.

Assessment of Critical Thinking in Design

While Paul and Elder (2005) might have provided all the competency standards, principles, performance indicators and outcomes, the master rubric proposed by Paul and Elder (2005) makes it challenging to rate all the 25 standards (refers to ↘**Figure 2.9**) as each standard contain 1) critical thinking principle describing a specific standard, 2) a paragraph that lists out the performance indicators and dispositions pertaining to the specific standard, and 3) a list of outcomes ranging from five to 22.

The 25 Critical Thinking Competency Standards
1. Purposes, goals, and objectives
2. Questions, problems, and issues
3. Information, data, evidence, and experience
4. Inferences and interpretations
5. Assumptions and presuppositions
6. Concepts, theories, principles, definitions, laws and axioms
7. Implications and consequences
8. Points of view and frames of reference
9. Assessing thinking
10. Fairmindedness
11. Intellectual humility
12. Intellectual courage
13. Intellectual empathy
14. Intellectual integrity
15. Intellectual perseverance
16. Confidence in reason
17. Intellectual autonomy
18. Insight into egocentric thought
19. Insight into sociocentric thought
20. Skills in the art of studying and learning
21. Skills in the art of asking essential questions
22. Skills in the art of close reading
23. Skills in the art of substantive writing
24. Ethical reasoning abilities
25. Skills in detecting media bias and propaganda in national and world news

Figure 2.9 **Paul-Elder critical thinking competency standards**

Additional to Paul and Elder (2005), the Association of American Colleges and Universities (2010) also develops their own rubrics (see ↘**Table 2.16**). Many universities in United States have since adopted–and some have made appropriate modification–the rubric to assess critical thinking at university level.

Table 2.16 **Critical Thinking VALUE Rubric**

	Capstone 4	Milestone (3)	Milestone (2)	Benchmark (1)
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

	Capstone 4	Milestone (3)	Milestone (2)	Benchmark (1)
Evidence (Selecting and using information to investigate a point of view or conclusion)	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/ hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different side of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcome (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Educators would generally agree that students acquire critical thinking by solving challenging and open-ended problems–that require genuine inquiry, analysis, synthesis and assessment–or learning experiences that incorporate element of inquiry including

discussions, debates, structured controversy, journaling, mock trials, inquiry-guided labs, debriefings of complex cases, simulations and role plays. In the context of design education, two of the most commonly used teaching and learning strategies to develop critical thinking skills are critique and reflective (or learning) journal. While critiques are mostly appeared at specific points in time, i.e., during the middle–commonly known as interim crit–and at the end–commonly known as final crit–of the design process (see **↘Table 2.17** for brief summary of different types of critiques), reflective journal can be used throughout the learning and designing process.

Table 2.17 **Types of Critiques**

Approach	Definitions
Blythman, Orr, & Blair (2007)	1) Peer crits, 2) desk crits, 3) online crits, 4) formative crits, 5) seminars, 6) review or group crits, 7) industry project crits, and 8) summative crits.
Hokanson (2012)	1) Individual or small group critiques, 2) desk crit, a central element in critique will be used to describe one-on-one sessions generally between learner and teacher, and student and critic, 3) final, formal, summative critiques are called final reviews, juries, or final critique, and 4) Intermediate critiques are usually called interim.

Central to all design studios–refers to "reflective practicum" by Schön (1983, 1987) as a learning environment that encourages making, analysis, and reflection on one's work–or design education is critique, often refers to as 'the crit' (Gray, 2013; Hokanson, 2012; Rennie, 2013; Wong, 2011). Fundamentally, critique sessions are used to develop students' ability to evaluate their technical, aesthetic, written and verbal skills (Whittington, 2004) and to transfer design knowledge between educators and students (Uluoglu & Taksim, 2000). However, in order to critique–or get one to think critically–it requires something. In other words, critique 'forces' students to make or do something (Kolko, 2011).

Critique, essentially, is a meaningful conversation between two or more parties–looking critically at a given completed artifact or a piece of work-in-progress–that "flows through open-ended questions … to rationalization … to very detailed value judgment" (Kolko, 2001, p. 81). It could also be seen as being critical about one's critical thinking, where "critical thinking is an essential and important aspect inherent in the activity of making … and the process of discovering forms, strategies and techniques includes the development of a critical attitude toward craft" (Gore, 2004, cited in de la Harpe, Peterson, Frankham, Zehner, Neale, Musgrave & McDermott, 2009, p. 37). According to Hokanson (2012), critique means "a systematic and objective examination of an idea, phenomenon, or artifact" (p. 74) and

> "a challenge to the designer's ability; information must be gathered and synthesized, and a guiding idea or concept, thesis, or partí must be developed and communicated to others. And, specifically, the designers must open themselves to the criticism of others and answer that criticism with the quality of their argument and improvement in their work" (p. 71).

In addition, Cross (1997, cited in Hokanson, 2012) also points out that the quality of design doesn't come from following rules but "through independent and seasoned expert judgment" that acquired from designing (p. 72).

However, one would argue to that critique is not the only way to develop critical thinking skills. Existing literature reveals that the role of reflection on the making process and outcome, i.e., design artifact is widely acknowledged as one of the essential components to the identity formation of becoming a 'thoughtful' and 'reflective' designer (Cross, 2007; Löwgren and Stolterman, 2004, p. 2; Schön, 1983; Schön, 1985). The next section will explore the potential use of learning journal as a tool to develop students' reflective and critical thinking skills.

5) Learning Journal as a Tool to Develop Reflective and Critical Thinking

> "Writing is thinking. To write well is to think clearly. That's why it's so hard."
>
> – David G. McCullough, two-time Pulitzer Prize winner

Quitadamo and Kurtz (2007) citing earlier works of scholars and argue the advantages of writing. Specifically, they believe that writing can improve thinking process (see Rivard, 1994 and Klein, 2004, cited in Quitadamo & Kurtz, 2007), and student learning (see Champagne & Kouba, 1999, Kelly & Chen, 1999, Keys, 1999, and Hand & Prain, 2002, cited in Quitadamo & Kurtz, 2007). In fact, in a study consist of writing group (N=128) and non-writing control group (N=152) of an undergraduate general education biology class, the results suggested the "writing group significantly outperformed their non-writing peers in both total critical thinking skills and the component critical thinking skills of analysis and inference (Quitadamo & Kurtz, 2007, p. 149). Furthermore, literature also reveals that "with written assignments, an instructor can encourage the development of dialectic reasoning by requiring students to argue both (or three, four, or five) sides of an issue" (Wade, 1995, p. 24). Çavdar and Doe (2011) also argue that,

> "through well-designed writing assignments, instructors can encourage students to reconsider concepts, critically evaluate assumptions, and

undertake substantive revisions of their writing ... [and] crucial in cultivating critical thinking skills" (p9. 298-299).

As a result, Paul and Elder (2007) argue that "one cannot be educated and yet unable to communicate one's idea in writing form" (p. 7).

Journal has been historically linked to travel diaries in the nineteenth century, to diaries written for spiritual or religious purpose and also to highly personal and self-revelatory accounts such as those of Carl Jung and Anais Nin (Moon, 2006). Journal, according to Stevens and Cooper (2009), can be defined as "[a] sequential, dated chronicle of events and ideas, which includes the personal responses and reflections of the writer (or writers) on those events and ideas" (p. 5). ↘**Table 2.18** provides a summary of different classifications of journal.

Table 2.18 **Classifications—Types and Formats—of Journal**

Author(s)	Classification
Hiemstra, R. (2001, pp. 20-23)	1. Learning journals 2. Diaries 3. Dream book or log 4. Autobiographies, life stories, and memoirs 5. Spiritual journals 6. Professional journals 7. Interactive reading log 8. Theory log 9. Electronic journaling
Moon, J. A. (2006, pp. 57-61)	1. Personal development planning (PDP) 2. Fieldwork or placement diaries/ logs 3. Research or project journals 4. Career management work 5. Lecture journals
Wood, J. (2013, pp. 22-24)	1. Narrative journal 2. Learning journal 3. Self-reflective or working journal 4. Positive achievement journal 5. Art or creative journal 6. Scrapbook journals or single page montage 7. Reflective frameworks and models 8. Visualization 9. Reflective worksheets 10. Dream journal

Today, journals are commonly used to record one's learning journey, which may include current and past learning experience, pace of learning, role of emotion, thoughts and insights that encourage role of cognition and facilitate the creation of new meaning or views about one's work or subject matter as one progresses through the

course (Cowan, 2014; McCallum, 2013; Silvia, Valerio & Lorenza, 2013). Keeping "**reflective journal**" (e.g., Cowan, 2014; Estrada & Rahman, 2014; Kim, 2013), "**reflective learning journal**" (e.g., Thorpe, 2004, cited in Lew & Schmidt, 2011), or "**learning journal**" (Moon, 1999, cited in Lew & Schmidt, 2011)–"as an alternative innovative tool to enhance the goals of student-directed learning" (Kim, 2013)–is an emerging requirement for higher education to promote one's self-reflection, critical thinking and other professional skills, including writing (Estrada & Rahman, 2014; Kim, 2013). As a tool, it is used for "inner dialogue that connects thoughts, feelings, and actions" (Hubbs and Brand, 2005, p. 62); recording one's thinking–i.e., about concepts acquired, critical learning incidents, interaction with peers and teachers–over a period of time with the intention to gain insights into one's learning (Thorpe, 2004, cited in Lew & Schmidt, 2011); and ask questions, admit confusion and make appropriate connections between theory and practice (Ciero, 2006, cited in Kim, 2013). It is one of many means to facilitate reflection and providing concrete evidence of professional growth and development in professions such as teaching and nursing (see Lowe, Prout & Murcia, 2013 for relevant literature). More specifically, Gleaves et al. (2008, cited in Lew & Schmidt, 2011) argue that reflective journal writing "enable students to critically review processes of their own learning and behaviors, and to understand their ability to transform their own learning strategies" (p. 531).

Similarly, Harris (2005) points out that,

> "[C]ritical reflective practice is seen as a mean of empowering practitioners and leading to more autonomous practice (Van Aswegan, 1998; Owens, Francis & Tollefson, 1998). In effect, it is the ability of practitioners to both literally and figuratively step back from their own practice and think about what they are doing in light of what they think or believe or know they ought to be doing. This thinking or believing or knowing is supported by reason, experience, evidence, analysis and logic ... through making explicit that which is implicit, it enables the practitioner to focus on decisions that will improve practice. Reflective journaling is a medium which supports this process" (p. 48).

In the context of education, Brookfield (1995, cited in Tsang, 2007) suggest the use of 'teaching log' as

> "a weekly record of critical incidents or significant experiences that leave vivid memories in their teacher's consciousness. A teacher recalls moments that make them feel most connected or disconnected, surprised, anxious or proud, and writes down such experiences in the log. By reading the log written over a period of time, he or she can detect the range, frequency and pattern of events in these incidents. By examining his/ her articulation of these experiences, the teacher can

> gain understanding of his or her values, assumptions and blind spots" (p. 682).

Scholars believe that–as a written form of expression, i.e., on paper or on the screen–journals provide an avenue, or more specifically, a physical, concrete space and place outside our mind, for us to look at ourselves, our attitudes, feelings and thoughts, and our actions in a different way, and increase our ability to develop higher order thinking skills (Doyle, 2008; Reagan, Case & Brubacher, 2000; Wood 2013). Furthermore, Desjarlais & Smith (2011) point out that reflection

> "is a process that involves playing back a period of time related to previous valued experiences in search of significant discoveries or insights about oneself, one's behaviors, one's values, or knowledge gained ... An important goal in reflection is bringing focus to an indeterminate situation (Dewey, 1938) by gaining clarity and by fully experiencing what has happened. It is important to gain closure during reflection and not ruminate repeatedly about the experience ... [it] involves divergent thinking and often includes journaling" (p. 3)

Through engaging with the experiences we encounter, we learn to appreciate and embrace what we have experienced. Such appreciation is what Eisner (1998) refers to as 'connoisseurs':

> "Connoisseurship is the art of appreciation. It can be displayed in any realm in which the character, import, or value of objects, situations, and performances is distributed and variable, including educational practice" (p. 63)

Connoisseurship entails one's ability to see, not merely to look (Eisner, 1998, p. 6). Since observation is one of the core skills of a designer, one needs to appreciate the different dimensions of given situations and experiences, and to understand how they relate to one another. Again, ability to make connection–or more specifically, synthesize–is also another key skills of a designer. In addition to the ability to observe and synthesis, one needs to also develop the ability to critique:

> "If connoisseurship is the art of appreciation, criticism is the art of disclosure. Criticism, as Dewey pointed out in Art as Experience, has at its end the re-education of perception ... The task of the critic is to help us to see.
>
> Thus ... connoisseurship provides criticism with its subject matter. Connoisseurship is private, but criticism is public. Connoisseurs simply need to appreciate what they encounter. Critics, however, must render these qualities vivid by the artful use of critical disclosure" (Eisner, 1985, pp. 92-93).

Perhaps, at the end of the day, what one should question about the value of learning journal is whether doing so will allow us to develop ourselves to become connoisseur and critic–in addition to other roles a designer play, including craftsman, facilitator, entrepreneur, researcher, life-long learner, communicators and responsible citizen (Press and Cooper, 2003).

More specifically, reflective writing–to be recorded in the learning journals–allows the writer and reader to "examine complex, ethically ambiguous, troubling, or inspiring situations to augment critical thinking skills and emotional awareness. Beyond developing an abstract reflective capacity, these papers may actively enhance phronesis, the practical wisdom necessary to guide clinical practice" (Walling, Shapiro & Ast, 2013, p. 7).

Reflective writing provides a permanent record of thoughts and experience and a safe outlet for personal concerns (Spalding & Wilson, 2002). It is also hoped that through reflective writing, students will use what they have. In fact, Holly (2003) argues that,

> "A journal is not merely a flow of impressions. It records impressions set in a context of description of circumstances, others, the self, motives, thoughts and feelings. Taken further, it can be used as a tool for analysis and introspection. It is a chronicle of events as they happen, a dialogue with the facts (objectives) and interpretations (subjective), and perhaps most importantly, it provides a basis for developing an awareness of the difference between facts and interpretations. A journal becomes a dialogue with oneself over time. To review journal entries is to return to events and their interpretation with the perspective of time. Over time, patterns and relationships emerge that were previously isolated events 'just lived'. Time provides perspective and momentum, and enables deeper levels of insight to take place" (p. 5).

Boud et al. (1985, cited in Cowan, 2014) concur and point out that journaling allows writers to "stand outside their experience, seeing it more objectively, and being detached from emotional outcomes" (p. 54).

In addition to recording experience, Moon (2003) also identifies 17 more reasons of writing journals, including: "

- To develop learning in ways that enhance other learning;
- To deepen the quality of learning, in the form of critical thinking or developing a questioning attitude;
- To facilitate learning from experience;
- To increase active involvement in learning and personal ownership of learning;

- To increase the ability to reflect and improve the quality of learning;
- To enhance problem-solving skills;
- As a means of assessment in formal education;
- To enhance professional practice or the professional self in practice;
- To explore the self, personal constructs of meaning and understand one's view of the world;
- To enhance the personal valuing of the self towards self-empowerment;
- For therapeutic purposes or as a means of supporting behavior change;
- As a means of slowing down learning, taking more thorough account of a situation or situations;
- To enhance creativity by making better use of intuitive understanding;
- To free-up writing and the representation of learning;
- To provide an alternative 'voice' for those not good at expressing themselves; and
- To foster reflective and creative interaction in a group (pp. 189-193).

The Role of Reflective Journal in (Design) Education

Mehta and Al-Mahrooqi (2015)–coming from English as Foreign Language (EFL) context–argue that "an immediate transfer of critical thinking skills, and perhaps an important way of retaining and evaluating it is to write about it" (p. 26). Citing appropriate literature, Mehta and Al-Mahrooqi (2015) go further and argue that writing is one of the most important strategies to "make the transformation from declarative to procedural knowledge and make critical thinking a life skill" (p. 26). This argument is well supported by Quitadamo and Kurtz (2007, cited in Goodwin, 2014). However, they also point out that such transformation cannot be accomplished without adequate training in the writing classroom. Goodwin (2014) also concurs such observation and points out that "[W]riting may help students develop their critical thinking skills, but writing does not necessarily teach critical thinking ... [as] the paradox of well-written, poorly reasoned student papers might lead us to wonder, what exactly, is the link between critical thinking and writing?" (p.1). Perhaps, one research-proven way to get students to write better, according to Graham and Perin (2007, cited in Anderson, 2014), is using models or the mentor text. It is believed that "[W]hen we talk about what works in the writing we read, we become more consciously aware of it" (Eagleman, 2012, cited in Anderson, 2014, p. 14). Furthermore, Jago (2014) points out that "[M]ost students do not write enough to learn to write well ... [and] students can't learn to write with so little practice" (pp. 19-20). In addition, Jago (2014) also argues that "[T]eachers do a disservice to their students when they accept first-draft jottings as finished papers.

Requiring students to hone their sentences improves not only their writing but also their thinking" (p. 20). It is believed that doing the latter gets students to be self-critical and become better readers of their own writing (Jago, 2014).

However, it is also right to argue that the use of journals may inhibit the reflective process and limit its values when the student is primarily concerned about its assessment rather than the value of the reflection for their professional and personal development (Bolton, 2005; Pavlovich, Collins & Jones, 2009). Orland-Barak (2005) comments on students' tendencies to present a favorable image of themselves and questions whether mandated portfolio writing is always conducive to critical reflection. This concern is shared by others who have commented on the influence of the intended audience on the student's reflection (Fersten & Fernsten, 2005; Hobbs, 2007). Other problems arise when students' writing ability prevents them from articulating their reflections or when students fail to reflect the depth of understanding and insight gained. Similarly, Richardson and Maltby (1995) argue strongly "whilst diary writing facilitates the skills required for reflection, the skills of critical inquiry and problem solving are frequently not demonstrated" (cited in Newton, 2004, p. 155).

This is partly because unlike the impressionistic mind, or more specifically, the impressionistic writing–which can be perceived as uncritical and tend to mix with prejudices and biases–our reflective mind,

> "seeks meaning, monitors what it writes, draws a clear distinction between its thinking and the thinking of its audience. The reflective mind, being purposeful, adjusts writing to specific goals. Being integrated, it interrelates ideas it is writing with ideas it already commands. Being critical, it assesses what it writes for clarity, accuracy, precision relevance, depth, breadth, logic, significance and fairness. Being open to new ways of thinking, it values new ideas and learns from what it writes.
>
> The reflective mind improves its thinking by thinking (reflectively about it. Likewise, it improves its writing by thinking (reflectively) about the writing. It moves back and forth between writing and thinking about how it is writing" (Paul and Elder, 2008, p. 40).

Goodwin (2014) points out "too few of us instructors understood that although writing and thinking may be linked, students don't learn to think just by learning to write; rather, to learn to write, they need to learn to think" (p. 80).

In the context of design education, one potentially effective method to allow us–both design students as well as educators–to constantly and consciously finding ways to refresh or get better in terms of what we are doing is known as 'reflective thinking' or 'reflection' (Dewey, 1933). Reflection–as discussed in earlier section of this chapter–comes in different forms. For instance, Cameron (2004) suggests the use of 'morning

pages' as a way to record thoughts and subsequently reflect back on those thoughts to discover re-occurring themes that could be blocking one's creativity. In fact, it is fairly common to see design students carry a notebook to record thoughts, things-to-do, lecture, key points from readings and any other things they find worth recording. In the context of architecture, Manolopoulou (2005) posits that note making "shifts between writing and drawing, and takes advantage of both" (p. 517). In many design disciplines, keeping learning journals is one of the commonly assessable components for students to review their own learning journey in design studio.

The use of a design diary or reflective journaling is a common learning and teaching strategy in design education to promote reflective practice in design studios (Webster, 2001). For examples, reflective journal writing has been used for the following reasons:

- as a means of 'evidencing' the learning approaches from students in Art and Design (Allan, 1998);
- as an efficient way of receiving feedback from students in a design course (Gelmez & Bagli, 2015);
- as a tool for making the reflection explicit in Art and Design (Gröppel-Wegener, 2012);
- as 'scaffolding' pedagogical technique in an interior studio to facilitate the exploration of sustainable design (Gulwadi, 2009);
- as a tool to enhance student learning and evaluate student design processes (Sobek, 2002); and
- as a cornerstone for effective experiential learning in undergraduate Engineering Design (Seepersad, Schmidt & Green, 2006).

Furthermore, in a two-year qualitative study, Arrendondo and Rucinski (1994) found that the incorporation of reflective journaling–in architecture education–helped to promote meta-cognition and foster self-regulated learning. In addition, journaling also "facilitates critical thinking, deep learning and purposeful design; it fosters reflective judgment and conscientious decision-making" (Chance, 2010). However, it was pointed out that critical thinking and reflection through the learning journals submitted tend to be superficial and descriptive by nature unless approached consistently and systematically (Orland-Barak, 2005) and in many cases do not lead to deep or comprehensive learning (see Lyons, 1999, and Samuels & Betts, 2005, cited in Moon, 2006). Moreover, Strampel and Oliver (2008) also report that most reflective blog entries produced by students in their study were descriptive and 'cognitive retrieval' rather than critical. Only on a few occasions did they demonstrate some levels of criticality–with indications of analysis, links to an underlying professional knowledge base and demonstration of the ability to draw out learning or new knowledge from the experience (Thompson & Pascal, 2012).

This inability to articulate explicitly what was learned or perhaps the incapability to distinguish understanding from knowing (and doing) remains problematic in design education partly due a shortcoming of the 'learning-by-doing' pedagogical approach and/ or depending heavily on episodic instead of semantic or theoretical knowledge in the given design problems or design exercises (Dorst & Reymen, 2004; Lawson & Dorst, 2009). From an education perspective, and as pointed in earlier section, many scholars argue that knowing (and doing) is not the same as understanding (Perkins, 1998; Stiles, 2006; Wiggins & McTighe, 2005; Willingham, 2007; Wurman, 2001). Furthermore, educators and scholars (Brandt, 2008; Davis, 2006; van Manen, 1977) also believe that there is a connection between reflection and learning, which is essentially one of the fundamental outcomes behind reflective practices (Sempowicz & Hudson, 2012). However, Price (2004) argues that for reflection to become a transferable skill that can be used in practice, one needs to learn how to combine reflective thinking with critical thinking.

Summary of Chapter 2

This chapter has several purposes. Firstly, it describes the key challenges faced by design education and design practice. All those challenges have great impact on the body of knowledge, the delivery methods, and the roles of educators and students. An assessment of those challenges and impacts led to the focus on three interrelated abilities, namely 1) synthetic ability, 2) analytic ability, and 3) practical ability, which are essential to designers when solving complex problem. Among the three, practical ability is the most obvious and easily detected, while the remaining two abilities are usually associated with creative thinking (synthetic ability) and critical thinking (analytical ability).

Then, I turned to examine reflective practice and reflection as one of the key activities that designers and design students carry out their design process. I have examined and looked at the criteria for reflection, and different classifications or levels of reflection. The outcomes of this section has informed my decision on the adoption of Kember et al.'s (2008) four-category scheme for coding and assessing learning journals in my study (refer to Methodology chapter for further detail).

Next, I have spent a great length in this review to clarify the concept of critical thinking. Through the review, I have discovered the various elements of critical thinking, including **1) understanding of content knowledge**–i.e., one cannot think critically when one has nothing to think about–and **2) cognitive skills**–i.e., one cannot be critical if he or she doesn't know how to; there are other elements that made up of the substantive concept of critical thinking, namely **3) the eight elements of thoughts**–i.e., serves as a framework for design proposal and report; **4) intellectual standards essential to reasoning**–i.e., the criteria for putting a strong case for one's argument; **5) the dispositions or the essential intellectual traits**–i.e., the consistent habits of mind;

and, to my surprise, **6) ideological beliefs**–i.e., be open-minded to the unknown territory that is out of our comfort zone.

Lastly, I have also looked at how the writing of reflective learning journals was used in various context. I have also paid specific attention on how learning journals could be used in the context of design and along the way, I have also discovered some of the challenge to using reflective learning journal as a tool to develop critical and reflective thinking.

In the next chapter, I will cover the methodology and design of my study.

3 Methodology: Research Design and Methods

"If someone wanted to know whether one drug is more effective than another, then, a double blind clinical trial would be more appropriate than grounded theory study. However, if someone wanted to know what it was like to be a participant in a drug study ... then he or she might sensibly engage in a grounded theory project or some other type of qualitative study."

– Strauss & Corbin, 1998, p. 40

Introduction

Although grounded theory was not the chosen methodology for my research, the essence of the quote from Strauss and Corbin (1998) reflected on how I designed and approached my study.

Essentially, research is a systematic inquiry and rigorous process for knowledge creation or "an undertaking through which we strive to increase our knowledge (of the world) ... The circularity [of extending and testing knowledge] and failure (leading to 'rebirth' [of new understanding] is central to the research undertaking" (Glanville, 1999, p. 81). In the context of design, good design research, according to Cross (2006) is: "

1. **Purposive**–based on identification of an issue or problem worth and capable of investigation;
2. **Inquisitive**–seeking to acquire new knowledge;
3. **Informed**–conducted from an awareness of previous, related research;
4. **Methodical**–planned and carried out in a disciplined manner; and

5. **Communicable**–generating and reporting results which are testable and accessible by others" (p. 102).

Similarly, Suri (2008) also points out that effective design research "is not just about analysis of objective evidence… also about the synthesis of evidence, recognition of emergent patterns, empathic connection to people's motivations and behaviors, exploration of analogies and extreme cases, and intuitive interpretation of information and impressions from multiple sources" (p. 54).

Hence, taken into consideration of the above paragraphs, design research is about maintaining a skeptical and curious mind; and adopting a methodical, careful, responsible and ethical approach to investigate and understand a given phenomenon to develop useful and actionable new understanding and insights that could inspire designers to generate potential ideas that are grounded with evidence and informed intuition. Ultimately, these new understandings are expected to increase and improve the design knowledge as a whole.

This study is set forth to answer the following question:

> **How do undergraduate communication design students perceive and use learning journal as a tool to facilitate the development of critical and reflective thinking?**

In this chapter, I will (i) introduce my understanding of research methodology and present the philosophical assumptions underpinning this study; (ii) define the scope and limitations of the research design; and (iii) situate the study amongst the existing research traditions in design education. All these have informed the choice of methods for data collection and analysis, which will be discussed accordingly.

Research Methodology: An Overview

There are many ways to conduct research and collect data. One could approach a study quantitatively or qualitatively–and depending on the nature of the research and its question(s)–some researchers may also choose mixed methods, combining both quantitative and qualitative approaches (Creswell, 2014). The question of when it is appropriate to use a particular research approach and the methods for data collection has been a long-debated and much discussed issue in educational research (Libarkin & Urdziel, 2002; Mackenzie & Knipe, 2006; Tobin & Begley, 2004). This ongoing debate will aggravate and add confusions to the less experienced researchers who seek clarification whether a research question falls into a qualitative or quantitative category (Mackenzie & Knipe, 2006). As a result, it is imperative that all research begins with an understanding of the distinctive characteristics of research approaches–or more specifically "plans and the procedures for research that span the steps from broad assumptions to details methods of data collection, analysis, and interpretation"

(Creswell, 2014, p. 3)–and the various research traditions before choosing a specific research design and its appropriate methods.

The term qualitative research is used predominantly as an umbrella term to suggest research conducted in natural setting to investigate human or social issues in contrast to those of positivist approach (Creswell, 1998; Creswell, 2014; Lancy, 1993; Neuman, 2004). Qualitative research, according to Denzin and Lincoln (2005),

> "involves the studied use and collection of a variety of empirical materials–case study; personal experience; introspection; life story; interview; artifacts; cultural texts and productions; observational, historical, interactional and visual texts–that describe routine and problematic moments and meanings in individuals' lives. Accordingly, qualitative researchers deploy a wide range of interconnected interpretive practices, hoping always to get a better understanding of the subject matter at hand. It is understood, however, that each practice makes the world visible in a different way. Hence there is a frequently a commitment to using more than one interpretive practice in any study" (pp. 3-4).

Literature suggests that qualitative methodologies are "powerful tools for enhancing our understanding of teaching and learning" (Johnson, 1995, cited in Hoepfl, 1997). Also, the choice of research methods such as interview and observation are congruent with some of the research purposes that, according to Richards and Morse (2007), are best suitable for using qualitative research approach: "

1. If the purpose is to understand an area where little is known or where previously offered understanding appears inadequate (thin, biased, partial),
2. If the purpose is to make sense of complex situations, multi-context data, and changing and shifting phenomena,
3. If the purpose is to learn from the participants in a setting or a process the way they experience it, the meanings they put on it, and how they interpret what they experience,
4. If the purpose is to construct a theory or a theoretical framework that reflects reality rather than your own perspective or prior research results,
5. If the purpose is to understand phenomena deeply and in details" (p. 30).

At the initial stage, I relied on references to help clarify various terms and justify the choice of data collection and analytical procedures as well as the general philosophical perspectives and research methodology behind the inquiry. Two models–Crotty (1998) and Creswell (2014)–were particularly useful in explaining the relationship among some of the terms covered in the course of study for qualitative research methodology.

Crotty (1998) argues that the researcher needs to address the four issues–namely the epistemology, the theoretical perspective, the methodology and the methods–when designing a research study. The relationships among the four elements are depicted in ↘**Figure 3.1**.

Figure 3.1 **Crotty's (1998) Four Basic Elements of Research Process**

Based on Crotty's (1998) work, Creswell (2003) conceptualized a similar model (see ↘**Figure 3.2**) that addresses three elements of inquiry, namely knowledge claims, strategies of inquiry and methods that led to approaches and the design process of a research study (p. 5). Knowledge claims, according to Creswell (2003), are similar to 'paradigms' in the view of Lincoln & Guba (2000, cited in Creswell, 2003, p. 6) or known as theoretical perspective, epistemology and ontology in Crotty's (1998) model. Creswell (2003) believes both ontological and epistemological issues tend to merge together, and "for each theoretical perspective embodies a certain way of understanding what is (ontology) as well as a certain way of understanding what it means to know (epistemology)" (p. 10).

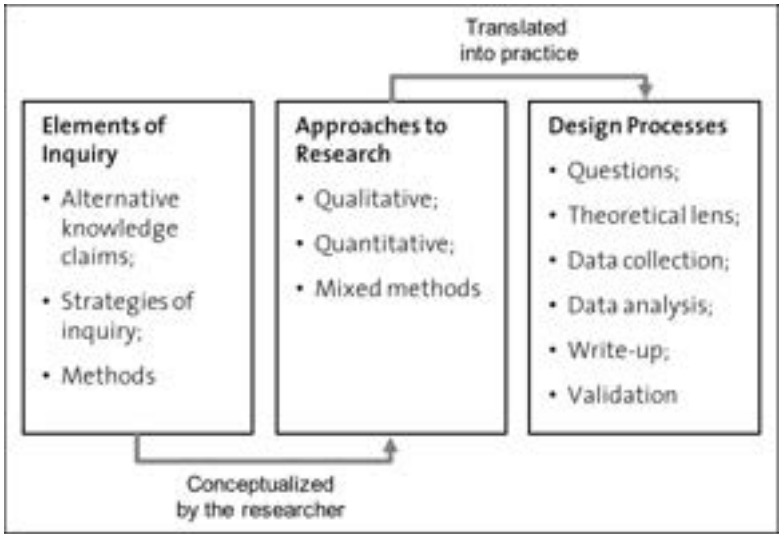

Figure 3.2 **Creswell's (2003) Three Elements of Inquiry**

These three elements of inquiry–i.e., alternative knowledge claims, strategies of inquiry and methods–are combined to determine different approaches to research that will

eventually be translated into practice. Based on the definitions and models proposed by Creswell (2003), Creswell & Clark (2007), and Crotty (1998), ↘**Table 3.1** presents common elements of worldview and implications for practice to address the research design concerns in this study, specifically, (a) the underpinning philosophical perspectives and research methodology, and (b) the rationale behind the choice of data collection and analysis procedures.

Table 3.1 **Common Elements of Worldview and Implications for Practice**

Worldview Element	Positivism / Post-positivism	Interpretivist / Constructivism	Advocacy / Participatory	Pragmatic
Characteristics	• Determination • Reductionism • Empirical observation and measurement • Theory verification	• Understanding • Multiple participant meanings • Social and historical construction • Theory generation	• Political • Empowerment and issue oriented • Collaborative • Change oriented	• Consequences of actions • Problem centered • Pluralistic • Real-world practice oriented
Ontology (the nature of reality)	Singular reality (e.g., researchers reject or fail to reject hypotheses)	Multiple realities (e.g., researchers provide quotes to illustrate different perspectives)	Political reality (e.g., findings are negotiated with participants)	Singular and multiple realities (e.g., researchers test hypotheses and provide multiple perspectives)
Epistemology (the relationship between researcher and that being researched)	Distance and impartiality (e.g., researchers objectively collect data on instruments)	Closeness (e.g., researchers visit participants at their sites to collect data)	Collaboration (e.g., researchers actively involve participants as collaborators)	Practicality (e.g., researchers collect data by 'what works' to address research question)
Axiology (the role of values)	Unbiased (e.g., researchers use checks to eliminate bias)	Biased (e.g., researchers actively talk about their biases and interpretations)	Biased and negotiated (e.g., researchers negotiate with participants about interpretations)	Multiple stances (e.g., researchers include both biased and unbiased perspectives)
Methodology (the process of research)	Deductive (e.g., researchers test an a priori theory)	Inductive (e.g., researchers start with participants' views and build 'up' to patterns, theories, and generalizations)	Participatory (e.g., researchers involve participants in all stages of the research and engage in cyclical reviews of results)	Combining (e.g., researchers collect both quantitative and qualitative data and mix them)

Worldview Element	Positivism / Post-positivism	Interpretivist / Constructivism	Advocacy / Participatory	Pragmatic
Rhetoric (the language of research)	Formal style (e.g., researchers use agreed-on definitions of variables)	Informal style (e.g., researchers write in literary, informal style)	Advocacy and change (e.g., researchers use language that will help bring about change and advocate for participants)	Formal or informal (e.g., researchers may employ both formal and informal styles of writing)
Approach	Quantitative	Qualitative	Qualitative	Mixed Method
Strategies of Inquiry	• Experiments (true vs. quasi-experiments) • Surveys (cross-sectional vs. longitudinal studies)	• Ethnographies • Grounded theory • Case studies • Phenomenological research • Narrative research	• Action research	• Sequential procedures • Concurrent procedures • Transformative procedures
Methods	• Closed-ended questions, pre-determined approaches, numeric data	• Open-ended questions, emerging approaches, text or image data	• Convergent interviewing • Delphi	• Open- and closed-ended questions, emerging and pre-determined approaches, and quantitative and qualitative data analysis

Source: Adapted from Creswell (2003), Tables 2.2 and 2.2 of Creswell & Clark (2007), and Crotty (1998).

Framework to Situate my Study within the Qualitative Research Paradigm

Coming from a non-traditional design education background–although it could be argued that instructional design or learning experience design falls into the broader umbrella and definition of the Design discipline–reviewing my endeavors and activities that I undertook at the beginning of my study in autumn 2007, i.e., using participant observations in various design studios and interviews few different faculty members to construct my understanding of design education and studio culture, including what was going on in the design studio, how design educators run a studio course and the experience of studio-based learning. All that subsequently led to my focus on reflective practice and critical thinking. This process–keeping rigor in consideration when observing activities in a studio, interacting with students, experiencing a design course,

talking to educators from various design disciplines and reading and grading students' reflections–would and could easily fall into the qualitative category.

Since the purpose of this study is to examine students' perceptions–i.e., how one perceives the value–of the use of learning journal as a tool to facilitate the development of critical and reflective thinking, it is reasonable to argue that collecting viewpoints from students warrants the adoption of a qualitative research approach.

In order to situate the research methodology of this study within the qualitative research literature, more specifically the constructivist/ interpretivist paradigm, I have used a framework (refer to Table 3.2) based on the works of Creswell (2003), Crotty (1998), Denzin and Lincoln (2000), and Lancy (1993). Lancy (1993) succinctly provides the following insight that leads to the formulation of my framework:

> "[B]efore one discusses what is or is not qualitative research one must first establish whether the discussion is occurring at the level of paradigm, method, or technique. To sum up: When one follows the qualitative paradigm, one buys into an entire philosophy of inquiry... that stands in sharp contrast to the tenets underlying quantitative research; one may follow a particular qualitative research method (e.g., case study) that deviates somewhat from the purest form of the paradigm and; one can work entirely within the quantitative paradigm and yet, occasionally, use a qualitative technique such as conducting open-ended interviews as a preliminary step in the design of a standardized survey instrument" (p. 8).

The philosophical assumptions underlying this research study are predominantly influenced by the interpretivist/ constructivist tradition (refer to Table 3.1). This suggests the ontological belief that there are multiple realities that are socially constructed as opposed to a single reality–this is particularly applicable to design education due to the wickedness and complex nature of design and design problems–and a subjective epistemology and close relationship between myself–the researcher–and participants. The epistemological stance on interpretive approach is that understanding and knowledge of reality–i.e., how students perceive learning journal as tool to develop critical and reflective thinking skills–are generally gained through social interaction and constructions, including the use of language, shared meanings, my personal experience, tools and documents to name a few.

The research strategy adopted was to conduct a study in a school of design in a local university in Hong Kong, and the data collection techniques adopted for this study were mainly semi-structured interviews and content (documentation) analysis.

The framework presented in **↘Table 3.2** provides a summary with appropriate justifications to illustrate my philosophical viewpoint, strategy or method of inquiry, and tactics for collecting and analyzing the collected data in this research study.

Table 3.2 **Framework to situate my study within the Constructivist/ Interpretivist Paradigm**

Considerations/ Rationale and illustrative quote	This research study
Underlying philosophy (Paradigm) "Qualitative researchers approach their studies with a certain paradigm or worldview, a basic set of beliefs or assumptions that guide their inquiries. These assumptions are related to the nature of reality (the ontology issue), the relationship of the researcher to that being researched (the epistemological issue), the role of values in a study (the axiological issue), and the process of research (the methodological issue)" (Creswell, 1998, p. 74).	ONTOLOGY Similar to understanding design and how different possible solutions could be generated to a given design problem, there is no particular way or correct route to knowledge or understanding the reality. My study examines communication design students' perception of learning journal as a tool to facilitate the development of critical and reflective thinking. The outcome of this study depends highly on how much the participants know–i.e., how each individual constructed their understanding–at the point in time and as Guba and Lincoln (1994) point out that "[C]onstructions are not more or less 'true,' in any absolute sense, but simply more or less informed and/ or sophisticated. Constructions are alterable, as are their associated 'realities'" (p. 111). This also implies that "social phenomena and categories are not only produced through social interaction but that they are in a constant state of revision' (Bryman, 2001, pp. 16-18). EPISTEMOLOGY Although understanding is subjective and differs from one person to another, the world "doesn't exist independently of our knowledge of it" (Grix, 2004, p. 83) and knowledge is context and time dependent. A learning journal is not a learning journal without someone to call it a learning journal. Meaning is constructed though the interaction between consciousness and the world and "consciousness is always consciousness of something" (Crotty, 1998, p. 44). This suggests that intention is the key. While different people may construct meaning differently as what Crotty (1998) suggests, truth is a consensus–culturally derived and historically situated (Creswell, 2009, p. 8)–formed by co-ccreators. Hence, the best way to understand is to visit participants at their sites to collect data.

Considerations/ Rationale and illustrative quote	This research study
	AXIOLOGY In constructivist inquiry, values "have pride of place; they are seen as ineluctable in shaping (in the case of constructivism, creating) inquiry outcomes. Furthermore, even if it were possible, excluding values would not be countenanced. To do so would be inimical to the interests of the powerless and of 'at-risk' audiences, whose original (emic) constructions deserve equal consideration with those of others, more powerful audiences and of the inquirer (etic). Constructivism, which sees the inquirer as orchestrator and facilitator of the inquiry process" (Guba & Lincoln, 1994). As a researcher–and also the tutor in the communication design discipline–investigating and examining students' perceptions of the use of learning journal as a tool to facilitate the development of critical and reflective thinking, I valued the 'closeness' and interaction I have with the participants–also former students whom I have taught in numerous occasions. It is this intimate relationship that encouraged them to share their views openly and willingly at the end of their learning journey. Due to this relationship, subjectivity and biasness are unavoidable. METHODOLOGY The study is characteristically (i) inductive, i.e., start with participants' views and (ii) emergent, i.e., build 'up' to patterns and theories that are shaped by experience in data collection and analysis as "individual constructions can be elicited and refined only through interaction between and among investigator and respondents" (Guba & Lincoln, 1994).
The strategy (Strategy, method, or tradition of inquiry) "A strategy of inquiry comprises a bundle of skills, assumptions, and practices that the researcher employs as he or she moves from paradigm to the empirical world. Strategies of inquiry put paradigms of interpretation into motion" (Denzin & Lincoln, 2000, p. 22).	The intentions of this study is clear: (i) to examine the perceptions of design students in relation to the use of learning journal as a tool to develop critical and reflective thinking; and (ii) provide explanations for the level of quality of learning journals produced by students. The proposed strategy is semi-structured interview and content analysis. The aims are to question–as a result of the puzzlement–(i) how do the undergraduate communication design students perceived the use of learning journal as a tool to facilitate the development of critical and reflective thinking; and (ii) why does quality of work produced in the learning journal tend to be more descriptive level than explanatory.

Research Designs

This study focuses on the undergraduate communication design students' perception, i.e., their opinion, on the value of learning journal as a tool to develop their reflective and critical thinking in in Hong Kong. Based on my earlier justifications presented in **↘Table 3.2** above, the chosen research approach for this study will be mainly: **(a) cross-sectional**–i.e., "carried out at one time point or over a short period … Usually there is no hypothesis as such, but the aim is to describe a population" (Levin, 2006, p. 24); **(b) descriptive**–i.e., "to provide a picture of a situation as its naturally happens" (Burns & Grove, 2003, p. 201); and **(c) contextual**–i.e., "[the] environment and conditions in which the study takes place as well as the culture of the participants and location" (Holloway and Wheeler, 2002, p. 34).

In addition, the following propositions were developed to direct the attention to what should be examined with the scope of study; more specifically, these propositions will guide the development of interview questions in this research study:

- Design students learn how to reflect effectively if principles and practices of high quality learning journal and its long-term value are formally introduced and demonstrated at the early stage of the design education;
- Writing good learning journal is similar to the iterative process of designing, it starts with writing freely, followed by revisiting and revising through questioning, and ends with producing concrete evidence on how one is able to do something;
- Reflective and critical thinking are both habits of mind that need to be cultivated and developed consistently over time.

Units of analysis

The units of analysis in this study are as follows:

- **Individuals**: This study is interested in a cross sectional study–i.e., at the time when students have completed their final (capstone) project–of a small group of recent graduates from the undergraduate communication design program stated above and how they use learning journal as a tool, including the types of content they choose to include in their journal;
- **Perceptions**: More specifically, this study is interested in what the small group of individuals said, i.e., the statements made in the interview in relation to the phenomenon of this study; and

- **Learning journals**: This study is interested in the breadth (types of topic) and the depth (levels of reflection) of their work.

The selection of participants

Parahoo (1997) defines a population as "the total number of units from which data can be collected" (p. 218). I have relied of theoretical or purposive sample–i.e., a sampling method where "researcher deliberately chooses who to include in the study based on their ability to provide necessary data" (p. 232)–in this study. Students of the same cohort were either approached individually or when they appeared in-group through verbal invitation. In the end, 10 students (out of the total of 32 in the cohort) had taken part in the interview. The basic information of the ten participants who took part in the interview is presented in ↘**Table 3.3**.

Table 3.3 **Basic participants' information**

Participant	Gender	Type	Duration
1	Female	Local	57:32 mins
2	Male	Local	52:33 mins
3	Female	Local	61:08 mins
4	Female	Local	66:26 mins
5	Female	International	53:21 mins
6	Female	Local	67:46 mins
7	Male	International	79.27 mins
8	Male	Local	56.56 mins
9	Male	Local	93.36 mins
10	Female	Local	112.36 mins

The choice of research methods

Guided by the questions and the units of analysis mentioned above, two complementary sources were collected and examined in this study using interview and content analysis.

Interviews are one of the very common forms of data collection in case study research (Hancock & Algozzine, 2006). The goal of qualitative interview is to learn about the interviewee's "feelings, intentions, meanings, subcontexts, or thoughts on a topic, situation or idea" (Lichtman, 2010, p. 140) or to explore shared meaning of people who

live or work together (Rubin & Rubin, 2005). Similarly, according to Stake (2010), interviews are used for a few reasons: “

- Obtaining unique information or interpretation held by the person interviewed
- Collecting a numerical aggregation of information from many persons
- Finding out about ‘a thing’ that the researchers were unable to observe themselves” (p. 95).

Since the focus of this study is on graduating design students’ perceptions –i.e., students’ perspectives–on learning journal as a tool to develop their critical and reflective thinking skills, the design educators’ and tutors’ perspective were intentionally left out for several reasons:

- Different faculty members may perceive the importance and needs of learning journal differently and place different emphasis (i.e., assessment weightage) on reflection as a learning tool to develop critical and reflective thinking depending on the subject matter. Having said that, the discussions with other more experienced design educators have always been meaningful and insightful;
- There may be other ways critical and reflective thinking skills can be developed. For instance, formal and informal group discussions, critiques, or taking part in any forms of exercises that require higher order thinking skill such as interpretation, analysis, reasoning, evaluation and synthesis. The only challenge is how to make thinking visible through such kind of activities; and
- Anecdotal evidence also shows that while students may be required to submit learning journal at different length, seldom do they get suggestions–similar to those comments or feedback received when they have completed a given project–on how they could improve their learning journal further as comments on written works such as learning journal or report can be a tedious task to some design educators. This tends to give wrong impressions to students that either written works are not important, or they could complete the task till very last minutes before submission.

To ensure the success and validity of the interviews, I adopted the guidelines proposed by Hancock and Algozzine (2006) shown in **↘Table 3.4**.

Table 3.4 **Guidelines for a successful interview**

Guidelines	Reference sections in this research study
1) Identify key participants whose knowledge and opinions may provide important insights regarding the research question.	The key participants were drawn from the pool of students recently graduated from the undergraduate communication design program. Refer to The Selection of Participants section for further details.
2) Develop and interview guide (sometimes called an interview protocol) to identify appropriate open-ended questions that the researcher will ask each interviewee.	The interview protocol was developed and discussed with a faculty member to ensure the questions were clear and appropriate. Minor changes were made after the first and second interviews taken into consideration how the participants responded to the questions. Refer to The design of the interview protocol section for further details.
3) Consider a setting in which the researcher conducts the interview.	All interviews were conducted within the environment the participants were familiar with.
4) Develop a means for recording the interview data.	All interviews were recorded with the permissions given from the participants.
5) Adhere to legal and ethical requirements for all research involving people.	All participants were briefed in the invitation email and subsequently informed at the beginning of the interview regarding the anonymity and confidentiality agreements and they were promised under no circumstance they personal identity will be revealed when the findings are presented.

Source: Adapted from Hancock & Algozzine (2006)

In addition to interviews, I also collected participants' final project learning journals as evidence for this study. I have asked all the participants to submit their reflections for quick review to get a sense of what they have reflected and how they have chosen to organize their work.

In order to gain a better understanding of how graduating students perceive learning journal as a tool to develop their critical and reflective thinking skills, both interviews and the collection of final project learning journals can only be done upon the completion and submission of each student's final project. For the purpose of this study, the grade of the project will not be taken into consideration. What's more important, in the context of this research study–is their authentic sharing during interview and what, why and how they have included and presented in the learning journals.

The arrangement for research access

Through my previous work experiences as a tutor in a number of subjects for many of the participants and as final project advisor for a few selected participants–I only had the opportunity to teach and have close interaction with few of the participants once or

twice (within the three-year period) due to project grouping or their choice of myself or other available tutors as their advisor–I was totally immersed in the subject of my research study as an active participant in the study (Blaxter, Hughes & Tight, 2001; Dwyer & Buckle, 2009). My close involvement is important and necessary as it explains how I gained access to the site, the program and the participants who have voluntarily–due to the relationship and past interaction–taken part in my research study. As mentioned in the previous section, the sample size is small due to the availability and their willingness to take part in this research study.

The design of the interview protocol

The entire interview session was divided into four main sections, namely the warm up, on reflection, on critical thinking and lastly integration and connection. The design intention for each section and the relevant questions are listed in **↘Table 3.5**.

Table 3.5 **The design intension and interview questions**

Section	Interview Questions & the design intention
PART 1: Warm Up	1) Thinking back to your final project experience, identify three things that you have learned. Please elaborate using appropriate examples.
	2) After three years of your study, what is it that you considered you have learned and what you have not learned?
	3) What do you consider the top three challenges you have ever encountered in the past three years of your study? (Have those challenges been resolved?)
PART 2: On Reflection	4) Reflection has always been an assessment component across subjects, after three years, what does reflection or reflective thinking mean to your? (How has your understanding of reflection changed over time? Elaborate.)
	5) Recall from your first experience writing reflection. Describe how did you learn to write reflection? (What were some of the challenges? Were you given guidance on writing good reflection? Did you receive any feedback on how to improve on your reflection?)
	6) In what way do you think your way of writing reflection has changed or improved? (Do you think your reflection truly reflect on your thinking? Explain.)
	7) In relation to your final project, how did you decide what to be included in your reflection? (Why did you choose to organize your work in that manner?)

Section	Interview Questions & the design intention
PART 3: On Critical Thinking	8) Everyone reflects. But not all reflections are critical. What does the word (being) critical mean to you? 9) On the scale of 1 to 10 (where 1=mom-critical, and 10=most critical), how would you rate yourself as a critical thinking? Why? 10) In relation to your final project reflection, how would you rate your work in terms of critical thinking? Why? 11) In general, how would you describe your ability to think critically over the past 3 years? Why (not)? 12) In your opinion, how useful is writing reflection helps developing your critical thinking skill? Explain. (What other ways can critical thinking skill be improved? Can you pinpoint specific subject/teacher that might have helped you improved your critical thinking skill? Explain.)
PART 4: Integration & Connection	13) Can you share how did you carry forward reflective/critical skills learned in earlier experiences to other design projects? Please elaborate with an example.

Overall procedures for interpreting the content of interviews and learning journals

Patton (2002) points out three key aspects in relation to qualitative research: 1) making the obvious obvious–i.e., to confirm what is already known; 2) making the obvious dubious–i.e., to identify necessary misconception; and 3) making the hidden obvious–i.e., to discover what have not yet been explained by others.

I. **The criteria for interpreting the findings for interview**:

   a) **Ordering the data**–All the interview recordings conducted in this research study were transcribed and kept for subsequent analysis.

   b) **Analyzing the data**–The analysis of the collected data was divided into the following stages:

      1. Read the entire content, i.e., interview scripts once to get an overall impression of what was collected, i.e., responses from interviews with a fresh perspective.

      2. Re-read the content a second time and pay closer attention to the interview responses. Highlight those responses and entries that may be relevant and useful for further analysis and explanation later. An example is shown in ↘**Figure 3.3**.

Oh... Ok. My work was more experimental. For instance, unlike conventional publication, where you get to see the content page at the beginning, the content page of my design was embedded somewhere in the middle of the publication.

Figure 3.3 **Highlighting Statements for Subsequent Coding**

3. **Abstract those highlighted statements and transfer them into the table** showed in **↘Figure 3.4** for coding. Each statement is assigned with a numbering code for referencing purpose. Whenever possible, analytical code is favored over descriptive code.

Participant 1 / Female
Question 1: Three things you have learned in your final project

Abstracted from the Script	Coding	
	Descriptive/Analytical	Interpretation
[20] My work was more experimental		
[21] The content page of my design was embedded somewhere in the middle of my work		

Figure 3.4 **Preparation for Coding in Table Format**

4. **Read the statements line by line** and assign either a descriptive and analytical code to the given statement. At any time, one or more codes will appear depending on the length of the statement.

5. At the end of coding process, the various statements will be **grouped based on the given codes**. In some instances, statements with similar nature may get to be moved up or down to form a complete 'group' for initial interpretation. An example is shown in **↘Figure 3.5**.

Participant 1 / Female
Question 1: Three things you have learned in your final project

Abstracted from the Script	Coding	
	Descriptive/Analytical	Interpretation
[8] All the while, my topic has been rather abstract... and unlike others that focused on specific question or issue	Project type (abstract vs. issue-based)	[8-9] Project type determines how (much) research is to be conducted. However, prior knowledge and clear thinking are needed to organize the research findings.
[9] I have done a lot of research but I didn't know how to organize those research findings	Having difficulty; organize findings	
[11] I believed it was when I was conducting user testing	User test	[11-13, 17] Project outcome was a book publication and given the duration of the project, it enables the student to have frequent encounters with the target users to solicit user needs and feedback on the improvement of work using questioning technique.
[12] My final outcome was book and my target users were design students	Design outcome; target users	
[13] I did three rounds of user testing	Frequency (of testing)	
[14] I found that different users have different intentions	User needs	
[17] Through the studies, I had to find ways to questions	Questioning; solicit user feedback; improvement	

Figure 3.5 **Grouping and Regrouping of Statements for Initial Interpretation**

6. When all the initial interpretation–from each case–is completed, all the analyses for the same question will be pulled out and group together for the final round of analysis. This includes comparison of each question across multiple cases for pattern recognition. Refer to Chapter 4 for further data analysis and discussion of findings.

II. **The criteria for interpreting the findings for learning journal**:

a) **Ordering the data**–All the original learning journals collected from participants are photocopied and kept separately for later analysis.

b) **Analyzing the data**–The analysis of the collected data was divided into the following stages:

1. Read the entire journal entries once to get an overall impression of the reflection with a fresh perspective.

2. Re-read the journal entries second time and pay closer attention to the responses. Highlight those responses that may be relevant and useful for further analysis and explanation later.

3. Read the statements line by line and assign a descriptive code to the given statement to identify the nature of topic, e.g., time management, interim presentation, project deliverables, etc. At any time, one or more codes will appear depending on the length of the statement. In addition, depending on the statements or chunk of statements, Kember et al.'s (2008) **four-category scheme for coding** and assessing learning journals–more specifically, Summary of the four category from **↘Table 2.7** –will be used to determine the depth of the reflection.

4. At the end of coding process, the **various statements will be grouped based on the given codes**. In some instances, statements with similar nature may get to be moved up or down to form a complete 'group' for initial interpretation.

5. When all the initial interpretation is completed, all the analyses will be consolidated for the final round of analysis. This includes the determination of coverage and depth of reflection drawing from all learning journals. Refer to Chapter 4 for further data analysis and discussion of findings.

Limitations of the Study

Ten communication design students from the design school of a university in Hong Kong constituted the research sample. The question of generalizability of this research study to the target population in other locations can be risky unless the samples share similar characteristics (Gall, Borg & Gall, 1996). Since the sample selected is unique to this particular design school–and the only government funded design school offering both undergraduate and postgraduate design degrees–in the local context, the findings in this research study can only serve as an attempt to understand the perceptions of a group of communication design graduates in relation to the use of learning journals to develop critical and reflective thinking. The research aims at a rich understanding of experiences of an indicative sample rather than claiming statistical validity across an entire class of cases. It is not the intention of this study to generalize the findings but rather to understand the fundamental question of why, despite knowing that learning journal is an assessable component, the quality of the work produced remains problematic. Having said that, the insights generated from this study–of one particular context–may help in giving insight and understanding of other cohorts of students. While personality, attitudes and beliefs may differ among students, many design students in Hong Kong–within my limited observations–do share similar characteristics, especially in relation to their earlier conception of, preconception and misconception about reflection, critical thinking and the use of learning journal in design education. As the literature section revealed, the absence of clear agreement about those terms and how we recognize them make it harder to 'teach' and 'learn.' Telling students to reflect and write critically and hoping they will get the job done simply doesn't work.

In addition, the modest sample size (ten students comprising four males and six females from the same cohort of 32 graduates from one single discipline, i.e., the formerly visual communication design program) and the fact that the sample size is drawn based on theoretical/ convenience sampling may also affect the availability of rich data to generate conclusive findings though the sample was selected to provide a representative cross-section of the students in the cohort. As a result, it will not be

appropriate to claim that findings generated from this study could or should be transferable to other design disciplines or broader implementation.

Since the researcher was the previous instructor for a number of subjects in the program and also served as the final project advisor for 5 of the participants in this research study, the consistency of teaching approach may be different from that of the other advisors, and hence may partially influence the consistency and quality of students' reflection submitted for evaluation.

Lastly, most of the interviews–except those with the two non-local students–were conducted in Cantonese and subsequently translated into English for analysis. While conducting interviews in Cantonese allowed the researcher to collect more fluid and natural responses, the translation in the end may suffer a slightly different meaning when texts get translated from Cantonese to English. For instance, while the words 'problem' and 'question' are clearly differentiated in English, the two characters (問題) commonly used in Cantonese can refer to either one of the two terms. Whenever possible, the researcher has chosen the appropriate English terms during the interviews to avoid unnecessary confusions.

As pointed out earlier, this study only focuses on students' perceptions. Ideally, the perceptions of design educators–and if possible, the employers– could be included in a more extensive study. Again, as the literature revealed, even design educators themselves have difficulty defining the terms, let alone 'teaching' or 'demonstrating' them. As a result, what can be viably claimed in my findings is limited to what the ten students shared in the interviews and the learning journals submitted.

Summary of Chapter 3

This chapter described the research methodology of my study. This study adopted a qualitative, cross-sectional study, descriptive and contextual research approach to understand students' perception of using learning journal as a tool to develop critical and reflective thinking skills. The rationales for the adoption were justified and the choice of methods–i.e., interview and content analysis–was also explained. In addition, the design of interview protocols and process of data analysis were also described accordingly. Lastly, the limitation of this study was also presented.

The next chapter will present the findings from the analysis of interview and learning journals.

This page is intentionally left blank.

4 Data Analysis and Discussion on Findings

Introduction

The academic curiosity that inspires this research study is the lack of depth in many students' reflection or learning journals. Specifically, many students tend to explain what they did but very few were able to explain how they were able to do it. Hence, the reflections submitted at the end of every research projects remained as a mere descriptive summary or narrative account that documents their learning journey. This observation has triggered me to question the usefulness of learning journal in design education and focus on students' perception of using learning journal to develop critical and reflective thinking.

At the individual level–if and when the students revisit their own work–learning journal may stimulate or trigger them to revisit the memory lanes and recall from what they have learned again. This may in turn develop their consciousness and habits of mind. However, merely describing what happened–unless it was presented with rich details–will be harder for individual to recall as times passes. In addition, when the work is displayed and examine by public, i.e., during graduation show, it is even harder for the public to understand and consider the description a worthy lesson learned due to the lack of context and meaning.

In this chapter, I will reveal what I have discovered from the analyzed findings drawing from the interviews and the learning journals collected. ↘**Figure 4.1** on the following page shows the process of how data sets were chosen for analysis. Specifically, I have decided to select the participants for analysis based on the following criteria:

1. The students must be local. Note that there were two non-local students took part in this study, of which one of them was under my care;

2. The students must be from another tutorial group;

3. The students must have least contact in previous learning experience–i.e., those I seldom teach when the whole cohort was divided into groups for small-class teaching.

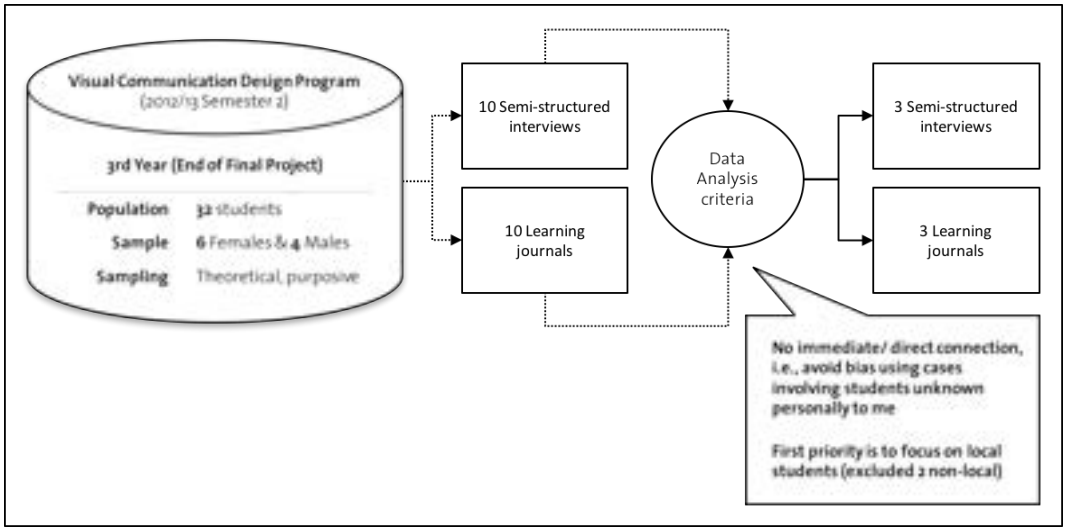

Figure 4.1 **Selection Criteria for Data Analysis**

↘**Table 4.1** shows the relationship between the research supporting questions and the use of appropriate research methods to answers the questions.

Table 4.1 **Relationship Between Sub-Questions and Research Methods**

Sub-Question	Method
a) What does it mean by reflective and critical thinking to the undergraduate communication design students?	Use of semi-structured interview to collect data for this question.
b) What is their perception of the value of learning journal in relation to the facilitation and development of reflective and critical thinking?	Use of semi-structured interview to collect data for this question.
c) What do students usually reflect on in the learning journal?	Use of content analysis to tease out the key themes from the data.

Sub-Question	Method
d) **Does the quality of learning journals support students' perception of the value of learning journals?**	Use of both interview results and quality of writing in learning journals as triangulation to determine if knowing or understanding of critical thinking is reflected on their writing in the journal.

Discussion of Key Findings

The remaining of this section will be divided into the following four sub-sections based on the supporting questions presented in ↘**Table 4.1** above. Each sub-section, i.e., a)-d) is further divided into parts. Each part will present the key findings drawn from interviews and/ or learning journals. This is followed by appropriate analysis with supporting evidence and references drawing from the literature previous discussed.

a) What Does it Mean by Reflective and Critical Thinking to the Undergraduate Communication Design Students?

i. Reflection (or learning journal) has always been an assessment component across subjects. After three years, what does reflection or reflective thinking mean to you?
→**Follow up** How has your understanding of reflection changed over time? Elaborate.

Participants were asked the above question to define the term **reflection** or **reflective thinking** in their own words. This part of the interview question was essentially an attempt to understand if they could explain the term and whether their understanding–if any–has changed.

Table 4.2 **Interpretation of the Meaning of Reflection from Three Participants**

Participant	Reflection as...
1	A conversation with self, including evaluation and explanation of action, performance, and emotions during a specific point in time.
2	A review or conclusion upon the completion of a project, considering what was gained in the entire learning experience.
3	Collection of work, combining writing over time. Reflective thinking is a natural daily activity that doesn't need a reminder to write in order to feel its existence.

While the responses derived from the interview scripts did not really overlap, in general, they were all moving toward same direction where '**conversation with self**,' '**review or conclusion**,' and '**collection of work over time**' all refer to similar understanding. In addition, all three participants also took a step further to cover the 'content of' or 'items to be included in' the reflection, for examples:

> **Participant 1** includes evaluation and explanation, emotions (feelings), and action (decision making);
>
> **Participant 2** includes difficulties encountered, feelings, and resolutions;
>
> **Participant 3** includes learning points, feelings, and personal thoughts.

Among the three participants, only **participant 3** mentioned reflection is a habit of mind, i.e.,

> "a natural daily activity that doesn't need a reminder ... to feel its existence."

The response from **participant 3** sets her apart from **participants 1** and **2**, not only she was able to point out reflection as a cognitive process–like participants 1 and 2 did–but also showed her understanding on **inclination** to invest effort (Perkins and Rtichhart, 2004) or the need for **disposition**–or **habit of mind**–to reflect on a regular basis.

As far as the follow-up question is concerned, all three participants believed that their understanding of reflection has improved over time. Both **participants 2** and **3** specifically mentioned how their earlier reflections were mostly descriptive but see the transformation in later part of their learning journey. Although **participant 1** did not address that in the follow-up question, the discussion on improvement was brought up in one of the subsequent questions during the interview. For instance:

> "When I first started to write reflection, I didn't have a key sentence or key title for what I was about to write subsequently" **(→ᵎ interview script p1-q5, sec # 68)** ...
>
> "So when I read them again I realized the reflections weren't very smooth. And it is very likely that I will repeat what I have mentioned at the beginning. It make me less comfortable" **(→ᵎ interview script p1-q5, sec # 70)**.

INTERPRETATION FOR SUB-SECTION a)-i:

On the surface, the response from **participant 3** might have suggested that she has better understanding of reflection than the other two participants. When cross-checking what she has produced, i.e., the breadth of content, in her reflective journal (see sub-section ↘ **c)-iii** below) and the criticality, i.e., the depth, of her reflective journal (see sub-section ↘ **d)-iii** below), it is not difficult to notice that her understanding did not get transferred into practice. This could be partly due to lack of reflective writing skills. Such observation could be inferred from her response to the next question (see sub-section ↘ **a)-ii** below).

On the other hand, **participant 2** seemed to be able to demonstrate his ability to put knowledge into practice. Among the three participants, **participant 2** is able to provide breadth (see sub-section ↘ **c)-iii** below) and depth (see sub-section ↘ **d)-iii** below) in his learning journal. Again, such observation could be inferred from his response to the next question (see sub-section ↘ **a)-ii** below), where he specifically mentioned the use of guided questions to facilitate reflective thinking.

While above inferences suggested that the key differentiator between **participants 2** and **3** was skill–or ability–related, **participant 1**'s response to the next question (see sub-section ↘ **a)-ii** below) and the breadth (see sub-section ↘ **c)-iii** below) and depth (see sub-section ↘ **d)-iii** below) of her reflective journal have positioned herself as an 'inbetweener' when compared with **participants 2** and **3**.

While all three participants were able to provide their so-called understanding of what the term reflection means–in fact, all have expressed their concerns on overly descriptive of their earlier reflections–none of the three participants were able to explain clearly how they could move their work from descriptive to be more explanatory and critical. All the three responses from the three participants suggest a realization of own shortcoming and such realization demonstrates their understanding of the terms–i.e., reflection and reflective thinking–and their ability to reflect. Perkins and Blythe (1994) also argue that understanding of something goes beyond knowing. Such knowing only suggests that one is able to "tell us the knowledge or demonstrate the skill" on demand (p. 5). Understanding, on the other hand, is "a matter of being able to do a variety of thought-demanding things with a topic–like **explaining**, **finding evidence and examples**, **generalizing**, **applying**, **analogizing**, and **representing the topic in a new way**" (Perkins & Blythe, 1994, pp. 4-5). Similarly, Wiggins and McTighe (2005) define understanding as "[A]n insight into ideas, people, situations, and processes manifested in various appropriate performances. To understand is to **make sense of what one knows**, to be able to **know why it's so**, and to have the ability **to use it in various situations and contexts**" (p. 353). In addition, true understanding, according to Wiggins & McTighe (2005), refers to one's ability to: "

- **Explain**: Provide thorough, supported, and justifiable accounts of phenomena, facts, and data;
- **Interpret**: Tell meaningful stories; offer apt translations; provide a revealing historical or personals dimension to ideas and events; make something personal or accessible through images, anecdotes, analogies, or models;
- **Apply**: Effectively use and adapt knowledge in diverse contexts;
- **Have perspective**: See points of view, with critical eyes and ears; see the big picture;
- **Empathize**: Get inside, find value in what others might find odd, alien, or implausible, perceive sensitively, based on prior direct experience;
- **Have self-knowledge**: Perceive the personal style, prejudices, projections, and habits of mind that both shape and impede understanding; be aware of what is not understood and why it is so hard to understand" (p. 343).

As a result, one could argue that if students are consciously (Dewey, 1993) or thoughtfully (Cross, 2007; Löwgren and Stolterman, 2004, p. 2; Schön, 1983; Schön, 1985) engaging themselves in their thinking–as much as most students engaging themselves in (design) making–they probably would pay attention to "what [they] are doing, capitalizing on [their] strengths and work on their weaknesses" (Perkins & Blythe, 1994, p. 6). However, failure to explain how one's reflection could move from descriptive to explanatory using appropriate explanations and applying theoretical knowledge showed inadequacy of one's thinking, which makes it hard to reach what Kember et al. (2008) considered as the level of **reflection** or **critical reflection**.

ii. Recall your first experience writing reflection. Describe how you learned to write reflection.

→**Follow up** What were some of the challenges? Were you given guidance on writing good reflection? Did you receive any feedback on how to improve on your reflection?

The intention of this question was to find out how all participants started their first reflection writing experience at the undergraduate level–this is to set the experience apart from their previous writing experience in secondary education or post-secondary education–and in an attempt to trace back if reflection has ever been formally introduced to the participants.

Among the three participants, only **participant 2** shared his experience of writing reflection in the *Design Thinking* subject:

> "I think it was **design thinking** that required us to write a reflection, like a learning journal, with the use of guided questions. Then I followed the question and answer format; but now in year 3, I didn't really pay much attention to those questions, I write what I feel like" **(→ interview script p2-q5, sec # 24)**.

Participant 3, on the other hand, focused more on her approach to writing reflection drawing inspirations or references from notes captured during daily activities, including lecture, tutorial, and research:

> "I took notes, including what the tutor said or mentioned something inspiring or useful, I will jot down the point. When I was ready to write, I would pull out those points and expand them with my own thinking" **(→ interview script p3-q5, sec # 26)**. ...
>
> "Another source of reference was taken from research. I would jot down those pointers that I thought were inspiring" **(→ interview script p3-q5, sec # 27)**.

Among the three, **participant 1** didn't seem to think that there is a need to formally learn how to write a reflection at the university:

> "I have never learned how to write reflection seriously. Not because I don't think learning to write reflection is something bad. But I think reflection is mainly for my own reference, and I usually write something that is memorable and that should be something different from others" **(→ interview script p1-q5, sec # 67)**.

However, **participant 1** did share how she first started to write reflection similar to writing an essay without the use of headings or sub-headings. She subsequently made a similar response in slightly more detail:

> "I did mention earlier about how I started writing reflection like an essay, not knowing how to break them into paragraphs and use key sentence as heading to 'package' and lead to what's coming next. But now I know all those techniques" **(→ interview script p1-q6, sec # 76)**.

The response made by **participant 1** regarding the needless to learn how to write is not uncommon. Many students seemed to think they know what a reflection is

but not many know how to reflect and/ or what makes a good reflection when questioned. Many of them acquired the term 'reflection' from similar exercise(s) in secondary or post-secondary education, i.e., book/ reading reviews but how to reflect or how to write a reflection rarely formerly introduced to them.

While students were expected to submit reflections but none of the participants could clearly point out the specific guidance or feedback they received from some of the tutors in their past learning experiences. For examples,

> "Many tutors would commonly mentioned particular points that I think are memorable: When we write reflection, not only we need to describe what happened and what was the outcome, how did we feel about what worked and what didn't work are equally and especially important" **(Participant 1 ⇾ interview script p1-q5, sec # 71).**

> "Not much guidance from the tutors because every time when you have submitted your work, you many not receive any comment from them (on the writing). But in general, some will remind us not to focus on description but pay more attention to what you have learned. I think reading others reflection could help" **(Participant 2 ⇾ interview script p2-q5, sec # 26).**

> "As far as I can remember, I don't seem to recall receiving any feedback" **(Participant 3 ⇾ interview script p3-q5, sec # 35).**

INTERPRETATION FOR SUB-SECTION a)-ii:

Students in general, including **participant 1** and possibly two other participants, tend to perceive and thought of reflection as something 'personal' and for own reference. In some cases, the term 'personal' could be interpreted as 'private' or 'intimate.' As a result, it is not difficult to discover that many reflections or reflective learning journals from the earlier–or even later–stage of undergraduate education tend to be subjective and emotional, i.e., mere expression of personal feelings such as like-dislike or agree-disagree on given matters. Less obvious in reflective journals–but much preferred from the learning and teaching standpoint –are those matters on how learning is relevant to individual's experience in specific context and beyond the 'flow of impressions' or 'detached from emotional outcomes' as what Holly (2003) and Boud et al. (1985, cited in Cowan, 2015) have rightly pointed out. Indeed, while many educators would hope that learning is meaningful to each individual, but that doesn't suggest that learning is 'personal' and cannot be shared.

On the contrary, according to Wenger (1998), learning is fundamentally social and it is the opportunity for social participant that makes learning more meaningful. However, due to the belief of 'personal' nature of reflection, the writing approach

could be different and expressed in whichever way they see fit. Consequently, many of them did not see a need for formal learning, especially when they have attended or are currently attending English composition classes. In addition, learning to write has long begun since their secondary education, which makes them perceive learning to write of less value.

Reflections that lack in-depth analysis and deep thinking seem to be a common challenge many encountered during their early undergraduate learning journey (Moon, 2006; Orland-Barak, 2005; Strampel and Oliver, 2008). Insufficient guidance from tutors could be a potential reason for this observation. Having said that, there wasn't single subject in the three-year curriculum other than the English writing requirement that could be identified as one that tasks to deal with such matter. However, reflection (or in many other names in disguise) has always been an assessable component in the undergraduate design education, specifically in communication design discipline.

Preconceptions and misconceptions about the need for formal learning in writing reflection, previous experience in writing reflection prior to entering the university, guidance from tutors and the lack of appropriate feedback on the improvement of reflection writing all contributing to the misunderstanding and the value of good reflection (Nilson, 2014). In addition, as pointed out earlier that knowing does not necessarily mean and should not be equated to understanding (Perkins, 1998; Ip, 2003). Due to past writing experience and incomplete knowledge and skills on reflection and reflective writing might have caused unnecessary misunderstanding toward the perceptions and the values of reflection. For instance, the word 'personal' was misinterpreted and caused some students to believe writing reflection was about expressing personal opinions and feelings of their own.

Furthermore, there seemed to be a misalignment of learning, teaching and assessment. Reflection as an assessment component has not been formally demonstrated and appropriately guided. As a result, students basically were required to develop their own understanding of reflection as they progress along the years through trial and error. While the idea of trial and error, i.e., learning by doing, may be appropriate for learning in design, such approach to learning how to reflect critically without sufficient guidance and feedback may not be helpful when it comes to improving one's thinking (Nilson, 2014).

iii. In what way do you think your way of writing reflection has changed or improved?

All three participants agreed and gave some evidence–such as pointing out the shortcoming of the 'way of writing' and noticed the changes of recent writing, including smoother flow and less repetitive; or noticed the reflection was no longer

mere description and added in additional elements such as challenges encountered, emotions and resolutions–on how their reflections have improved over time. In fact, **participant 3** made a distinction between reflection that is surface and in-depth:

> "For surface, maybe one tends to write more about what's observable or literally what has/ have been learned. Say, when you put a few reflections together, may be what they have learned are more or less similar, the difference among them is one that wrote more about the thinking and feeling behind the matter or how the learning has triggered one to think of other things. That's more in-depth" **(→ interview script p3-q6, sec # 38)**.

INTERPRETATION FOR SUB-SECTION a)-iii:

In relation to reflection, participants' ways of writing have certainly changed over time and moved away from mere descriptions and added wider range of coverage to include the challenges encountered, emotions and resolutions. However, changing ways of writing and merely pointing out the challenges encountered, the emotions and resolutions do not necessarily make a reflection 'good.' That's something that students failed to discuss in greater detail during the interview, such as using appropriate standards or frameworks including those proposed/ developed by Hatton and Smith (1995), Hutson, Ristic and Tregloan (2013), Johns (2004), Kember et al. (2008), Paul & Elder (2013), and Singh and Minsky (2004) to name a few.

iv. Everyone reflects. But not all reflections are critical. What does that word (being) critical mean to you?

The intention of this question was to get the participants to share their understanding of the term (being) critical. After three years of using the term, all participants were able to mention some of the more commonly used keywords in their responses. Specifically, both **participants 1** and **2** used '**criticism**' and '**judgment**', while **participant 3** used '**evaluation**' in their responses. For examples:

> "The most direct meaning is that in addition to understanding to what you have done–good or bad–you need to have your own perspective on the matter involved and consider how you could improve it further. That's the part on being critical, and that's the most important in the entire process of reflection" **(Participant 1 → interview script p1-q8, secs # 93-95)**.

"The word critical includes both 'criticism' and 'judgment'. There must be some kind of judgment. You must be able to judge and determine the significance of your work" **(Participant 2 ⇥ interview script p2-q8, secs # 35-36)**.

"I think it's how you evaluate something in terms of right or wrong. Well... not necessary right or wrong. I think you need to consider the value. This can be subjective and personal as every has different 'positioning'" **(Participant 3 ⇥ interview script p3-q8, secs # 46-47)** ... "To determine if something such as a reflection is critical or not, I would expect critical reflection to include or raise a number of perspectives that I have not taken into consideration. That depends on the person who is writing the reflection. It is only when the matter is relevant to the person, then he/ she will be able to write something that is critical. As for non-critical, it is usually surface, shallow or something expected" **(Participant 3 ⇥ interview script p3-q8, secs # 50-51)**.

INTERPRETATION FOR SUB-SECTION a)-iv:

In terms of the three responses, **participant 3** seemed to have more understanding or able to describe and explain with depth over the other two participants, as she not only tried to explain what critical meant to her, she also presented the distinction between critical and non-critical using reflection as example in her explanation. However, on a closer examination of the responses, this question by itself could only determine if the participants were able to explain in their own words the meaning of critical or being critical in the context of thinking and design education. As pointed in the review of literature and earlier discussion on understanding (Perkins, 1998; Ip, 2003), merely mentioned words cannot be used as evidence on whether all three participants, especially **participant 3**, truly understand what it meant to be truly critical in relation to reflection. At least, none were able to draw reference from existing literature or theory–if this is truly matter in design education–in their explanations.

Having said that, the responses of **participants 1** and **2** may present additional challenge on whether both truly understood those terms hence made their explanation more precise and less wordy, or they were only familiar with such terms that are commonly used to mean something but had little clue what were they really referring to. Also, there could be another scenario where some might have thought that they knew what a particular term meant–without full understanding–and have chosen to use it and hoping that others who share similar understanding and misunderstanding will know what they are trying to say. Such scenario is very common in design education as Frascara (2007) rightly pointed out in his reflection on *Hiding lack of knowledge: Bad words in Design Education*.

Specifically, he mentioned how fuzzy words such as 'intuition,' 'creativity' and 'design research' to name a few might have helped some instructors to hide their inability "to articulate concepts and to deliver actual instruction" (p. 62). It is not surprised to realize that how such inability gets transferred to students.

b) What is Their Perception of the Value of Learning Journal in Relation to the Facilitation and Development of Reflective and Critical Thinking?

i. In your opinion, how useful is writing reflection in developing your critical thinking skill? Explain.

→**Follow up** What other ways could you improve your critical thinking skill?

This question requires participants to consider the value of learning journal in relation to the facilitation and development of their reflective and critical thinking. There wasn't a clear consensus in the responses from the three participants on this question. For instance, **participant 3** firmly believed that writing reflection has helped her developing critical thinking as writing gets one to think and be more methodical when writing thoughts down. Reading back those writings would help her revisits or redefines those thinking:

> "you get to think about them with different perspectives and maybe you will learn something new as a result" **(→ interview script p3-q12, sec # 64)**.

On the other hand, **participant 1** believed that writing reflection is only somewhat useful in developing critical thinking skills, as reflection allows the thought process to be revisited after one has cleared the mind and spent some time to review the past incidents. To her, that review represented the closure for one's work after one gets to tidy up the various loose ends. Similarly, **participant 2** believed that writing reflection alone would not necessarily help in developing critical thinking skills, because

> "merely relying on writing reflection is insufficient" **(→ interview script p2-q12, sec # 47)**.

INTERPRETATION FOR SUB-SECTION b)-i:

Does writing reflection really help one to improve critical thinking or is writing just yet another tool–such as drawing, dancing, music, etc.–that one could use to give a form to what's on one's mind, i.e., thinking made visible through writing? All three participants believed that writing reflection is one of the different ways to improve critical thinking skill. It was particularly useful in structuring and organizing thinking. In fact, all participants believed that in addition to writing,

discussions with peers, taking part in class critiques, and even observing classmates in small group tutorials and how they interacted with the tutors all contribute to the development of critical thinking skills.

Such finding from a small sample size of three could not be used as substantial or conclusive evidence to confirm or refute the earlier findings from Mehta and Al-Mahrooqi (2015) and Quitadamo and Kurtz (2007), or Paul and Elder's (2007) argument on "one cannot be educated and yet unable to communicate one's idea in writing form" (p. 7), or the advantages of learning journals in relation to the creation of new meaning or performance improvement over time (Thorpe, 2004, cited in Lew & Schmidt, 2011; McCallum, 2013; Silvia, Valerio & Lorenza, 2013; Cowan, 2014), or what Gleaves et al. (2008, cited in Lew & Schmidt, 2011) have argued on the usefulness of reflective journal writing in terms of enabling students "to critically review processes of their own learning and behaviors, and to understand their ability to transform their own learning strategies" (p. 531). However, it could be fair to argue that this cohort of students may not able to provide insightful responses partly due to little/ insufficient knowledge and skills on reflective journal writing and critical thinking, and/ or insufficient feedback from respective tutors on improving one's writing or how to move to a higher level of reflection.

ii. <u>In general, do you think your critical thinking has been improved over the past 3 years? Why (not)?</u>

This question requires participants to take a critical stance on whether their critical thinking has improved over time. All three participants were positive and believed that their critical thinking skill has been improved over the years. The explanations were mostly identification and comparison of their shortcomings in the past–i.e., when they were in first year of their undergraduate study–and when they looked at what they have done recently, they were able to give examples to support their arguments. For instance:

> "Can't really give you a clear example but I could share with you a situation, that is in the past when I was in HKDI or in my first year, I always showed appreciation to many things, even though the work may have some flaws, I would still appreciate the work … Usually we would give comments to the work–I am sure there were some kind of critical thinking involved–but I don't think I managed to do that … But through year 2 and year 3, I started to discuss my own work or others' works on how to improve further in relation to techniques and ideas; and through the process of discussion, I think my critical thinking has improved" **(Participant 1 ↠ interview script p1-q11, secs # 111-112, & 114)**.

> "I would have rated myself 4 or 5 when I first came to SD. Maybe because then my thinking was 'one-directional'. Prior to that I was studying at IVE. I did learn a little bit of design thinking or critical thinking there... but I thought I have learned a lot by the time when I first got into SD and as a result I couldn't 'jump' out of the box. Until later when I began to learn more new things, and to converse more with other classmates and tutors, I started to pick up different ways of thinking unknowingly. This is one of the best things I acquired in my learning journey here" **(Participant 2 →ı interview script p2-q11, secs # 43-45)**.

> "I would think yes but not much improvement because when I realized other classmates also have their own unique perspective when looking at things, that would trigger me to think more and avoid only looking at the surface... That... I saw some improvement there. The reason I said not much... I was referring to the part that I know I need to be more critical, but not sure if there is a more clearer or specific way to be critical" **(Participant 3 →ı interview script p3-q11, secs # 60-61)**.

INTERPRETATION FOR SUB-SECTION b)-ii:

Among the three responses–with the possible exception of the response from **participant 3**, although it could be interpreted implicitly–classroom discussions with peers and observing responses from classmates seemed to be the positive ways to directly or indirectly help them to develop their critical thinking. While it is not possible to return to the past to observe their classroom activities, this could be a potential instructional strategy that faculty members could use more to help developing students' critical thinking skill in class. The challenge remains how teachers can be more conscious when 'demonstrating' or 'facilitating' critical thinking in class while at the same time making students aware of their own action in a more conscious manner.

c) What Do Students Usually Reflect on Their Learning Journal?

i. In relation to your final project, how did you decide what to be included in your reflection?
→**Follow up** Why did you choose to organize your work in that manner?]

All three participants made clear distinction between content included in the report or process book and the reflection. Partly because the design brief/ report guidelines clearly stated what was required for the report but the requirements for the reflection tend to be loosely defined. **Participant 1** specifically pointed out this

distinction in the interview. In terms of the coverage, all participants seemed to share similar thoughts on what to be included in the reflection:

> "But when I was writing reflection, I tend to include more personal opinions on the design process. I would also include things beyond project such as key sentences or concept that I learned from a lecture or newspaper clipping, or anything I think that inspire me. Those accumulated, would help me a lot in my project, especially my thinking and the overall structure of my project" **(Participant 1 →ı interview script p1-q7, sec # 81).**

> "... also included the challenges I encountered and how I struggled and pulled through to the current stage ... As for reflection, it was meant to record the learning during the process of final project" **(Participant 2 →ı interview script p2-q7, sec # 33).**

> "What to be included depends on the impact or how much it has influenced me" (**Participant 3 →ı** interview script p3-q7, sec # 40) ... "In the midst of learning, tutor will provide guidance, including skills that I didn't know and I realized that the guidance will benefit to my future work [will also be included]" (**Participant 3 →ı** interview script p3-q7, sec # 41) ... "In addition, something that I have encountered, ... experienced and unexpected, will also be included into the reflection" **(Participant 3 →ı interview script p3-q7, sec # 43).**

In terms of how the participants choose to organize their reflection, both **participants 1** and **3**–who both happen to be female–chose to present their reflection according to stages of their report while the male **participant 2** has chosen to present his work following a weekly arrangement. Perhaps this was just a coincidence.

INTERPRETATION FOR SUB-SECTION c)-i:

When questioned why both report and reflection could not be combined or merged as a single document, all seemed to have a strong 'feeling' towards the 'personal' aspect of reflection and all have reiterated the need to keep the two apart as if both documents can be clearly separated and addressed in isolation. For instance, should a report only focus on nothing but outcomes, i.e., what decision was made? Can't the report be showing the decision-making process, i.e., three directions were developed and how the final direction was selected based on given criteria? Similarly, must reflection really be all about emotions and personal opinions and can't those emotions and personal opinions in such a way that can be included in the report as designer's decision that directly or indirectly influenced the final

outcome? Must report always be formal and objective while the reflection be personal and subjective?

Previously acquired knowledge and skills on formal report writing could be factors that restrict their creativity when producing a design report. Similarly, it could also due to the misinterpretation of the word 'personal' mentioned earlier that made them think so rigidly. Perhaps, what they need is a design documentation that demonstrates the co-existence of process and outcome and can equally 'house' both objective and subjective views. After all, design decision is usually made based on a number of factors including objective factual information, subjective responses from both users and even the designer himself or herself.

All participants managed to make clear distinction between a report and a reflection. While the requirements and assessable components for report have always been clear, the requirements for reflection remained flexible and open for interpretation. This conclusion might raise a question on whether (critical) reflection and critical thinking should be formerly introduced or integrated into the curriculum. Different participants adopted their own approach to structure and organize their reflection, including presenting their works either in weekly format or followed the stages of the design process.

All participants agreed that both report and reflection should be separated into two distinct documents and should not be combined. The rationale was mainly due to the objective and subjective nature of how each piece of work was presented due to past writing experience but never considered why it could not be done differently.

ii. How is the learning journal organized?

This is fairly easy to detect. Essentially, there are two types of organization:

Chronological order–The work was organized in chronological order in terms of how they were presented, usually by weeks. This type of organization was very obvious in the works of **participants 2** and **3**, more specifically, **participant 3** also include a consolidated section–i.e., reflections on project as a whole–to serve as closure for the learning journal.

Thematic–The work was organized by themes. Only **participant 1** has chosen to organize the work using sub-headings such as 'decision on design direction/ how to write the topic sentence' and 'user testing' etc.

iii. What do students usually reflect on their learning (in the learning journal)?

This question focuses on the content of learning journal, more specifically, given the lack of clear guidelines, what do students choose to reflect on their learning. ↘**Table 4.3** below provides a summary of codes gather from the three learning journals. Altogether, 101 statements were coded–excluding an additional un-coded statement (see grayed text under **Participant 1**).

Table 4.3 **Unsorted Codes Generated from Three Learning Journals Using Content Analysis**

Participant 1	Participant 2	Participant 3
Realization of own shortcoming [P1: 01]	Summary of what was acquired (knowledge) [P2: 01]	Realization of 'design in a bigger context' [P3: 01]
Summary of newspaper article [P1: 02]	Realization of more need to be done [P2: 02]	Anticipation of design solution [P3: 02]
Inspiration (through reading) [P1: 03]	Inspiration from reading [P2: 03]	Identification of design criteria [P3: 03]
Use of tool [P1: 04]	Make connection between reading and potential application [P2: 04]	Evaluation of own design solutions against others [P3: 04]
Summary of lecture attended [P1: 05]	Explanation of concept [P2: 05]	Idea speculation [P3: 05]
Make connection between lecture and project [P1: 06]	Idea speculation [P2: 06]	Summary of what has been done in relation to observation [P3: 06]
Workshop experience (with brief explanation) [P1: 07]	Anticipation of potential challenge [P2: 07]	Reaction to (observation) activity [P3: 07]
Execution decision [P1: 08]	Summary of what has been done [P2: 08]	Identification of challenge encountered [P3: 08]
Coverage of user test [P1: 09]	Tutor's comment on premature decision [P2: 09]	Reaction to the challenge encountered [P3: 09]
Result of evaluation (original design) [P1: 10]	Anticipation of what needs to be done to move forward [P2: 10]	Identification of challenge during activity [P3: 10]

Participant 1	Participant 2	Participant 3
Redesign work [P1: 11]	Event experience [P2: 11]	Realization of own shortcoming (lack of experience) [P3: 11]
Result of evaluation (after redesign) [P1: 12]	After thoughts [P2: 12]	Tutor's suggestion [P3: 12]
Reaction(s) from participant(s) [P1: 13]	Realization of own improvement [P2: 13]	Identification of challenge with solution to the challenge [P3: 13]
Drawback of design [P1: 14]	Explanation of concept [P2: 14]	Identification of challenge related to manage research data [P3: 14]
Success of design [P1: 15]	Idea speculation (after event) [P2: 15]	Identification of design criteria [P3: 15]
Anticipation of outcome [P1: 16]	Experiment design on speculated idea [P2: 16]	Summary of what has been done [P3: 16]
Evaluation of work [P1: 17]	Discovery from experiment [P2: 17]	Idea speculation [P3: 17]
Design tasks [P1: 18]	Idea speculation (after discovery from experiment) [P2: 18]	Summary of what has been done [P3: 18]
Expectation [P1: 19]	Experiment design on speculated idea round 2 [P2: 19]	Design decision [P3: 19]
Coverage of presentation [P1: 20]	Reaction(s) from participant(s) [P2: 20]	After thoughts on Self-doubt about own solution [P3: 20]
Evaluation of own presentation [P1: 21]	Realization of complexity of collected data [P2: 21]	Strategy to overcome self-doubt [P3: 21]
After thoughts on FYP [P1: 22]	Discovery from experiment [P2: 22]	Realization of the need for better time management [P3: 22a]

Participant 1	Participant 2	Participant 3
Realization of the difficulty of project [P1: 23]	Explanation of own understanding of sound [P2: 23]	Evaluation of time spent on tasks [P3: 22b]
Recall tutorial experience [P1: 24]	Coverage of own concerns in the project [P2: 24]	Realization of action speaks louder than thinking [P3: 22c]
Uncodable. Not sure what does it mean by 'it' [P1: 25]	Idea speculation [P2: 25]	Idea speculation (after final presentation) [P3: 23]
Realization of action speaks louder than thinking [P1: 26]	Evaluation of own thoughts [P2: 26]	
Evaluation of time spent on tasks [P1: 27]	Idea speculation [P2: 27]	
Realization of the importance of prototyping [P1: 28]	Summary of completed tasks [P2: 28]	
Realization of the purpose of FYP training [P1: 29]	Realization of potential challenge to complete the task [P2: 29]	
	Suggested solution to resolve the challenge [P2: 30]	
	Coverage of presentation content [P2: 31]	
	Anticipation of the outcome of solution [P2: 32]	
	Evaluation of proposed deliverables [P2: 33]	
	Self-justification of what can be done [P2: 34]	
	Self-doubt about solution [P2: 35]	

Participant 1	Participant 2	Participant 3
	Declaration of target audience/ user [P2: 36]	
	Inspiration through classmate's traveling experience [P2: 37]	
	Explanation of concept [P2: 38]	
	Idea speculation (UI design and functionality) [P2: 39]	
	Development of idea [P2: 40]	
	Vision of speculated idea [P2: 41]	
	Idea speculation (functionality) [P2: 42]	
	Declaration of shortcoming of function [P2: 43]	
	Inspiration of new function through previous experience [P2: 44]	
	Explanation of concept [P2: 45]	
	Summary of what has been done [P2: 46]	
	(Brief) Description of deliverable (video) components [P2: 47]	
	Explanation of the development of video [P2: 48]	

The analysis reveals the following seven key themes–in no particular order–that best describe what participants are reflecting on:

1. **Summary of something** (see ↘**Table 4.4**)–usually descriptive–where 'something' could include a summary of what has been done, i.e., an activity; a summary of what was covered in the lecture; or what someone has done to name a few. For examples:

   "My tutor shared a piece of newspaper with me, about "how to write the topic sentence, interesting vs practical". The newspaper has mentioned that students didn't know how to narrow down the scope of the topic and didn't consider limitation, how can they implement the research plan in a limited time. ..." **[P1: 02]**

Table 4.4 **Theme: Summary of Something**

Participant 1	Participant 2	Participant 3
[P1: 02]	[P2: 01]	[P3: 16]
[P1: 05]	[P2: 08]	[P3: 18]
	[P2: 28]	
	[P2: 46]	

2. **Realization of something** (see ↘**Table 4.5**)–i.e., being aware of the existence of concept, fact or meaning as a result of an incident or experience–this could include understanding of design in bigger context, action speak louder than thinking, complexity of data, effect of ineffective color scheme, understanding of self, to name a few. For examples,

   "The difficult part of recording in public area, is that when you walk too close to somebody, they notice that I'm recording sounds, then they'll stop what they were doing, stopping the sound they've been making." **[P2: 29]**

   "I should have better time management in the whole project. At the beginning it seemed that I spent too much time on finalizing the concepts but not start working or trying. ..." **[P3: 22a]**

Table 4.5 **Theme: Realization of Something**

Participant 1	Participant 2	Participant 3
[P1: 01]	[P2: 02]	[P3: 01]
[P1: 23]	[P2: 13]	[P3: 11]
[P1: 26]	[P2: 17]	[P3: 22a]
[P1: 28]	[P2: 21]	[P3: 22c]
[P1: 29]	[P2: 29]	

3. **Reaction to/ over something** (see **↘Table 4.6**)–refers to a response to an experience, activity or object, include reaction to performance, opinion or comment from tutor. For examples,

   "...I found a study from Frog Design explaining about method to design synthesis. Through this exercise, I have forced myself to think out of the box, moving away from the focus of my study subject ..." **[P5: 15]**

   "...At the beginning I was quite disappointed but after having more experiences, I feel already when interviewees rejected my request and I respected them ..." **[P3: 09]**

Table 4.6 **Theme: Reaction to/ over Something**

Participant 1	Participant 2	Participant 3
[P1: 13]	[P2: 20]	[P3: 07]
		[P3: 09]

4. **Idea speculation and possibility** (see **↘Table 4.7**)–refers to the willingness to try generating ideas for formal or informal testing. This is very obvious in participant 2's learning journal. For examples,

   "...This experience also inspired me to think of how we can listen in a city environment. Can we listen with all our attention to those seemingly meaningless sounds in daily life?..." **[P2: 18]**

   "This week I came up with new functions for the app. Aiming at travelers, the app can record a short clip for 5 secs for every hour ..." **[P2: 42]**

   "I thought about methods in order to make my design different such as adding elements of travel journal to make it personalized, ..." **[P3: 05]**

Table 4.7 **Theme: Idea Speculation and Possibility**

Participant 1	Participant 2	Participant 3
	[P2: 06]	[P3: 05]
	[P2: 15]	[P2: 17]
	[P2: 18]	[P3: 23]
	[P2: 25]	
	[P2: 27]	
	[P2: 39]	
	[P2: 41]	
	[P2: 42]	

5. **Sources of inspiration** (see ↘**Table 4.8**)–Both **participants 1** and **2** reflect on this theme at least once except **participant 3**. Inspiration generally comes from readings, discussion with tutor or peers. For examples,

> "And I was inspired by a statement "以小見大的題目", which means we could start from studying a little things or issue to project larger value. It is a good reminder to me for writing the topic sentence." **[P1: 03]**
>
> "I was inspired by the comparison of sounds and visual in the book Audible Past." **[P2: 03]**
>
> "I have been looking many design references online. There are many great ideas and design flying everywhere. I can adopt the ideas to use on my design because it looks cool." **[P5: 11]**

Table 4.8 **Theme: Sources of Inspiration**

Participant 1	Participant 2	Participant 3
[P1: 03]	[P2: 03]	
	[P2: 37]	
	[P2: 44]	

6. **Excitement and anticipation** (see ↘**Table 4.9**)–Every participant reflected at least once in their journal on this theme. For examples:

> "...Once I can answer these questions, I think I will be able to think of a suitable execution method." **[P2: 10]**

"...But that is not what I want to design it. I was trying to find something from my research that can support why I design it." **[P5: 12]**

Table 4.9 **Theme—Excitement and Anticipation**

Participant 1	Participant 2	Participant 3
[P1: 16]	[P2: 07]	[P3: 02]
	[P2: 10]	
	[P2: 32]	

7. **Tutor-related matters** (see ↘**Table 4.10**), including suggestion, explanation, comment, and reaction coming from the individual tutor. Both **participants 2** and **3** except **participant 1** have reflected on such matter. For examples,

"But tutor gave me comments that this stage was too fast for execution methods. I had to find more about the contextual information about sound. What is important about sound? How does listening improving our lives? Why would people bother to listen the usual daily sounds that I think is significant?" **[P2: 09]**

"Then I was told to scan the hand-drawing pencil sketch into computer and print several copies out and paint on the copies. In that way, I didn't have to afraid wasting the hand-drawings and I could practice painting on it." **[P3: 12]**

Table 4.10 **Theme: Tutor-related Matters**

Participant 1	Participant 2	Participant 3
	[P2: 09]	[P3: 12]

INTERPRETATION FOR SUB-SECTION c)-iii:

Scholars such as Brookfield (1995), Christenson (2001) and Fook (2002, cited in Hickson, 2011) argue the importance of 'criticality' in reflection. In fact, Christenson (2001) specifically point out the need for questioning or critiquing "the way we are doing things and thinking about things at present" (p.37) so that we could improve ourselves as a result. Furthermore, Adams (2002) also points out that critical practitioners do not take things for granted and emphasizes that not only critical practice involves reflective thinking, but must transcends it. Moreover, the literature also suggests that critical reflection tends to go beyond individual and include the need to: "

- Incorporate issues of forethought or planning: reflection-for-practice;
- Take greater account of the central role of language, meaning and narrative as key elements in the process of meaning making;
- Go beyond individualism or 'atomism' to appreciate the significance of the wider social context;
- Take greater account of the emotional dimension of reflection;
- Incorporate a greater understanding of the important role of power;
- Be clear about the differences between reflection and reflexivity and understand the relationship between the two;
- Take account of time considerations, at both individual and organizational levels, and crucially;
- Develop a critical approach that addresses the depth and breadth aspects of criticality and the interrelationships between the two" (Thompson and Pascal, 2012, p. 322).

As a result, it is not difficult to realize the challenge to reach the critical reflection stage for some design students. The fact that all three participants only focused on the project and failed to realize the need to relate their reflection in a bigger context, i.e., how was handle the given issue–or learning point–similar or different from a similar incident in the past? Or to what extend they have changed or evolved over time that makes them more ready for practice? As a final thought of their undergraduate education, how can they not look back and reflect critically on identity formation (Brown, 2006; Wenger, 1998), i.e., what and how they have changed and developed themselves to become a designer?

If all learning involves change (Mandell & Herman, 2009) and learning is essentially about meaning-making or to make sense or interpretation of a given experience and later use this interpretation to guide decision-making (Mezirow, 2009), then it is imperative that we pay attention to how we have made sense of or interpreted the given experience, i.e., how much do we truly understand the given experience as per Ip (2003); Kember et al. (2008); Perkins (1998); Perkins & Blythe, (1994); and Wiggins & McTighe (2005), and how such learning experience–i.e., deeper meaning and understanding (Hinett, 2002; Hutson, Ristic & Tregloan, 2013; Vernava, 2002; Walling, Shapiro & Ast, 2013)–might have led to positive transformation as a result.

However, given that guidelines don't (really) exist, participants tend to focus on what they perceived memorable and meaningful in relation to their learning experience in the final project. As a result, this might have led them to produce an

incomplete reflection on learning experience. Even if the guidelines did exist, given that many design students tend to put the writing of reflective journal to the end of their designing process–or treat writing as secondary to making–it is unlikely to see meaningful reflective journals.

d) Does the Quality of Learning Journals Support Students' Perception of the Value of Learning Journals?

i. On the scale of 1 to 10 (where 1=non-critical, and 10=most critical), how would you rate yourself as a critical thinker? Why?

This question requires participants to give a rating to themselves in relation to their critical thinking. In the context of this study, one's justification supersedes one's rating. The responses from participants are presented in **↘Table 4.11**.

Table 4.11 **Self-Perceived Rating on Self as a Critical Thinker**

Participant	Self-rating	Justification
1	7 or 8	"[F]irst of all, I know I need to be critical in my reflection in terms of what I have done, at least I must be aware of this and know I have to do it this way. Second, I will think of how I could improve the whole thing so I could do it better, regardless of the merit of my proposal in the end" **(→ interview script p1-q8, secs # 97-98)**.
2	7	"Sometimes when I suggested some ideas during the tutorials, the tutor will critically comment on my ideas and tell me that I have not thought through everything completely. Then I would question myself why didn't I see that and why do I need someone to remind me?" **(→ interview script p2-q9, secs # 38)**.
3	5 or 6	"I think I have not done enough. When I am dealing with something, I certainly would be thinking about what I am doing but… to be critical, in addition to doing more research, one also needs to read more that are related to the work in order to build own perspective. But for me, I don't usually read more about what I was dealing with. While I may have passed my own judgment on what I was working on, due to the lack of reading, I might have missed out something else" **(→ interview script p3-q9, secs # 54-55)**.

INTERPRETATION FOR SUB-SECTION d)-i:

The motivation behind this question was not meant to focus too much on the accuracy of the rating from each participant. Instead, it was hoping that through the self-perceived rating and the justifications, the analysis could determine if respective participants could clearly articulate and justify the worth of their own rating, most importantly do the justifications make any sense.

While all three participants were able to provide reasons to justify their ratings, closer examination to their justifications revealed that the such ratings may not be sufficiently convincing. Among the three participants, the response from **participant 3** was more informative and convincing–not because of its length but–partly due to her honestly and her explanations on the implication for her actions, and the ability to identify the shortcoming of her judgment as a result. On the other hand, the response from **participant 2** was generally weak and less convincing. For instance, merely including the word 'critically' in his response without appropriate evidence could not prove that the comments from tutor were indeed 'critical' but–to some extent–reflected his inability to consider the given issue critically, i.e., look at the issues from multiple perspectives. Additional to critical thinking, there could be other reasons why he was unable to see things as he expected, such as lack of experience and lack of understanding and knowledge to name a few. Having said that, if the participant was truly critical in terms of his response, he would have been more specific. While not as equally unconvincing as **participant 2**, the response from **participant 1** did not go beyond knowing. Although awareness of being critical is important, however, knowing doesn't mean understanding. Knowing that she needs to be critical during reflection doesn't mean and guarantee she knows how to do it effectively.

Essentially, what is lacking in this rating exercise was the clear articulation of evaluation criteria from each participant, i.e., what criteria do they rely on to rate themselves? What was on their mind when they gave an overall score to rate their own critical thinking ability? Does a single rating make any sense or could the rating be further broken down into specific aspects or components such as accuracy of interpretation, strength of the argument, and thoughtful analysis to name a few. When assessment criteria do not exist, will the participants able to develop appropriate aspects or components to evaluate themselves?

ii. In relation to your final project reflection, how would you rate yourself in terms of critical thinking? Why?

This question requires participants to rate their reflective journal in relation to critical thinking. Again, in the context of this study, one's justification supersedes one's rating. The responses from participants are presented in ↘**Table 4.12**.

Table 4.12 **Self-Perceived Rating on Criticality of One's Work**

Participant	Self-rating	Justification
1	5 or 6	"This time I did not write consistently, that is I did not reflect on the process every week, but every two weeks or so. In the end when I have to reflect and write about the whole process over the past 14 weeks, I probably would have missed out something that I think is considered crucial" **(→ interview script p1-q10, secs # 102-103)**.
2	8	"After I have finished reading it, I was kind of surprised that I have gone through so much. It was like 'it has been a long way'. Actually, I am happy that I can write something like this, i.e., to talk about my own journey. I doubt this would be something that I could handle easily in the past" **(→ interview script p2-q10, secs # 102-103)**.
3	7	"Thinking back, I realized the part on critical thinking wasn't that much. But what's there was my personal view on the role of future designer, although that also didn't really take up much space" **(→ interview script p3-q10, sec # 59)**.

INTERPRETATION FOR SUB-SECTION d)-ii:

Without a clear rating standard, the participants were not able to reflect on the criticality of their work in a more objective manner. It was originally anticipated that the rating for individual's work would be slightly lower as one becomes more critical when looking at one's own work, except **participant 1**–and with reasonable justification why she deserved a lower rating for her own work–both **participants 2** and **3** have given themselves higher ratings but their justifications were more subjective–probably due to the 'hardship' they have gone through and the sense of achievement after the completion of the project. **↘Table 4.13** below shows the comparison of two sets of rating.

Table 4.13 **Comparison of Ratings**

Participant	Rating for critical self	Rating for critical work
1	7 or 8	5 or 6
2	7	8
3	5 or 6	7

The respective ratings and justifications revealed a gap between self-perception and actual performance presented in one's reflective journal. Most participants tend to believe that their reflection and reflective thinking have changed or improved after three years. While all three participants were able to provide justification for own work in relation to the given rating, those justifications could not reflect truly their performance based on Kember et al.'s (2006) four-category scheme for coding and assessing the level of reflection in written work, even though **participant 1** may have admitted the weakness in her work (see sub-section **↘ d)-iii** below).

iii. How critical are they when they reflect?

As pointed in the Methodology section, this study will adopt Kember et al.'s (2008) four-category scheme for coding and assessing learning journals. Unlike coding themes for the interview, where appropriate code(s) can be assigned to a sentence or a paragraph, assessing critical thinking needs to be done in context, i.e., whole paragraph or the journal entry must be read to get a full picture of writer's argument. **↘Table 4.14** below presents the summary of assessment results for the three learning journals collected from the participants.

Table 4.14 **Assessment of reflection Based on Kember et al. (2008) Four-Category Scheme**

	Participant 1	Participant 2	Participant 3
Non-Reflection	[P1: 01-03] [P1: 04] [P1: 05-06] [P1: 07-08] [P1: 16-18] [P1: 19-20]	[P2: 42-43]	[P3: 01-05] [P3: 06-10] [P3: 11-15] [P3: 16-19] [P3: 20-23]
Under-standing	[P1: 09-15] [P1: 22-24] [P1: 26-28]	[P2: 08-10] [P2: 19-22] [P2: 27-30] [P2: 31-32] [P2: 33-35] [P2: 36-41] [P2: 46-48]	-
Reflection		[P2: 11-18] [P2: 23-26] [P2: 44-45]	-
Critical Reflection	[P1: 29]	[P2: 01-07]	-

The following observations could be made drawing from the results presented in **↘Table 4.14** on the previous page:

1. The majority of the journal entries fall under the 'non-reflection' category. In fact, the learning journal from **participant 3** has never gone beyond the non-reflection level.
2. Learning journals of **participants 1** and **2** managed to reach the 'understanding' category.
3. Among the three, **participant 2** performed fairly well to keep most of his entries at the 'understanding' category.
4. Of all the three learning journals, only some of **participant 2**'s journal entries can reach the 'reflection' category.
5. While **participant 1**'s journal entries did not reach the 'reflection' category, a small portion of participants 1 and 2's entries managed to reach the 'critical reflection' category.

INTERPRETATION FOR SUB-SECTION d)-iii:

If writing could indeed improve critical thinking and learning as the literature revealed (see Cavdar & Doe, 2011; Doyle, 2008; Kim, 2013; Gleaves et al., 2008, cited in Lew & Schmidt, 2011; Thorpe, 2004, cited in Lew & Schmidt, 2011; Paul & Elder, 2007; Quitadamo & Kurtz, 2007; Reagan, Case & Brubacher, 2000; Wade, 1995; Wode 2013), then critical and reflective writing must be taught and cultivated. Simply getting students to write or express their thoughts and feelings about their learning is only one of many aspects of reflective writing. While all participants may be able to articulate their 'understanding' of terms such as reflection, reflective thinking and critical thinking, there is no guarantee they are able to perform their work effectively to truly reflect their understanding. While **participant 1** may not see a need for formal introduction of critical reflection, **participant 2** was conscious enough to (re)use what was formerly introduced in his earlier learning experience to frame his writing. Even though **participant 3** was able to clearly articulate her knowledge of those terms with depth, her work appeared to be the weakest among the three participants. This truly reflects, again, the notion of knowing is not the same as understanding (Perkins, 1998; Stiles, 2006; Wiggins & McTighe, 2005; Willingham, 2007; Wurman, 2001).

Descriptive writing, which is common in many reflective journals (Orland-Barak, 2005; Strampel and Oliver, 2008), not only does not improve students' learning, it also depreciates the value of critical and reflective writing. To make one's (reflective) writing critical, one needs to think clearly, logically, and analytically as these are essential to good reasoning, which are the core of critical thinking. To get students to reflect critically without much guidance or feedback, educators are doing a disservice to their students.

Summary of Chapter 4

In this chapter, I have presented the selection criteria for data analysis and discussed the key findings with appropriate supporting evidence from the data collected from the interviews and learning journals. In addition, I have also presented my interpretations drawing references from literature presented in Chapter 3.

In the next chapter, the summary and implications of the findings for communication design education will be discussed.

This page is intentionally left blank.

5 Summary, Conclusions, and Recommendations

Introduction

In the context of education, the **ability to think critically** is one of the attributes almost all universities would want their graduates to acquire and develop before they leave their university. Similarly, in the context of practice, employers would expect their employees to be equipped with such quality. However, while most design educators and scholars from the literatures agree that design students need to be reflective and critical in their thinking and making, the findings from this study revealed that simply asking students to reflect and be more critical without much guidance and feedback have been shown to be insufficient and less productive.

A closer examination of the learning journals submitted by students revealed that most of the reflections were descriptive and tend to be a summary of what occurred in the learning experience. Essentially, the intention of reflective learning journals is meant for students to develop higher-order thinking skills and to provide a structure to make their learning experience and thinking visible in terms of what one thinks, does, and feels, but most importantly it provides students to focus on why–the rationale behind their thinking, doing and feeling. In addition, the reflective learning journals also encourage the students to focus on how could things be done differently–the possibilities, alternative point of views, and opportunities for change that leads to transformation. Unfortunately, as existing literature and this study have revealed that many of the reflective journals received tend to be less satisfactory. In short, while many young design students were able to describe what they did but very few were able to explain how they were able to do something. This is partly due to the fundamental learning-by-doing nature in design education. It is hope that by getting students to reflect critically at various intervals, they could move away from mere

working on design projects–which according to Dorst and Reymen (2004), can be 'labor intensive,' 'repetitive' and many times 'unclear what was learned'–and pay more attention to what they thought they have learned in relation to the development of their design ability (Cross, 1990). However, it was the disappointment of the quality of work presented in the learning journals that triggered and inspired the focus of this study. Merely describing the process or reproducing content–from lecture slides into more organized notes in learning journal–can never be a convincing evidence to claim or prove one has, indeed, learned something.

To recap, this study was originally sought to examine the perception of the use of learning journal as a tool to develop critical and reflective thinking skills from recent graduates from the undergraduate communication design program at the local university in Hong Kong. This study was guided by the following key research question and four supporting sub-questions:

> **How do undergraduate communication design students use learning journal as a tool to facilitate the development of critical and reflective thinking?**

a) What does it mean by reflective and critical thinking to the undergraduate communication design students?
b) What is their perception of the value of learning journal in relation to the facilitation and development of reflective and critical thinking?
c) What do students usually reflect on in the learning journal?
d) Does the quality of learning journals support students' perception of the value of learning journals?

The remaining of this Chapter will first present a synthesis of findings from the literature review and how such findings might put into perspective, then follow by a synthesis of findings from the primary data. The recommendations section will focus on how might things be done differently to promote reflective and critical thinking using learning journal. Lastly, Implications for future research will be discussed.

Key Synthesis from the Literature

Conscious development of thinking–such as investigating the world, solving problem, making judgment, collecting and organizing information, managing resources and creating work (Fisher, 2007; Frascara, 2004)–is essential to response to doubt or ignorance (Baron, 1991) and to enable students to become effective learners (Paul & Elder, 2005). As educators, we need to (a) understand what comprises intellectual work, the functions of mind, how to intellectually engaging the mind, how to take ownership of ideas seriously (Paul & Elder, 2005) and (b) cultivate 'conscious thinking',

'thoughtfulness' and 'mindfulness' so that the creation of knowledge–through making, thinking and doing in the context of design–can become the property of one's mind, and that in turn, not only allows one to create artifacts that fit for purpose, i.e., effective and sensitive to users (Frascara, 2004; Johns, 2004; Löwgren & Stolterman, 2004); but also enables one to share, debate, challenge, extend, reject and use the knowledge (Löwgren & Stolterman, 2004; Pestalozzi, n.d., cited in Paul & Elder, 2005).

An effective thinker shares the following attributes (Perkins & Ritchhard, 2004):

1. **Sensitive** to the opportunity that leads to thinking, i.e., hasty causal inference, sweeping generalization, etc.;
2. **Incline** to invest effort in thinking as a result of curiosity, relevance, and habits of mind; and
3. **Able** to think effectively–a mental capacity–with the appropriate knowledge and skills, including making connection and generate alternative explanation for the supposed causal relationship. Abilities can be divided into:
    a) **Generic concepts** (Sternberg & Williams, 1996):
        - **Synthetic ability**–a.k.a. experiential intelligence or creative thinking;
        - **Analytic ability**–a.k.a. componential intelligence or critical thinking; and
        - **Practical ability**–a.k.a. contextual intelligence or contextual thinking.
    b) **Generic skillsets** (Fisher, 2007; Löwgren & Stolterman, 2004):
        - Questioning and inquiry
        - Concept formation, creating and shaping
        - Design (structural, functional, ethical, and aesthetic qualities)
        - Planning
        - Rationalization and communication
        - Imagination
        - Analysis
        - Synthesis
        - Evaluation
        - Decision making

While being mindful in design practice would be ideal and strongly encouraged, this may not necessarily be the case in most design education or practice. Designers, most of the time, tend to rely on their intuition–or better, intellectual intuition developed through experience–more than their analytical mind as pointed out in earlier

discussions. If enculturation into the 'way of being' a (mindful) reflective practitioner is what design education really intends to achieve, then we need more than just skillful or experienced design educators. It is relatively easy for design educators to tell students they need to be more critical or their works are not critical enough, but if educators were not themselves critical or able to demonstrate the act of criticality explicitly, then it would make teaching critical thinking harder to achieve (Hayes, 2014) in the context of design.

1) Putting reflective practice and reflection into perspective

While reflective practice can be, at times, misunderstood as mere confession (Bolton, 2005), it refers to putting reflection into a context of a specific profession that wider our perception of experiences from a range of viewpoints or a conforming mechanism to examine practice critically (Bolton, 2005). Many also argue the importance of criticality–i.e., the depth (Murray and Kujundzic, 2005, Thompson & Pascal, 2012) and breadth (Brechin, Brown and Eby, 2000, Thompson & Pascal, 2012)–in reflective practice (Adams, 2002; Christenson, 2001; Fook, 2002, cited in Hickson, 2011; Meizirow, 1990, cited in Hickson, 2011; Thompson & Pascal, 2012), including the avoidance of taking the world for granted and critique on one's beliefs and values (Adams, 2002; Meizirow, 1990, cited in Hickson, 2011), and be aware of the role of language, emotional dimension, and power relations that go beyond individualist level (Brechin, Brown and Eby, 2000, cited in Thompson & Pascal, 2012).

Originally theorized by Dewey (1910) but subsequently developed by Schön (1983; 1987) and many other scholars, reflection–or thinking reflectively–requires one's conscious effort to critically analyze and make judgments about what has happened during or after the experience in order for one to achieve deeper meaning and understanding that may help improving one's practice in the future (Atkins & Murphy, 1994; Boud, Keogh & Walker, 1994; Di Stefano, Gino, Pisano, and Staats, 2014; Fook & Gardner, 2007, cited in Hickson, 2012; Hinett, 2002; Walling, Shapiro & Ast, 2013). In addition, scholars (Bain, Balantyne, Mills & Nestor, 2002; Francis and Ingram-Starrs, 2005; Moon, 2004; Rau, 2012; Rodgers, 2002; Wilkinson, 1999) caution on 1) the complication and challenge of using the term 'reflection' or 'reflective thinking'; 2) the need for 'proper' training in providing evidence of their reflection on professional practice, and 3) draw our attention to criteria of reflection. A closer examination of the definitions covered in this review suggests the following key elements in a reflection:

- It needs conscious effort, i.e., being 'presence' at 'the moment' is essential;
- It is a mental processing or metacognitive act, hence the skill or ability can be acquired and developed over time;

- It involves both critical and analytical thinking skills to challenge the status quo, make reasoned judgments, and reach a conclusion with supporting evidence;
- It requires suspension of immediate action and careful consideration of one's belief, values, knowledge, experience, and emotions during the process;
- Its goal is to achieve deeper meaning and understanding, gain insights or improve performance;
- Its outcome demands articulation and communication–in any form as an attempt to codify one's understanding–to a community of practice to achieve greater result, i.e., go beyond self; and most of all,
- It needs the appropriate attitudes or habits of mind that tie all other elements together that eventually put all the thinking into (future) action, i.e., preferred ways to act.

2) Putting critical thinking into perspective

Arguments on the importance of critical thinking is indisputable and that has been widely discussed in the existing literature (see Bensley & Murtagh, 2012; Davies, 2013; Johnson & Hamby, 2015; Lai, 2011; Ralston & Bays, 2013; and many more covered in the literature review section), despite the discussions on:

- Differing perspectives contributing to framing the concepts (Thompson, Irmer, and Tang, 2012),
- Whether critical thinking is generic (Ennis, 1989, cited in Davies, 2013) or discipline specific skills (McPeck, 1981, cited in Davies, 2013);
- The nature of critical thinking skills and how easy these skills can be defined, taught, assessed, applied and transferred between disciplines and beyond the university into workplace (Jones, 2007; Thompson, Irmer, and Tang, 2012)

Critical thinking remains challenging to many educators, students and even practitioners partly due to a lack of substantive concept of critical thinking. Worse, many either don't even realize that they lack the basic understanding of the concept or they believe naively that they sufficiently understand and practicing critical thinking (Elder and Paul, 2007; Paul, 2004; Paul, 2005; Paul, Elder and Bartell, 1997). In addition, Fox (1994, cited in Moore, 2013) suggests that many acquired the concept intuitively, where it is easier for some to recognize but not easy to define or explain clearly. It is believed that, the ability to think critically depends on having adequate content knowledge–i.e., knowing one should think critically is different from having the ability to perform (Willingham, 2007). This is because one cannot think critically about given topic or solve problems if one lacks appropriate knowledge on problem recognition and

solution execution. That requires effortful and slow thinking (Kahneman, 2011, cited in Goodwin, 2014).

A critical thinker must regularly analyze, assess and reconstruct his or her own thinking (Paul, 2005). Description of a well-cultivated critical thinker (Pascarella & Terenzini, 1991; Paul & Elder, 2007) include:

- Raises and formulate questions and problems clearly and precisely;
- Gathers and assesses relevant information;
- Identify central issues and assumptions in an argument;
- Evaluate evidence or authority;
- Recognize and assess the assumptions, relationships, implications, and practical consequences;
- Make inferences and deduce well-reasoned conclusions and solutions;
- Testing them against relevant criteria and standards;
- Communicates effectively with others.

Some scholars extend the understanding of critical thinking beyond just a set of skills and include the dispositions or habits of mind including inquisitiveness, open to alternatives, flexibility, empathy, clarity and diligence to name a few (Cheung, Rudowicz, Kwan, & Yue, 2002; Ennis, 1996); and even ideological beliefs that support the endorsement to scientific worldview and appreciation of paranormal belief (Cheung, Rudowicz, Kwan, & Yue, 2002)

In the context of design, critical thinking is perceived as the ways designers observe, learn, analyze challenges and make sound and logical decisions to propose desirable, feasible and viable solutions (Tippey, 2008). Not only it expands designers' value to clients, it also improves business performance and makes designers better citizen.

3) Putting use of reflective learning journal into perspective

Keeping a learning journal is one of many means to facilitate reflection and provide concrete evidence of professional growth and development (Allan, 1998; Gelmez & Bagli, 2015; Gröppel-Wegener, 2012; Gulwadi, 2009; Sempowicz & Hudson, 2012; Webster, 2001) in many professions (see Lowe, Prout & Murcia, 2013 for relevant literature). As a written form of expression, journals provide an avenue, a physical, concrete space and place outside our mind, for us to look at ourselves, our attitudes, feelings and thoughts, and our actions in a different ways, and increase our ability to develop higher order thinking skills (Arrendondo and Rucinski, 1994; Chance, 2010; Doyle, 2008; Holly, 2003; Reagan, Case & Brubacher, 2000; Hubbs and Brand, 2005; Spalding & Wilson, 2002; Walling, Shapiro & Ast, 2013; Wood 2013). In addition, it also develops our

connoisseurship, i.e., ability to see, synthesis, i.e., ability to make connection, and critique, i.e., ability to judge critically (Eisner, 1985).

Better reflective journals tend to demonstrate some levels of criticality–with indications of analysis, links to an underlying professional knowledge base and demonstration of the ability to draw out learning or new knowledge from the experience (Thompson & Pascal, 2012). However, the inability to articulate explicitly in writing–especially in undergraduate design education–is doing more harm to design education as students tend to rely heavily on episodic knowledge instead of semantic or theoretical knowledge in long run (Dorst & Reymen, 2004; Lawson & Dorst, 2009). Scholars argue that writing about something could be a way to develop, retain and evaluate critical thinking (Mehta and Al-Mahrooqi, 2015; Quitadamo and Kurtz, 2007, cited in Goodwin, 2014) but not necessary teach critical thinking (Goodwin, 2014) Hence, good writing requires constant revision, as making revision also improves thinking, and eventually makes students to be more self-critical (Jago, 2014). Price (2004) also argues that for reflection to become a transferable skill that can be used in practice, one needs to learn how to combine reflective thinking with critical thinking as the mind tends to improve thinking by thinking (reflectively) about the thinking; similarly, the mind improves its writing by thinking (reflectively) about its writing and "it moves back and forth between writing and thinking about how it is writing" (Paul and Elder, 2008, p. 40).

Triangulation–Better Understanding of the Issues

So what can the findings from both interview and content analysis tell us about students' perception of using learning journal as a tool to develop critical and reflective thinking skills? The remaining of this section will present the four supporting research questions and the key insights drawn from previous Chapter:

a) What does it mean by reflective and critical thinking to the undergraduate communication design students?

i. While interview may serve as a relatively effective method to elicit responses from participants, one would argue that true understanding of something needs to go beyond knowing (Perkins and Blythe, 1994; Wiggins and McTighe, 2005).

ii. Without formal introduction to concepts such as reflection and reflective thinking, one tends to rely on prior knowledge, that could include misconceptions and preconceptions about what it really is, and at times may misunderstood it as a 'personal,' 'private' or 'intimate' process. This misunderstanding might have caused some students to overlook the need for formal learning on critical reflection or tend to focus on more subjective and emotional matters and less able to focus on how learning is relevant to individual's experience in specific context (Boud et al., 1985, cited in Cowan, 2015; Holly, 2003). Furthermore, without appropriate guidance from tutors and

the lack of appropriate feedback on the improvement of reflection writing have all contributed to the misunderstanding and the value of good reflection (Nilson, 2014).

iii. When a task is done repeatedly, it is easy for one to perceive positive improvement over time until the shortcoming gets pointed out, it is the concrete feedback on how things could have been done differently that will eventually move one to the next level of expertise, which is equally applicable to any skill-based activity, including writing and designing.

iv. Learning requires deeper and meaningful understanding. It is easier to overlook one's true understanding of something under the disguise of reasonable explanation. When fuzzy words such as 'intuition' and 'creativity' are used it is easier to hide one's inability to articulate concepts (Frascara, 2007).

Findings from this supporting question revealed that while one might be able to provide standard response–using appropriate vocabulary–to a given question, we cannot assume a true understanding without getting the respondent to demonstrate it. In the case of reflective thinking, if learning journal is meant to assess one's ability to reflect critically, then the written work should reflect such understanding as Perkins and Blythe (1994) or Wiggins and McTighe (2005) suggested.

b) What is their perception of the value of learning journal in relation to the facilitation and development of reflective and critical thinking?

i. While the value of learning journal in relation to the facilitation and development of reflective and critical thinking may be somewhat positive–as per the three participants and substantial evidence from the literature, in particular from nursing education–the work may not truly reflect such belief, i.e., what one perceives may not reflect on one's behavior.

ii. While one may perceive improvement (on critical thinking) over time, lack of meaningful understanding and appropriate content knowledge (about critical thinking) may prevent one to use appropriate vocabulary to discuss and articulate clearly and tend to rely heavily on specific example(s) or incident(s) to get the point across.

Findings from this supporting question complements the previous question and revealed that when one learns something intuitively, i.e., through repetitive work or trial and error, without adequate content knowledge–especially when the subject matter was not formally introduced in the curriculum, i.e., as a standalone subject (a.k.a. course in some contexts), or as a topic in a given subject such as design thinking–it makes one harder to define or explain what was learned (Fox, 1994, cited in Moore, 2013; Willingham, 2007).

c) What do students usually reflect on in the learning journal?

i. When it comes to learning, one may have his/ her own interpretation of what makes the learning memorable and meaningful. As a result, what one choses to reflect on is highly dependent on what one considers a learning incident critical (Cox, 2005). Hence, the focus should be less about what was included but more about how one finds meaning out of the existing or new experience.

ii. While there isn't a strict requirement in terms of what to be included, the way how one choses to organize his/ her own work is subject to personal preference.

iii. A total of seven themes were identified from the content analysis of learning journals, namely 1) summary of something, 2) realization of something, 3) reaction to/ over something, 4) idea speculation and possibility, 5) sources of inspiration, 6) excitement and anticipation, and 7) tutor-related matters.

Findings from this supporting question revealed the subjective nature of how one choses to interpret the memorability and meaningfulness of a given learning incident. As a result, teaching in the context of design is less about content coverage–although essential–but more about the facilitation of meaning-making process in relation to reflective and critical thinking.

d) Does the quality of learning journals support students' perception of the value of learning journals?

i. Two self-reporting questions–using 10-point Likert scales–were included in this study. The questions require all three participants to rate themselves and their work produced in relation to critical thinking.

ii. The respective ratings and justifications revealed a gap between self-reporting and actual performance.

iii. The analysis of all three learning journals–using content analysis–revealed that there were more non-reflective entries as per Kember et al.'s (2008) four-category scheme. While some entries may reach 'understanding' category, reaching the 'reflection' and 'critical reflection' categories might be challenging, especially when one lacks sufficient knowledge and skill.

While self-reporting may suffer from challenges such as exaggeration, faking, self-favoring bias and self-enhancement (see Paulhus & Vazire, 2007), the justifications from all three participants did reveal the lack of critical thinking where none was able to devise or refer to a set of standards or criteria to evaluate themselves or their work when they were explaining why they gave the specific numeric rating to themselves. If writing can indeed be used to reflect one's thinking ability, then critical and reflective writing must be taught and cultivated. Having said that, the quality (of reflective and

critical) writing should be implemented throughout the curriculum than leave it to or stop at writing subjects. Also, this has to be an explicit or implicit discipline-wide requirement rather than leaving it to the only few faculty members. Appropriate guidance and feedback need to be in place to move students to higher level in relation to their reflective and critical thinking.

Recommendations

a) Learning and teaching strategies

1. Provide a structure to facilitate learning. This could be either explicit or implicit. An explicit structure is especially necessary at the early stage of one's education but could be relaxed as time passes, especially at the later part of one's education. It is expected that consistent reinforcement may lead to habitual actions. This structure could be in the forms of:

    - Lesson plan that build into the syllabus, project brief, and/or lecture;
    - Classroom discussions in various formats, i.e., formal, informal, individual or group critique, round robin, brainstorming, mini design challenge etc.;
    - Template for recording learning points by week (if topic-based) or by stage (if project-based) or combination of both (for complex project);
    - Timeline for the purpose of project or time management; and
    - Content knowledge and design language bank where students either build their own or work together as a group, the bank should be used together with the classroom discussions for reinforcement.

b) Developing generic thinking skills

2. Either develop a new or strengthen exiting assessment criteria, so that students could use that as benchmark when they evaluate themselves or their own work. **The Taxonomy of Critical Thinking** (refer to **↘Table 2.10**) from Cambridge Assessment (Black, 2008), **The Paul-Elder Critical Thinking Framework** (refer to **↘Figure 2.5**) From Paul and Elder (2005, 2007, and 2013) and **The Critical Thinking VALUE Rubric** (refer **↘Table 2.16**) from the Association of American Colleges and Universities (2010) are the available resources that could be adopted. This could be shared across subjects so that students get to expose to the same or similar assessment especially at the early stage of their design education.

3. Introduce Socratic questioning techniques to students so that they could easily switch between concrete thinking (what is?) and abstract thinking (what could be?) Framing and reframing techniques should also be introduced to improve their abstraction skill. Models and Frameworks of Reflection presented in **↘Table 2.6** can be used to facilitate one's thinking. In addition, mentor text (Graham & Perin, 2007, cited in Anderson, 2014) could be used to demonstrate quality writing.

c) Management of time, project and self

4. Explicitly build the process management into every project. Either provide students a sample process management plan or get them to develop their own plan especially in the more advanced level subjects.

d) Reflection, reflective and critical thinking

5. As suggested in earlier recommendations, formally introduce reflection as one of the topics especially at the early stage of foundation subject(s) to clear all the preconceptions and misconceptions about reflection is necessary. This also gives sufficient time for students to practice and receive constructive feedback from tutors over time.

6. Build reflection into the weekly activities of a given subject. This is to make students understand 'designers also have to be good thinkers' and not simply to beautify 'things'. However, ensure a variety of strategies are employed to avoid unnecessary resistance. For instance, one could try reflection in oral (individual or group sharing) or written (mostly individual but could also consider group sharing). In addition, tutor could also consider debriefing as a form of reflection, especially at the end of a project or exercise.

7. Collect and share past students' work or success stories to inspire the students especially during demonstration. Tutor could deconstruct or explain to students what makes the example or non-example of a good reflection. In addition, tutor could also demonstrate by showing reflection of his or her own (if any).

e) Presentation of work

8. Introduce different organization methods, e.g., LATCH to provide sufficient training on using different methods to organize their thoughts and work. This could be reinforced through individual or group oral and visual presentations. This could also develop one's ability to organize work in various forms. While timeline (or weekly presentation) may be closer match to one's writing habit, it is the theme-based organization forces students to look at the issue on hand more holistically.

9. Demonstrate how work can be done and presented differently using a wide variety of examples to inspire their willingness to explore. This could be done through changing the submission requirements, e.g., booklet, poster, presentation slides, etc.

In short, a clear demonstration on how to write and ample exemplary examples with annotated notes showing what makes a good reflection could improve such misalignment among learning, teaching, and assessment. To bring this to the next level, perhaps there is also need for clear demonstration on how good reflection may eventually lead to better and improve thinking, including the use of reflection as source of reference and inspiration for personal growth and development.

As a result, it is necessary for skills such as critical thinking and reflective thinking to be formally introduced and demonstrated at the beginning of their learning journey and at the level that they could comprehend. Once students are familiarized with this, there must be opportunities for them to practice with feedback and yet another practice and further feedback. This is similar to the process of making, where students get to see how their own creation–and, hopefully, critical thinking–gets evolved and improved over time.

In general, all the nine recommendations above could and should be built into any subject. Reflective and critical thinking are generic skills that work best if they are demonstrated and applied in a specific context. In addition, if developing thinking skills is mandatory in design education, then they need to be built into the curriculum and assessment. In fact, it should be treated as an essential and equally important component in a design project. Similar to many other forms of assessment, appropriate guidance and timely feedback need to be in place if learning is to be made meaningful to the students.

Recommendations for Future Study

This study represents an attempt to understand student's perception of using learning journal as a tool to develop reflective and critical thinking. If reflection is truly a process that enables students to consider their learning as and when it occurs or to look back on a past learning experience–while at the same time critically evaluate what happened or what was learned–then we might need to understand how did the whole reflective process really take place. More specifically, the following areas could be considered for future research:

- Studies from Cross (1990, 2006, 2007 and 2011), Dorst and Reymen (2004), Lawson (2006) and Lawson and Dorst (2009) have drawn my attention to the development of design ability. This study has shed some lights on the development of reflective and critical thinking in design. Future investigation

of how design students develop reflective and critical thinking over time could give us better understanding of how one develops such thinking skills.

- The work of Dorst and Reymen (2004) and the findings of this study also suggest the possibility to explore the conception of understanding in the context of design. While design students may be able to solve design problems using the skills they acquire over time, how could we get students to develop a conscious awareness and ability to articulate what they have actually learned?
- The work of Arrendondo and Rucinski (1994) and the findings of this study also trigger a potential direction on the use of learning journal to foster self-regulated learning. Can this develop independent design learner?
- Scholars such as Paul and Elder (2008) suggest a complementary relationship between critical and creative thinking. How can both thinking skills be used to develop holistic (communication) designers?
- The perception of design educators was intentionally left out in this study. Future study could take into consideration from both ends–i.e., educators and students–to reflect a more complete and holistic view of how reflective and critical thinking can be developed in the context of design education.

Summary of Chapter 5

In this Chapter, I have synthesized and presented key findings drawn from the literature and the analysis of primary data from previous Chapter. Appropriate references were drawn from the literature to support my conclusions. In addition, appropriate recommendations were made to further strengthen the integration and cultivation of reflective and critical thinking into the communication design curriculum. Lastly, I have also suggested a list of potential directions for future research.

This page is intentionally left blank.

Appendices

Appendix 1
Sample Interview Transcription–Participant 1/ Female

INTRODUCTION

R: Hello, thanks for coming. The aim is to understand what students think about–i.e., the perception of–critical thinking and reflection. You could relate your final project or past experience–over the past 3 years of your study–when you reply (answer) the given questions. Before we start, allow me to clarify my role in this interview. Please treat me as a researcher instead of your former teacher and share your thoughts on the questions as honest as you could. Your name and identity will be kept confidential in the entire conversation, no part of this conversation will be revealed to faculty in the School. This is to reassure the anonymity of all the participants in this study.

P1: Ok.

QUESTION 1

R: Right. Thinking back to your final project experience, could you identify three things that you have learned? Whenever possible, please elaborate your answer using appropriate examples.

P1: Err… first of all, due to the nature of the project was different from other projects, in terms of managing emotions it required specific attention, partly because the final project lasted a longer period compared to other projects in the past. All the while, I have been searching for a way to manage my own emotions, as managing emotions played an important role in the final project. One of the things I find particularly helpful to me was learning how to draw mind maps. Through the process of mind mapping, I got to know clearly what I have and what direction(s) I am particularly interested in. This calmed me down and allowed me to sort out the messy thoughts. All the while, my topic has been rather abstract–about exploring papers–and unlike others that focused on specific question or issue. As a result, I have done lots of research but I didn't know how to organize those research findings. As a result, I found mind map a way to calm myself down. This is the first thing I learned. Next, I believed it was when I was conducting user testing. My final outcome was a book and my target users were design students. And I am one of them too. I did three rounds of user testing. I found that different users had different intentions. Through the studies, I had to find ways to question those users so that I could find out from them the directions I could improve my book. I remembered during the first attempt of user testing, I didn't have the conception (understanding) of user testing, I didn't know how to guide the users, and the beginning was very confusing. And because the duration (of final project) was longer, I get to be in touched with those users, whom will be using (the outcome of) my work. That was a good experience to me as in the past projects, I didn't get have such

profound experience. Even though in the end I may not have produced the ideal result that I wanted, but I did make changes based on users' comments. Through this, I got to strike a balance between my own idea and comments from the users. This is the second thing I learned in my final project.

R: Ok. I need you to further elaborate on 'intention' that you mentioned earlier. What exactly did you mean by that?

P1: Oh... Ok. My work was more experimental. For instance, unlike the conventional publication, where you get to see the content page at the beginning, the content page of my design was embedded somewhere in the middle of the publication. I want the users to explore during the journey (of viewing my work). But when the users were viewing my publication and realized that it was different from their pervious (viewing) experience, they felt it was harder to handle and sometimes confusing. As a result, I need to strike a balance–i.e., own idea vs. users' prior experience. In the end, I moved the content page to somewhere in the beginning of the publication and clearly listed out what will be included in each chapter, which was less confusing compared to the previous attempt.

R: Ok. Could you talk about the last thing you learned from your final project?

P1: The last thing I learned... Ah, the last thing I have learned... Actually it has no direct relation to my final project but I did learn something new as a result of working on my final project. I purposely took a bookbinding class because of my final project. I realized that in the past we always left bookbinding to the last. We either used saddle stitch binding or perfect binding in the past. But through working on this project and my research, I realized that in book design, the biding decision of a book is corresponding to the structure and the form of the book. Then I thought why not go pick up bookbinding... as said, it wasn't directly related to my project. I learned a number of binding methods there. But when I went back to my work, I didn't really apply what I have learned from the class but I did draw from the learning experience in relation to the choice of biding method for my project. In the end, I picked the most simple and normal biding method for my final work. Again, the decision had to do with the overall design of the book, as the entire work involved a number of experimentations, a lot of flipping and cutting, so I didn't want the binding to appear too fancy to avoid–or add another layer of–unnecessary confusion to the publication. That's why I have decided to choose the most basic and simplest binding.

R: Which is...?

P1: Oh... I have chosen the basic single-thread stitching–i.e., Coptic stitch–to bind and put together the entire publication. That's because the appearance of the publication is basically white in color, so when it comes to choice of binding and selection of thread, I have chosen white (as the color of the thread) and the most basic binding. I didn't use those Chinese binding techniques I learned from the class as I need to ensure to

publication can be opened completely flat and also because the Chinese binding technique doesn't allow certain parts of the publication to open completely flat. All these need to be taken into consideration.

R: Can you to elaborate a little bit more on a point you made earlier?

P1: Ok.

R: When you said you have decided to take up bookbinding class, have you then already decided that you wanted to make a book or you have yet to decide the final form of your work?

P1: Well... I actually wanted to make a publication since the beginning. But when I was attending the class, I wasn't sure as the book has yet to be conceived and also the content has yet to be decided. So I went ahead with the idea of attending class to allow me to widen my exposure, after all, I have decided to make a book so why should I not learn something ahead. I thought it was a good learning experience. Even now that I have finished my final project, I still want to continue with making books. This whole experience has triggered my interest in book making.

R: Great. Can you say a little bit more? I remember a while back Esther also taught bookbinding in her class.

P1: Oh yes, that's right, that's right!

R: So... The knowledge that you have acquired earlier in Esther's class could not be transferred into your final project?

P1: Well... I realized it was her class that somehow inspired me to want to continue to explore book making in my final project. But then her teaching method wasn't focused much on the content–i.e., words and images. Instead, her teaching was focused more on how to use papers, colors, binding techniques to build up the emotional aspect of a book. In essence, she wanted us to trigger user's emotion–i.e., when they first spotted the book from far; or when they are touching the paper or the texture of paper, or looking at the color–way before they open the book. I think this (Esther's teaching) is another way to showcase a book. As for my project, I need realistic information to support my work. So I have chosen not to focus on emotional appeal for my project. I am hoping the book can achieve a sense of balance. On the one hand, I hope my project can bring across useful information to the users, and on the other hand, emotional appeal through the selection of papers–i.e., smooth vs. with texture - that also felt differently in the hands of the users. Esther's teaching indeed has sparkled my project.

R: Great. Thank you. Ok, let's move on to the next question.

P1: Ok.

QUESTION 2

R: After three years of your study, what does 'I have (not) learned something' mean to you?

P1: Did you mean exactly what I have learned? When did I 'feel' I have learned something?

R: Yes, when you said 'you have learned' or 'you have not learned', what did you mean?

P1: Err... actually this I feel it is a little abstract. That's because I personally have a habit, no matter what circumstances, if I hear something that inspires me or 'sparkle' me to do something, I would write it down fairly quickly. I will mark them down in my notebook / sketchbook, including what someone said or something visual. When I am free, when I fell like doing a little project on my own, I will refer the sketchbook on what I have recorded about what someone said or the visuals to brainstorm some ideas. Actually, about this process of whether I have learned something or not... err... I can't really concretely identify exactly what I have (not) learned, but it sort of helped me to develop my design.

QUESTION 3

R: Ok. Let's move on to the next question. The third question is on the challenges you have encountered throughout your three years learning experiences. What would be your top three challenges you have ever encountered in the past three years of your study?

P1: Err... I was studying at Hong Kong Design Institute (HKDI) for three years before I come to Poly. The way they taught design was so different from here. When I first entering to the School, I was hoping to try another learning approach. That's because after three years with HKDI, I have acquired a lot of techniques but I feel that my brain isn't good enough. As a result, I was hoping to push myself to learn something extra. That was the reason why I enrolled for the study here. I think the first challenge is to learn how to change my own mentality / attitude. The way I learn was already different before I entering Poly, so I need to 'clean myself up again' (unlearn), and rebuild the ability to think on my own from year one and at Poly we need to write reflection. To be honest, I wasn't wholeheartedly put in my effort to write those reflections because I didn't see any use of writing them. After all, I won't be taking them out to 'revisit' what was I thinking at that point in time. It was till end of year two or beginning of year three, I begin to realize reflection is... I don't know... like, as you grow older, when you revisit those reflections, they really make me compare how I used to 'think' and how I am thinking now–like providing feedback for the learning process. Sometimes I feel that I much prefer reading my reflections to my process. That's because reflections has more depth (from the heart). At least I took a more inward approach (用比較內心一點的方式) when I wrote my reflections. Sometimes what I wrote has nothing to do with the project, just that in the midst of the project, err... I got something... then I will include those in the reflection. I didn't really encounter much challenge over the past

three years; I think it is more like changing my attitude towards how I see a piece of work.

QUESTION 4

R: OK. Let's move on. For the next question, we are moving on to the second part of the interview. This section is about reflection. We may repeat some of the things that you mentioned earlier. We use the term reflection–or sometimes, learning journal–as one of the assessment components, I would like to know, after three years, what is your understanding of the word reflection or reflective thinking?

P1: My understanding? I feel it is like a conversation between the process 'self' and the reality 'self'. Although the reflections are for tutor's assessment, I also put more emphasis on how I would read them because what I wrote described my feeling during project or what actions I have took during the decision-making (process). Sometimes–at the end of the project–I realize I have made the wrong decision(s) during the project. Sometimes I feel that I did a good job. I would recall why at that time I was having such 'feeling' or making such decision. As a result, I would do a... not so much of review, but a little bit more like a reminder to myself why to certain extent the right/wrong decisions made were depending on my emotions at that point in time. I am a very emotional person, and many of times the decisions made were influenced by my emotions. I feel that the function of reflection is like a way to have conversation with what happened in the past and it also serves as a reminder.

R: In your respond to the earlier question, you have begun to mention your realization about reflection is a tool that allows you to look the growing up (learning) journey. I see that you have different view on reflection, comparing one year ago and now. Do you have anything else to add on?

P1: Add on? Mmm... Mmm... Nothing for now.

QUESTION 5

R: Ok. Let's move on to the next question. How did you first begin to learn how to write reflection?

P1: (Laugh) Actually, I have never learned how to write reflection seriously. Not because I don't think learning (to write reflection) is something bad. But I think reflection is mainly for my own reference, and I usually write something that is memorable and that should be something different from others. Hence, I never really learn how to write reflection.

R: Mmm... How about any challenges when you begin to write reflection?

P1: Oh... At the beginning... when I first started to write reflection, I don't usually have a key sentence or key title for what I was about to write subsequently that is without a key summary. As a result, when I begin to write, my thinking will be jumping around,

such as sometimes I will talk about how did I manage my mind map and sometimes I will talk about the user tests. So when I read them again I realized the reflections weren't very smooth. And it is very likely that I will repeat what I have mentioned at the beginning. It made me (and others whom may be reading it) less comfortable. What I have learned now is that, based on the past experience and suggestions from other tutors on how to improve my writing, Sometimes, tutor will indirectly mention something worth for me to pay attention to during the design process, I think those are the points for reflection. I will capture what they said and include them in my reflection.

R: You mentioned tutor will also give pointers on how to improve your reflection. Could you be more specific in terms of how the tutors guided you to write better reflection or what kind of feedback they gave you to improve your reflection?

P1: Oh... Right. On reflection, many tutors would commonly mention a particular point that I think is memorable. When we write reflection, not only we need to describe what happened and what was the outcome, how did we feel about what worked and what didn't work, but the most important point is have we thought of a new way to... not as a remedy but more like an improvement, to make the reflection more complete. Its really not just about describing what has happened or what went wrong.

R: Was that what tutor said verbally or commented on your work?

P1: Oh. There used to be verbal and written comment. Not just from one tutor but few other tutors also suggested that.

R: So that means there were some form of guidance on how to write better reflection.

P1: Yes, there were some guidance but mostly they allow us to write freely. Usually tutor will summarize at the end of the subject, they will mention this as one of the points.

Appendix 2
Sample Coding–Participant 1/ Female

Question 1: Three things you have learned in your final project

Abstracted from the Script	Coding	
	Descriptive/Analytical	**Interpretation**
[1] Nature of the (final) project was different from other projects	Comparison; project nature	[1-4] The project nature and duration makes it even more necessary for emotion control as it takes longer to complete and the student needs to work and make all the design decision alone.
[2] In terms of managing emotions, it required specific attention	Need for emotion management	
[3] Partly because the final project lasted longer period	Length of project duration	
[4] All the while, I have been searching for ways to manage my own emotions, as managing emotions played an important role in the final project.	Emotion management is part of final project management	
[5] One of the things I find particularly helpful to me was learning how to draw mind maps	Mind-mapping	[5-7,10] Use of mind mapping as a technique to better manage the disorganized thoughts and identify the project directions and interests. This puts the student at ease and thinking clearly sorted out. Hence, feeling less confused and frustrated emotionally. Perhaps it was better organization (instead of the tool itself) that gives student sense of security.
[6] Through the process of mind mapping, I got to know clearly what I have and what direction(s) I am particularly interested in.	'Stock-take'; identification of directions and interests	
[7] This calmed me down and allowed me to sort out the messy thoughts.	Feel more relaxed; organize thoughts	
[10] As a result, I found mind map a way to calm myself down	Mind-mapping; calm one down	
[8] All the while, my topic has been rather abstract... and unlike others that focused on specific question or issue	Project type (abstract vs. issue-based)	[8-9] Project type determines how (much) research is

[9] I have done a lot of research but I didn't know how to organize those research findings	Having difficulty; organize findings	to be conducted. However, prior knowledge and clear thinking are needed to organize the research findings.
[11] I believed it was when I was conducting user testing	User test	[11-15, 17] Project outcome was a book publication and given the duration of the project, it enables the student to have frequent encounters with the target users to solicit user needs and feedback on the improvement of work using questioning technique. [16] Lack of understanding (of user testing concept) and skill to guide the user create unnecessary confusion. [18] Full involvement and challenges encountered have made student to value the learning more and made the experience meaningful.
[12] My final outcome was book and my target users were design students	Design outcome; target users	
[13] I did three rounds of user testing	Frequency (of testing)	
[14] I found that different users have different intentions	User needs	
[15] Through the studies, I had to find ways to questions those users so that I could find out from them the directions I could improve my work	Questioning; solicit user feedback; improvement of work	
[16] I remember during the first attempt of user testing, I didn't have the concept of user testing, I didn't know how to guide the users, and the beginning was very confusing	Lack of knowledge; lack of skill; confusion	
[17] And because the duration (of final project) was longer, I get to be in touched with those users	Longer duration; contact with users	
[18] That was a good experience to me as in the past projects, I didn't get to have such profound experience	Working with users; profound experience	
[19] Even though in the end I may not have produced the ideal result that I wanted, but I did make changes based on users' comments. I got to strike a balance between my own idea and comments from the users	Outcome (ideal vs. final); designer-centric vs. user-centric, improvement (based on feedback)	[20-23] Experimental nature of project while allows student to experiment and explore, that doesn't mean one should ignore user's prior knowledge and viewing experience and create unnecessary and confusing
[20] My work was more experimental	Experimental (nature of project)	
[21] The content page of my design was embedded somewhere in the middle of my	Design decision (placement of TOC)	

work		experience to users. [19, 24-25] When working on a personal project, the ideal design outcome should always strike a balance between personal preference and meeting the needs of the users to enhance their viewing experience.
[22] I want the users to explore during the journey	Exploration of work	
[23] But when the users were viewing my work and realized that it was different from their previous (viewing) experience, they felt it was harder to handle and sometimes confusing	Prior knowledge; viewing experience; confusion	
[24] As a result, I need to strike a balance, i.e., own idea vs. users' prior experience	Striking a balance	
[25] In the end, I moved the content page to somewhere in the beginning of my work and clearly listed out what will be included in each chapter, which was less confusing compared to the previous attempt	Revert design decision; enhance viewing experience	
[26] The last thing I have learned has no direct relation to my final project but I did learn something new as result of working on my final project	Learning something new; acquire new knowledge	[26-27, 37-40] Sometimes student needs to take a step back to see how smaller piece of learning fits into the bigger picture. Attending (bookbinding) class with a vaguely defined design direction in mind suggests that the student anticipated the new knowledge might somehow influences the design decision even though student may not have seen the connection clearly at the beginning or even when asking to recall from the learning experience. [30-31] While the students may not have used the binding methods acquired in the class, but the
[27] I purposely took a bookbinding class because of my final project	Bookbinding class	
[30] As said, it wasn't directly related to my project	Perception	
[31] I learned a number of binding methods there. But when I went back to my work, I didn't really apply what I have learned from the class but I did draw from the learning experience in relation to the choice of binding method for my project	Binding methods; application; choice of binding method	
[37] Well... I actually wanted to make a publication since the beginning	Design direction	
[38] But when I was attending the class, I wasn't sure as idea has yet to be conceived and also the content has yet to be decided	Final 'form' has yet to be developed	
[39] So I went ahead with the idea of attending class to allow me to widen my exposure	Learning to widen exposure	

[40] I have decided to make a publication so why should I not learn something ahead	Learning with an intent (need)	entire experience did provide a better understanding of the various possibilities. As a result, this experience certainly enabled the student to make better and informed decision.
[28] I realized that in the past we always left bookbinding to the last. We either used saddle stitch binding or perfect binding in the past	Bookbinding decision; design process; binding methods (saddle stitch & perfect binding)	[28-29] Bookbinding decision including the binding method should have been taken into consideration together with the format at the beginning of the design process. The binding decision wasn't left to the last (in the past); instead, the student (including many other) did not see what they were working on as a piece of work but an assignment.
[29] But through working on this project and my research, I realized that in book design, the binding decision of a book is corresponding to the structure and the form of the book	Format (structure and form); bookbinding decision	
[32] In the end, I picked the most simple and normal binding method for my final work	Final binding decision	[32-35] Final binding decision– including the binding method and the selection of thread–was determined by the overall design of the work, i.e., how the work will be used and experienced. [36] The Chinese binding technique was left out due to its limitation and the requirement, i.e., the work must be able to open completely flat when being used.
[33] Again, the decision had to do with the overall design of the book, as the entire work involved a number of experimentations, a lot of flipping and cutting, so I didn't want the binding to appear too fancy to avoid unnecessary confusion to the publication	Final binding decision; overall design; abandonment of fanciful binding; avoid confusion	
[34] I have chosen the basic single-threat stitching to bind and put together the entire work	Binding method (single thread stitching)	
[35] That's because the appearance of my work is basically white in color, so when it comes to choice of binding and selection of thread, I have chosen white and the most basic binding	Binding decision; color; selection of thread	
[36] I didn't use those Chinese binding	Binding decision; Chinese binding technique; limitation of	

techniques I learned from the class as I need to ensure my work can be opened completely flat because the Chinese binding techniques doesn't allow certain parts of the publication to open completely flat	binding technique	
[41] Even now that I have finished my final project, I still want to continue with making books	Develop future interest; book making	[41-43] The previous learning and a good (final) project learning experience not only triggered further exploration but also develop student's future interest in book making.
[42] This whole experience has triggered my interest in book making	Learning experience; future interest	
[43] I realized it was her class that somehow inspired me to want to continue to explore book making in my final project.	Previous learning experience; further exploration	
[44] But then her teaching method wasn't focused much on content. Instead, her teaching was focused more on how to use papers, colors, binding techniques to build up the emotional aspect of a book	Teaching method; focus (content vs. form)	[44-47] A better design criteria or solution is never one-sided or partial but one that is 'holistic' taken into consideration of both the functional appeal (i.e., content) and the emotional appeal (i.e., form giving).
[45] In essence, she wanted us to trigger user's emotion, when they first spotted the book from far, or when they are touching the paper or the texture of paper, or looking at the color way before they open the book	Form giving as trigger; user's emotion	
[46] As for my project, I need realistic information to support my work. So I have chosen not to focus on emotional appeal for my project. I am hoping the book can achieve a sense of balance	Sense of balance; final outcome	
[47] On the one hand, I hope my project can bring across useful information to the users; and on the other hand, emotional appeal through the selection of papers	Functional appeal (content); emotional appeal (choice of paper)	

Question 2: The meaning of learning

	Coding	
Abstracted from the Script	**Descriptive/Analytical**	**Interpretation**
[48] Err… Actually this I feel it (learning) is a	Learning is an abstract concept	[48, 52] Learning is

little bit abstract.		perceived as an abstract concept to the student and it was hard to articulate clearly and concretely what was learned and not learned.
[52] About this process of whether I have learned something or not, I can't really concretely identify exactly what I have (not) learned, but it sort of helped me to develop my design	Articulation; what has (not) learned but that's how she learns	
[49] I personally have a habit, no matter what circumstances, if I hear something that inspires me or 'sparkle' me to do something, I would write it down fairly quickly	Personal learning habit; inspirations; jot down	[49-51] However, the student shared a personal learning habit, i.e., make appropriate notes in sketchbook as and when the student finds something inspiring, including quotes and visuals. Those inspirations will be used for subsequent idea generation for self-initiated projects. Researcher's note: While the student had difficulty articulating what was learned or not learned with specific example(s), it is believed and hope that the sketchbook would contain theoretical knowledge that are inspiring to the student. Perhaps what needs to be clarified is how the student decides if something is inspiring. The result would certainly be useful to inform what could be included more to 'inspire' students.
[50] I will mark them down in my notebook / sketchbook, including what someone said or something visual	Making note; quotable quotes; visuals	
[51] When I am free, when I feel like doing a little project on my own, I will refer to the sketchbook on what I have recorded about what someone said or the visuals to brainstorm some ideas	Use of quotes; visuals; sources of inspiration; idea generation	

Question 3: Top three challenges encountered throughout the three years of learning

Abstracted from the Script	Coding	
	Descriptive/Analytical	Interpretation
[53] I was studying at HKDI for three years before I come to Poly. The way they taught design was so different from here	Comparison; past and new; learning experiences	[53-54] Realization of own strength in technical skills (from the previous learning) and weakness in thinking skills gave the student a sense of direction and hope in the new learning experience and environment.
[54] When I first entering to the School of Design, I was hoping to try another learning approach. That's because after three years with HKDI, I have acquired a lot techniques but I feel that my brain isn't good enough. As a result, I was hoping to push myself to learn something extra. That was the reason why I enrolled for the study here	Hope; different learning experience; thinking development (vs. technical skills)	
[55] First challenge is to learn how to change my own mentality / attitude. The way I learn was already different before I entering Poly, so I need to 'clean myself up again' and rebuild the ability to think on my own from year one	Change attitude; thinking independently	[55] Changing attitude toward thinking independently is probably one of the challenges many students need to deal with when entering into higher education.
[56] At Poly we need to write reflection. To be honest, I wasn't wholeheartedly put in my effort to write those reflections because I didn't see any use of writing them. After all, I won't be taking them out to 'revisit' what was I thinking at that point	Reflection; mandatory; awareness; purpose and value of reflection, i.e., more than revisit past 'thinking'	[56-59] Redefining one's perception of reflection is yet another challenge. As a mandatory assessment component, the sooner students get to understanding the purpose and value of reflection–i.e., how it could help develop thinking skill and provide feedback to the learning process–the earlier students get to appreciate the writing and reading of their own reflection over time. Of course, this also depends on the coverage and the richness of one's work.
[57] It was till end of year two or beginning of year three, I begin to realize reflection is like, as you grow older, when you revisit those reflections, they really make me compare how I used to 'think' and how I am thinking now, like providing feedback for the learning process	Realization; usefulness of reflection, i.e., see the development of thinking over time and provide feedback for the learning process	
[58] Sometimes I feel that I much prefer reading my reflection to my process. That's because reflections have more depth (from the heart). At least I took a more inward approach when I wrote my reflections	Preference; reading; reflection over design process; richness; inward approach	
[59] Sometimes what I wrote has nothing to do with the project, just that in the midst of the project, I got something then I will	Coverage (of reflection)	

include those in the reflection		
[60] I didn't really encounter much challenge over the past three years; I think it is more like changing my attitude towards how I see a piece of work	Major challenge; changing attitude; perception of a piece of work	[60] Changing attitude toward the perception of a piece of work or how one (re)-defines what constitutes work inwardly and outwardly is another challenge worth facing.

Question 4: Understanding of reflection and reflective thinking

	Coding	
Abstracted from the Script	**Descriptive/Analytical**	**Interpretation**
[61] I feel it is like a conversation between the 'process' self and the 'reality' self	Conversation with self	[61, 66] The function of reflection on action is like a conversation with self on what's done and serves as reminder to self.
[66] I feel the function of reflection is like a way to have conversation with what happened in the past and it also serves as a reminder	Function of reflection; conversation; what's done and a reminder to self	
[63] Sometimes at the end of the project I realize I have made the wrong decision during the project. Sometimes I feel that I did a good job. I would recall why at that time I was having such 'feeling' or making such decision	Evaluation and explanation; self performance	[63- 65] The conversation with self may include evaluation and explanation of action, performance and emotions during a point in time.
[64] As a result, I would do a... not so much of review, but a little bit more like a reminder to myself why to certain extend the right/wrong decisions made were pending on my emotions at that point in time	Awareness of emotions (feeling); action (decision making) as reminder	
[65] I am a very emotional person, and many of times the decisions made were influenced by my emotions	Perception of self (emotional); affect; decision making	
[62] Although the reflections are for tutor's assessment, I also put more emphasis on how I would read them because what I wrote described my feeling during project or what actions I have took during the decision making process	Presentation; target audience (including self); content coverage varies	[62] The conversation with self is usually presented with target audience in mind. This could include tutor and self and the content coverage

		usually varies but pertaining to a specific learning experience.

Question 5: First experience writing reflection, including challenges, guidance on writing good reflection and feedback for improvement

Abstracted from the Script	Coding	
	Descriptive/Analytical	**Interpretation**
[67] I have never learned how to write reflection seriously. Not because I don't think learning to write reflection is something bad. But I think reflection is mainly for my own reference, and I usually write something that is memorable and that should be something different from others	Personal; for self reference; need for formal learning; writing approach (can be different from others)	[67] The student (and possibly many others) perceived and thought reflection as something personal and only for own reference thus the writing approach can be different and personal. As a result, many did not see reflection requires formal learning.
[68] When I first started to write reflection, I don't usually have a key sentence or key title for what I was about to write subsequently	Headings, cueing	[68-69] At the beginning, the student's writing tends to be disorganized partly due to the lack of headings and sub-headings as visual cues to guide own thinking and writing. As a result, the work tends to be repetitive and the flow of the work lacks smoothness.
[69] As a result, when I begin to write, my thinking will be jumping around, such as sometimes I will talk about how did I manage my mind map and sometimes I will talk about the user tests	Disorganized thoughts	
[70] So when I read them again I realized the reflections weren't very smooth. And it is very likely that I will repeat what I have mentioned at the beginning. It made me less comfortable	Flow; not so smooth; repetitive; feel uncomfortable	
[75] There were some guidance but mostly they allow us to write freely	Basic guidance was given but content remains flexible	[75, 71-73] The basic guidance was made available and the essence of reflection have been reiterated by a number of tutors including: • Describe what
[71] Many tutors would commonly mention a particular point that I think is memorable: When we write reflection, not only we need to describe what happened and what was the outcome, how did we feel about what	Essence of reflection; tutors' suggestion; describe what happened, the outcome, and feelings about what worked and what didn't work	

worked and what didn't work		happened; • The outcome; • Feelings about what worked and what did not work; and • How could things be done differently in the future Usually a better one is less about summarizing of the incidents.
[72] But the most important point is have we thought of a new way to... not as a remedy but more like an improvement, to make the reflection more complete	And most importantly consider how can things be done differently in the future	
[73] Its really not just about describing what has happened or what went wrong	Less about summary of the incident, e.g., what happened or what went wrong	
[74] There used to be verbal and written comments on my reflection. Not just from one tutor but few other tutors also suggested that	Tutors used to provide verbal and written comments on reflection	[74] Some tutors will provide appropriate verbal and written feedbacks.

Appendix 3
Complete Learning Journal–Participant 1/ Female

Abstracted from the Script	Coding–Content	Coding–Depth
Decision on design direction / how to write the topic sentence [01] After studying different kinds of information, which related to paper, I found that it is harder for me to decide the design direction, even I could not use one sentence to conclude the key statement. [02] My tutor shared a piece of newspaper with me, about "how to write the topic sentence, interesting vs practical". The newspaper have mentioned that students didn't know how to narrow down the scope of the topic and didn't consider limitation, how can they implement the research plan in a limited time. Deciding target audiences is one of the keys to success in doing research. [03] And I was inspired by a statement "以小見大的題目", which means we could start from studying a little things or issue to project larger value. It is a good reminder to me for writing the topic sentence.	[P1: 01] Realization of own shortcoming on (1) Reframing design direction and (2) Synthesis of (own) work. [P1: 02] Summary of newspaper article on (1) Topic framing & delimitation, (2) Project limitation (3) Implementation timeframe and (4) Target group. [P1: 03] Inspiration through reading.	[P1: 01-03] Non-reflection–Describing own shortcoming and a newspaper article from tutor might have inspired P1 on writing topic sentence. Writing attempted to reach understanding level but stopped at describing and explaining what happened and failed to put understanding in context with specificity.
Mind map [04] Drawing mind map as a way to calm down myself; I kept integrating, rearranging and linking the keywords. And reviewed the analysis and statement repeatedly before going to the next step. During drawing the mind map, it is a valuable experience for me to do a research to define a topic and generate the key message for the following design direction.	[P1: 04] Use of tool -mind map on (1) calming down the mind, (2) organizing thoughts, (3) making connection, (4) Defining topic and (5) Generating design direction.	[P1: 04] Non-reflection–Explaining (without much detail) how P1 used mind map to get things done. Writing stopped at describing and explaining what happened but failed to put learning/ experience at understanding

Abstracted from the Script	Coding–Content	Coding–Depth
		level, i.e., in context with specificity.
Representation [05] I had taken a lecture, which is about "culture representation and signifying practice". How meaning is produced? Design is a kind of the product of meaning. And it depends on language, which is not only built up by dots, lines and shape, but also imagery, text, artificial spaces and garments. [06] In our project, we were trying to create a new relationship between abstract ideas, target audiences and design objects. The concept of 'production of meaning' is quite refreshing for me. Since there is nothing new in the world, what we can do is building up a system of signifies and new signified for empowering audiences' experience.	[P1: 05] Summary of lecture attended. [P1: 06] Make connection between lecture and project.	[P1: 05-06] Non-reflection–P1 attempted to make connection between the lecture and own project but writing was largely reproduction from lecture and explanation doesn't own understanding.
Bookbinding [07] Besides building the structure of the book, I have also learned the book binding from a bookmaking workshop in Sheung Wan. Bookbinding is as spine of the book, which is one of key element for book design. Therefore, I would like to learn more about it, to see if anything can match with my design. [08] Although I learned some 'fancy' binding, I finally choose the basic binding. Since the structure of the book is different from the normal book, if the binding is too fancy or complicated, it would be over design.	[P1: o7] Workshop experience (with brief explanation). .	[P1: 07-08] Non-reflection–a quick summary on the topic but writing doesn't show the level of depth and decision on execution was vague.
User testing [09] In the first user test, I haven't finished the book cover. Therefore, I mainly test the structure of the book and the content. [10] Did the book provide enough information or attractive enough for the user? The user	[P1: 09] Coverage of user test. [P1: 10] Result of evaluation (original design). [P1: 11] Redesign	[P1: 09-15] Understanding–Writing shown P1's understanding of how to use test results to inform design decision.

Abstracted from the Script	Coding–Content	Coding–Depth
expected that the book could be read in two sides since they saw the binding start in the middle of the cover. But I didn't have the design intention. [11] Therefore, I redesigned the book cover to be more directional by covering the middle binding and using the torn paper to lead the direction. Torn paper is also a part of symbol of traces on paper. [12] During the user text, the user could not directly find out the structure of the book, Different from normal book, the content page is in the middle of the book. [13] In the second user test, I had finished the book cover. But the user was afraid to open the book, since the torn paper (book cover) looked like easy to fragile. And she didn't get the content of the book directly from the book cover. But she was curious that what is the meaning of the broken strokes. And she tried to follow the direction of the stroke to the open page. The user was surprised by different effect and some stuff in the book. [14] And the chapter page could not draw the user's attention. [15] My intention was shown in the user test. User could read the story through.	work. [P1: 12] Result of evaluation (after redesign). [P1: 13] Reaction(s) from participant(s). [P1: 14] Drawback of design. [P1: 15] Success of design.	However, writing lacks clear indication whether P1 understand truly the essence of user test and neither the writing tells much about the depth of thought.

Abstracted from the Script	Coding–Content	Coding–Depth
Finalizing the book [16] It is tough but energetic weeks for me. I had to start to finalize the book and I couldn't imagine how it would look like as final. [17] Since I didn't test enough the printing effect and quality on different texture of papers, there is still a room for improvement. [18] The book has lots of handcraft details, therefore, some stuff needs to be placed, cut, folded and stitched. The planning of printing has to be refined; I had to estimate some space for the stuff. For the final display setting, I planned to make it more clean and concentrated with some paper craft. And the final display setting would be finished in coming graduate show.	[P1: 16] Anticipation of outcome. [P1: 17] Evaluation of work. [P1: 18] Design tasks.	[P1: 16-18] Non-reflection–Writing mostly descriptive or summary of thoughts at surface level.
Final presentation [19] For the presentation, I need more proactive way of thinking about how to present my ideas or communicate with others. [20] In the presentation, I presented the concept of my project, the specific content and the reading method step by step. [21] But I thought there is something lack of my presentation after listening the overall by others classmates. They are trying to tell a story behind the project more than the design. It is really touch for the audiences get into their project directly. Especially, when we told the design concept, we better show audiences by visual. A strong visual of image could represent a thousand words. I learned lots of presentation skill from them.	[P1: 19] Expectation. [P1: 20] Coverage of presentation. [P1: 21] Evaluation of own presentation (in comparison with others).	[P1: 19-20] Non-reflection–Writing remains descriptive and lacks depth. [P1: 21] Reflection–Writing goes beyond understanding of good presentation and P1 was able to touch on briefly the application of learning (from the observation).
Love and hate [22] After finished the finalization of the book, I realized that how much I like book design. Being an author, a designer and a reader,	[P1: 22] After thoughts on FYP with list of questions drawn	[P1: 22-24] Understanding–Writing stops at understanding level of the design

Abstracted from the Script	Coding–Content	Coding–Depth
which content will get the get the readers interested? How could reading the book in spire the readers? There are many considerations and decision-making during every section. [23] Designing a book is more difficult than my imagination. [24] Because of lack of experience, tutor asked me questions during every tutorial for leading me to rethink or reorganize the communication of the book. [25] It also becomes my daily practice.	from experience. [P1: 23] Realization of the difficulty of project. [P1: 24] Recall tutorial experience. [P1: 25] Uncodable. Not sure what does it mean by 'it'.	process due to lack of elaboration.
Time management [26] Time management is the key in the whole final year project. Tutor always reminds me 'Just do it. Don't be obstructed! At least, we got something to discuss or improve physically.' [27] During the project, I spend a half time on thinking the concept and the overall mind map; therefore it is lack of time on testing the layout and the structure of the book. It is a lesson for me to learn when is the time to stop thinking but doing. Since one step of the progress is delayed, the discussion with tutor would be affected. [28] Actually doing is the best method for testing the project is work or not.	[P1: 26] Realization of action speaks louder than thinking. [P1: 27] Evaluation of time spent on tasks. [P1: 28] Realization of the importance of prototyping.	[P1: 26-28] Understanding–Although lacks depth, writing did show some level of understanding.
Mental and physical [29] (To the coming final year student and to myself) Final project is absolutely a great opportunity to train your mental. I have never been depressing during last three years in my school life. But I was lost a few times during the project. It is hard to describe what I was thinking at the moment. I believe most of my classmates would also feel the same way. Sometimes, we might need to step back and review what we have and make it the best	[P1: 29] Realization of the purpose of FYP training • Got stuck in the design/ thinking process. • Need for stepping back and review • Learning from mistake and	[P1: 29] Critical reflection–Writing encapsulates the essence of P1's learning and shows great transformation as a result of learning.

Abstracted from the Script	Coding–Content	Coding–Depth
under limited scope and time. It is easy to say, but hard to do it. I am still learning how to forgive my mistake and give myself a chance. Don't be afraid to discuss with your classmate, friends even tutors if we got any obsession. It would be an effective way to release pressure. Final year project is a start but not the end as a designer.	opportunity • Willingness to seek help • Stepping stone to becoming a design	

This page is intentionally left blank.

6 References

Abrami, P. C., Bernard, R. M., Borokhovski, E., Wade, A., Surkes, M. A., Tamin, R., & Zhang, D. (2008). Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis. Review of Educational Research, 78(4), pp. 1102-1134.

Adams, R. (2002). Developing critical practice in social work. In R. Adams, L. Dominelli, & M. Payne (Eds.), Critical practice in social work. Basingstoke: Palgrave Macmillan.

Alghafri, A.S & Hairul. N.B.I. (2014). The Effects of Integrating Creative and Critical Thinking on School Students' Thinking. International Journal of Social Sciences and Humanity, 4(6): pp. 518-525.

Allan, D. (1998). Using learning journals to identify critical incidents of understanding. Improving student learning outcomes. Oxford Brookes University, pp. 1-9.

Ancona, D. (2012). Sensemaking: Framing and acting in the unknown. In S. A. Snook, N. N. Nohria, & R. Khurana (Eds), The handbook for teaching leadership: Knowing, doing and being. Thousand Oaks, CA: SAGE Publications.

Anderson, J. (2014). What writing is and isn't? Educational Leadership, 71(7): pp. 10-14.

Andrade, A. D. (2009). Interpretive research aiming at theory building: Adopting and adapting the case study design. The Qualitative Report, 14(1), pp. 42-60. Retrieved 16 October 2013 from http://www.nova.edu/ssss/QR/QR14-1/diaz-andrade.pdf.

Areesophonpichet, S. (2013). A development of analytical thinking skills of graduate students by using concept mapping. Paper presented at The Asian Conference on

Education 2013, Osaka, Japan. Retrieved from http://iafor.org/archives/offprints/ace2013-offprints/ACE2013_0381.pdf.

Arrendondo, D. E., & Rucinski, T. T. (April 1994). Using reflexive journals and the workshop approach in university classes to develop students' self-regulated learning. Paper presented at the Annual Meeting of the American Educational Research Association. New Orleans, LA.

Association of American Colleges and Universities. (2010a). Inquiry and analysis VALUE rubric. Retrieved from https://www.aacu.org/value/rubrics/inquiry-analysis.

Association of American Colleges and Universities. (2010b). Creative thinking VALUE rubric. Retrieved from https://www.aacu.org/value/rubrics/creative-thinking.

Association of American Colleges and Universities. (2010c). Critical thinking VALUE rubric. Retrieved from https://www.aacu.org/value/rubrics/critical-thinking.

Atkins, S., & Murphy, K. (1994) Reflective Practice. Nursing Standard, 8(39): 49-56.

Australian Physiotherapy Council. (2006). Australian standards for physiotherapy. Retrieved from https://physiocouncil.com.au/media/1021/the-australian-standards-for-physiotherapy-2006.pdf

Babapour, M., Rehammar, B., & Rahe, U. (2012). A Comparison of Diary Method Variations for Enlightening Form Generation in the Design Process. Design and Technology Education: An International Journal, 17(3).

Babapour, M., Rahe, U., & Pedgley, O. (2012). The Influence of Self-reflective Diaries on Students' Design Processes. Paper presented at the DesignEd Asia Conference 2012, Hong Kong.

Bain, J. D., Ballantyne, R., Mills, C., & Lester, N. C. (2002). Reflecting on practice: Student teachers' perspectives. Flaxton: Post Pressed.

Bakarman, A. A. (2005). Attitude, skill, and knowledge: (ASK) A new model for design education. Proceedings of the Canadian Engineering Education Association, retrieved from http://ojs.library.queensu.ca/index.php/PCEEA/article/view/3894.

Barnett, R. (2000). Realizing the university in an age of supercomplexity. Buckingham, England: Open University Press.

Baron, J. (1991). Beliefs about thinking. In J. F. Voss, D. N. Perkins, & J. W. Segal (Eds.), Informal reasoning and education, pp. 169-186. Hillsdale, NJ: Erlbaum.

Barratt, J. (2009). A plea for more critical thinking in design, please. Retrieved from http://www.fastcompany.com/1327667/plea-more-critical-thinking-design-please

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. The Qualitative Report, 13(4), pp. 544-559.

Baynes, K. (2006). Design education: What's the point? Design and Technology Education: An International Journal, 11(3): pp. 7-10.

Beatson, A. T., & Larkin, Ingrid K. (2010). Developing reflective practitioners online: The business of blogs in work integrated learning. In: International Conference on Work Related Learning: "University-Industry Collaboration for Real Life Education" 2010 World Association of Collaborative Education (WACE) Conference, 3 - 5 February, 2010, Hong Kong.

Bensley, D. A., & Murtagh, M. P. (2012). Guidelines for a scientific approach to critical thinking assessment. Teaching of Psychology, 39(1): pp. 5-16.

Biggs, J. B., & Tang, C. (2007). Teaching for quality learning at university: What the student does (3rd ed.). Maidenhead, England; New York: McGraw-Hill / Society for Research into Higher Education & Open University Press.

Black, B. (2008). Critical thinking—a definition and taxonomy for Cambridge Assessment: Supporting validity arguments about critical thinking assessments administered by Cambridge Assessment. Retrieved from: http://www.cambridgeassessment.org.uk/images/126340-critical-thinking-a-definition-and-taxonomy.pdf.

Blaschke, L. and J. Brindley. (2010). Establishing a foundational framework for development of reflective thinking: Learning journals in the MDE. www.eden-online.org (accessed 17/03/2014).

Blaxter, L., Hughes, C., & Tight, M. (2001). How to research (2nd ed.). Buckingham [England]: Open University Press. Retrieved 22 July 2012 from http://www.nova.edu/sss/QR/QR13-4/baxter.pdf

Bloom, B. S., & Krathwohl, D. R. (1956). Taxonomy of educational objectives: The classification of educational goals, by a committee of college and university examiners. Handbook 1: Cognitive domain. New York: Longmans.

Blythman, M., Orr, S., & Blair, B. (2007). Critiquing the crit. Retrieved from http://intranet.rave.ac.uk/quality/docs/LTR080107-Critprojecfinal sentreportversion2.doc

Bok, D. (2006). Our underachieving colleges: A candid look at how much students learn and why they should be learning more. Princeton, NJ: Princeton University Press.

Bolton, G. (2005). Reflective practice: Writing and professional development, (2nd ed.). London: Sage.

Borton, T (1970). Reach, Teach and Touch. Mc Graw Hill, London.

Boud, D., Cohen, R., & Walker, D. (1993). Using experience for learning. Buckingham, U.K.: Society for Research into Higher Education and Open University Press.

Boud, D, Keogh R & Walker D (1985): Promoting reflection in learning: A model. IN Reflection: Turing Experience into Learning (Eds: Boud D, Keogh R & Walker D). Kogan Page, London.

Bourner, T. (2003). Assessing reflective learning. Education + Training, 45(5): pp. 267-272.

Brandt, C. (2008, January). Inegrating feedback and reflection in teacher preparation. English Language Teaching (ELT) Journal, 62(1), pp. 37-46.

Bromley, D. B. (1990). Academic contributions to psychological counseling: I. A philosophy of science for the study of individual cases. Counseling Psychology Quarterly, 3(3), pp. 299-307.

Brookfield, S. D. (1995). Becoming a critically reflective teacher. San Francisco: Jossey-Bass.

Brookfield, S. D. (2012). Teaching for critical thinking: Tools and techniques to help students question their assumptions. San Francisco: Jossey-Bass.

Brown, J. S. (2006, September/October). New learning environment for the 21st century: Exploring the edge. Change Magazine, 38(5), pp. 18-24.

Brown, T. (2008). Design thinking. Harvard Business Review, 86(6): pp. 84-92.

Brown, T. (2009). Change by design: how design thinking transforms organizations and inspires innovation. New York: Harper Business.

Bryman, A. (2001). Social research methods. Oxford: Oxford University Press.

Buchanan, R. (1992). Wicked problems in design thinking. Design Issues, 8(2): pp. 5-21.

Burdick, A. (2007). Graduate education: Preparing designers for jobs that don't exist (yet). Retrieved January 25, 2008 from Adobe Designer Center – Think Tank http://www.adobe.com/designcenter/thinktank/burdick.html

Burns, N & Grove, S. K. (2003). The practice of nursing research: Conduct, critique and utilization. Toronto: WB Saunders.

Burrows, N. L. (2012). Reflective thinking by teachers and improvement in teaching practice (Unpublished doctoral dissertation). Oklahoma State University, Stillwater, OK.

Cameron, J. (2004). The artist's way: A spiritual path to higher creativity. New York: Jeremy P. Tarcher/Putnam

Canada National Research Council. (2015). Management behavioral competency: Analytical thinking. Retrieved from http://www.nrc-cnrc.gc.ca/eng/careers/behavioural_competencies/mg_analytical_thinking.html.

Carper, B. (1978) Fundamental ways of knowing in nursing. Advances in Nursing Science, 1(1), pp. 13-23

Casserly, M. (2012). The 10 skills that will get you hired in 2013. Retrieved 28 July 2013 from http://www.forbes.com/sites/meghancasserly/2012/12/10/the-10-skills-that-will-get-you-a-job-in-2013/.

Çavdar, G., & Doe, S. (2012). Learning through writing: Teaching critical thinking skills in writing assignments. Political Science and Politics, 45(2), 298-306.

Cennamo, K., Baum, L., Newbill, P. & Finn, T. (2012). Teaching to Develop Critical and Creative Thinking Skills. In P. Resta (Ed.), Proceedings of Society for Information Technology & Teacher Education International Conference 2012 (pp. 3553-3557). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Chance, S. M. (2010). Writing architecture: The role of process journals in architectural education. In MADE: Design Education and the Art of Making. Proceedings of the 26th National Conference on the Beginning Design Student, March 18-21, College of Arts + Architecture, The University of North Carolina at Charlotte.

Cheung, C., Rudowicz, E., Kwan, A. S. F., & Yue, X. D. (2002). Assessing university students' general and specific critical thinking. College Student Journal, 36(4), pp. 504-525.

Christenson, T. (2001). Wonder and critical reflection: An invitation to philosophy. London: Prentice-Hall International.

Chuah, C. K. P., Ma, J., & Ho, K. L. (2010). Understanding users: A phenomenological study on design educators and students experiencing user study in design. Paper presented in Cumulus 2010 Shanghai Conference, September 7-10, Shanghai, China.

Cisero, C. (2006). Does reflective journal writing improve course performance? College Teaching 54.2, 231-236.

Clune, S. (2010). Deep learning and industrial design education for sustainability. In G. Forsyth (Ed.) Proceedings of ConnectED, UNSW, 28th June - 1st July, 2010, pp. 1-5.

Cohen, L., Manionm, L., & Morrison, K. (2006). Research methods in education (6th ed.). London, New York: Routlege.

Colley, B. M., Bilics, A. R., & Lerch, C. M. (2012). Reflection: A key component to thinking critically. The Canadian Journal for the Scholarship of Teaching and Learning, 3(1): Article 2. Retrieved from http://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=1045&context=cjsotl_rcacea

Collins, A., Brown, J. S., & Holum, A. (1991, Winter). Cognitive apprenticeship: Making thinking visible. American Educator, 15(3), 6-11, 38-46.

Combs, L. B., Cennamo, K.S., & Newbill, P.L. (2009). Developing critical and creative thinkers: Toward a conceptual model of critical and creative thinking processes. Educational Technology, 49 (5), 3-13.

Cowan, J. (2014). Noteworthy matters for attention in reflective journal writing. Active Learning in Higher Education. 15(1): 53-64.

Cox, E. (2005). Adult learners learning from experience: Using a reflective practice model to support work-based learning. Reflective Practice, 6, pp. 459-472.

Craig-Lees, M. (2001). Sense making: Trojan horse? Pandora's box? Psychology & Marketing, 18(5), 513-526.

Creswell, J. W. (1998). Qualitative inquiry and research design: Choosing among five traditions. Thousand Oaks, CA: Sage Publications, Inc.

Creswell, J. W. (2003). Research design: Qualitative, quantitative, and mixed methods approaches (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches (3nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Creswell, J. W. (2014). Research design: Qualitative, quantitative, & mixed methods approaches (4th ed.). Thousand Oaks, CA: Sage Publications, Inc.

Creswell, J. W. & Clark, V. L. P. (2007). Designing and conducting mixed methods research. Thousand Oaks, CA: Sage Publications, Inc.

Cross, N. (1990). The nature and nurture of design ability. Design Studies, 11(3): pp. 127-140.

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

Cross, N. (2007). Designerly ways of knowing. Basel, Switzerland: Birkhäuser.

Cross, N. (2011). Design thinking: Understanding how designers think and work. Oxford; New York: Berg Publishers.

Crotty, M. (1998). The foundations of social research: Meaning and perspective in the research process. London: Sage Publications.

Çubukcu, E. & Gökçen Sebnem, D. (2007). Can Creativity Be Taught? An Empirical Study on Benefits of Visual Analogy in Basic Design Education. A|Z ITU Journal of Faculty of Architecture, 4(2), pp. 67-80.

Davidson, E. J. (2005). Evaluation methodology basis: The nuts and bolts of sound evaluation. Thousand Oaks, California: Sage Publication.

Davies, M. (2013). Critical thinking and the disciplines reconsidered. Higher Education Research & Development, 32(4): 529-544.

Davis, E. A. (2006). Characterizing productive reflection among pre-service elementary teachers: Seeing what matters. Teaching and Teacher Education, 22, pp. 281-301.

de la Harpe, B., Peterson, J. F., Frankham, N., Zehner, R., Neale, D., Musgrave, E., & McDermott, R. (2009). Assessment focus in studio: What is most prominent in architecture, art and design? The International Journal of Art and Design Education, 28(1): 37-51.

Denzin, N. K., & Lincoln, Y. S. (2000). The seventh moment: Out of the past. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research (pp. 1047-1069). Thousand Oaks, CA: Sage.

Denzin, N.K., & Lincoln, Y.S. (2005). Introduction: The discipline and practice of qualitative research. In N.K. Denzin & Y.S. Lincoln (Eds.), The sage handbook of qualitative research (2nd ed.). Thousand Oaks, CA: Sage.

Denzin, N, K., & Lincoln, Y. S. (Eds.). (2011). The SAGE handbook of qualitative research (4th ed.). Thousand Oaks, CA: Sage.

Desjarlais, M., & Smith, P. (2011). A comparative analysis of reflection and self-assessment. International Journal of Process Education, 3(1): pp. 3-18.

Dewey, J. (1910). How we think. Boston: D. C. Health & Co. Publishers.

Dewey, J. (1991). How we think. (Rev. ed.). Boston: D. C. Heath.

Dewey, J. (1933). How We Think: A restatement of the relation of reflective thinking to the educative process (Revised ed.), Boston: D. C. Heath.

Dewey, J. (1944). Democracy and education: An introduction to the philosophy of education, New York: Free Press.

Di Stefano, G., Gino, F., Pisano, G., & Staats, B. (March 25, 2014). Learning by thinking: How reflection aids performance. Harvard Business School Working Paper No. 14-093. Retrieved 30 April 2014 from http://www.hbs.edu/faculty/Publication%20Files/14-093_4d4e874c-8e46-4054-84fd-df533e94ccd8.pdf.

Dorst, K. (2010). The Nature of Design Thinking, Design Thinking Research Symposium, Faculty of Design, Architecture and Building, University of Technology, Sydney, October 2010 in DTRS8 Interpreting Design Thinking: Design Thinking Research Symposium Proceedings, ed Dorst, K., Stewart, S., Staudinger, I., Paton, B., Dong, A., DAB Documents, Sydney, Australia, pp. 131-139.

Dorst, K., & Reymen, I. (2004). Levels of expertise in design education. International Engineering and Product Design Education Conference, Delft, September 2004 in The changing face of design education, proceedings of the 2nd International Engineering and Product Design Education Conference, ed Lloyd, P., Delft University Press, Delft, The Netherlands, pp. 1-8.

Doyle, T. (2008). Helping students learn in a learner-centered environment: A guide to facilitating learning in higher education. Sterling, VA: Stylus Publishing, LLC.

Drucker, P. (1967). The effective executive. Oxford, UK: Butterworth-Heinemann.

Dubberly, H., Evenson, S., and Robinson, R. (2008). The Analysis-Synthesis Bridge Model, Interactions, 15(2): 57-61.

Duffy (1998). Supporting imagination and creativity in the early years. Buckingham: Open University Press.

Dwyer, S. C., & Buckle, J. L. (2009). The space between: On being an insider-outsider in qualitative research. International Journal of Qualitative Methods, 8(1), pp. 54-63.

Eckstein, H. (2002). Case study and theory in political science. In R. Gomm, M. Hammersley, & P. Foster (Eds.), Case study method: Key issues, key texts (pp. 119-163). London: Sage.

Eisenhardt, K. M. (1989). Building theories from case study research. The Academy of Management Review, 14(4), pp. 532-550.

Eisner, E. W. (1985). The art of educational evaluation: A personal view. London: Falmer Press.

Eisner, E. W. (1988). The enlightened eye: Qualitative inquiry and the enhancement of educational practice. Upper Saddle River, NJ: Merrill.

Elder, L., & Paul, R. (2004). The miniature guide to the human mind: How it learns, how it mislearns. CA, USA: Foundation for Critical Thinking.

Elder, L., & Paul, R. (2007). A critical thinker's guide to educational fads. CA, USA: Foundation for Critical Thinking.

Elder, L., & Paul, R. (2010). Critical thinking: Competency standards essential for the cultivation of intellectual skills, Part 1. Journal of Developmental Education, 34(2), pp. 38-39.

Elder, L., & Paul, R. (2012). Critical thinking: Competency standards essential for the cultivation of intellectual skills, Part 4. Journal of Developmental Education, 35(3), pp. 30-31.

Ellmers, G. N. (2014). Graphic design education: Fostering the conditions for transfer in a project-based and studio-based learning environment, through a structured and critical approach to reflective practice (Unpublished doctoral dissertation). University of Wollongong, Australia.

English, S. G. (2009). Enhancing the reflective capabilities of professional design practitioners. Undisciplined! Proceedings of Design Research Society Conference 2008, Sheffield Hallam University, Sheffield, UK, 16-19 July 2008.

Ennis, R.H. (1985). A logical basis for measuring critical thinking skills. Educational Leadership, 43(2): 44–48.

Ennis, R. H. (1996). Critical thinking dispositions: Their nature and assessability. Informal Logic, 18(2&3): 165-182.

Estrada, F. F., & Rahman, H. M. A. (2014). Reflective journal writing as an approach to enhancing students' learning experience. Brunei Darussalam Journal of Technology and Commerce, 8(1): 22-35.

Facione, P. A. (2015). Critical thinking: What I it is and why it counts? 2015 update. Insight Assessment. Retrieved from http://www.insightassessment.com/About-Us/Measured-Reasons/pdf-file/Critical-Thinking-What-It-Is-and-Why-It-Counts-PDF

Fernsten, L. & Fernsten, J. (2005). Portfolio assessment and reflection: Enhancing learning through reflective practice. Reflective Practice: International and Multidisciplinary Perspectives, 6(2): 303-309.

Finlay, L. (2008). Reflecting on 'reflective practice'. Practice-based Professional Learning (PBPL) paper 52. Retrieved 10 March 2013 from The Practice-based Professional Learning Centre for Excellence in Teaching and Learning (PBPL), The Open University, http://www.open.ac.uk/opencetl/resources/pbpl-resources/finlay-l-2008-reflecting-reflective-practice-pbpl-paper-52

Finn, T., Baum, L. & Newbill, P. (2013). Building Critical and Creative Thinkers through Design-Based Learning Environments. In R. McBride & M. Searson (Eds.), Proceedings of Society for Information Technology & Teacher Education International Conference 2013 (pp. 4580-4584). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Fischer, R. (2007). Teaching Thinking in the Classroom. Education Canada, 47(2), 72-74.

Fook, J., White, S. and Gardner, F. (2006). Critical reflection: A review of contemporary literature and understandings. In S. White, J. Fook and F. Gardner (eds.). Critical reflection in health and social care. Maidenhead, Berks: Open University Press.

Francis, D., & Ingram-Starrs, L. (2005). The labour of learning to reflect. Teachers and Teaching: Theory and Practice, 11(6): pp. 541-553.

Frascara, J. (2004). Communication design: Principles, methods, and practices. New York: Allworth Press.

Frascara, J. (2007, Autumn). Hiding lack of knowledge: Bad words in design education. Design Issues: 23(4), 62-68.

Geertsen, R. (2013). Barriers to critical thinking across domains. SSWA Faculty Publications. Paper 445. Retrieved from http://digitalcommons.usu.edu/sswa_facpubs/445

Gelmez, K., & Bagli, H. (2014). Learning from students: Reflections from personal magazines in Basic Design course. DRS 2014 Conference The Big Debates, 16-19 June 2014, Umea, Sweden.

Geis, C. & Birkhofer, H. (2009). Checklists as tools for reflective practice for designers. Proceedings of the 17th International Conference on Engineering Design, Volume 9. Stanford, CA, USA

Gelmez, K., & Bagli, H. (2015). Learning from students: Reflections from personal magazines in basic design course. Design and Technology Education: An International Journal, 20(1): pp. 29-37.

Gibbs, G. (1988) Learning by Doing: A guide to teaching and learning methods. Further Education Unit, Oxford Brookes University, Oxford.

Gibbs, G., & Simpson, C. (2004). Conditions under which assessment supports learning. Learning and Teaching in Higher Education, 1, pp. 3-31.

Glanville, R. (1999). Researching design and designing research. Design Issues, 15(2), pp. 80-91.

Glaser, E. M. (1941). An Experiment in the Development of Critical Thinking, New York: Teacher's College, Columbia University.

Glicksman, S. B. (2013). Become a better designer through critical thinking. Retrieved from http://www.vanseodesign.com/web-design/critical-thinking/

Gorzycki, M. (n.d.). Integrating thinking into the curriculum. Retrieved from http://ctfd.sfsu.edu/content/integrating-critical-thinking-curriculum

Goodwin, B. (2014). Teach critical thinking to teach writing. Educational Leadership, 71(7), pp. 78-80.

Gray, C. M. (2013). Informal peer critique and the negotiation of habitus in a design studio. In J. B. Reitan, P. Lloyd, E. Bohemia, L. M. Nielsen, I. Digranes, & E. Lutnæs, Design education from kindergarten to PhD–Design learning for tomorrow. Proceedings of the 2nd International Conference for Design Education Researchers (Vol. 2), Oslo and Akershus University College of Applied Sciences, 14–17 May 2013, Oslo, Norway, (pp. 702-714).

Griffin, M. L. (2003). Using critical incidents to promote and assess reflective thinking in preservice teachers. Reflective Practice, 4, pp. 207-220.

Grix, J. (2004). The foundations of research. London: Palgrave Macmillan.

Grossman, R. (2008). Structures for facilitating student reflection. College Teaching, 57(1), pp. 15-22.

Gröppel-Wegener, A. (2012). Developing academic writing skills in Art and Design through blogging. Journal of Academic Writing, 2(1), pp. 85-94.

Gröppel-Wegener, A. (2012). Developing academic writing skills in Art and Design through blogging. Journal of Academic Writing, 2(1), pp. 85-94.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (eds.), Handbook of qualitative research, pp. 105-117. Thousand Oaks, CA: Sage.

Gulwadi, G. B. (2009). Using reflective journals in a sustainable design studio. International Journal of Sustainability in Higher Education, 10(2), pp. 96-106.

Halpern, D. F. (1996). Thought and knowledge: An introduction to critical thinking. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Dispositions, skills, structure training, and metacognitive monitoring. American Psychologist, 53(4), pp. 449-455.

Halpern, D. F. (1999). Teaching for critical thinking: Helping college students develop the skills and dispositions of a critical thinker. New Directions for Teaching and Learning, 80, pp. 69-74.

Hamlin, K. D. (2004). Beginning the journey: Supporting reflection in early field experiences. Reflective Practice, 5, pp. 167-179.

Hancock, D. R., & Algozzine, R. (2006). Doing case study research: A practical guide for beginning researchers. New York: Teachers College Press.

Hanover Research (2011). A crosswalk of 21st Century Skills. Retrieved 30 July 2013 from http://www.hanoverresearch.com/wp-content/uploads/2011/12/A-Crosswalk-of-21st-Century-Skills-Membership.pdf.

Harris, M. (2008). Is journaling empowering? Students' perceptions of their reflective writing experience. Health SA Gesondheid, 10(2), 47-60.

Hatton, N. and Smith, D. (1995) Reflection in Teacher Education: Towards Definition and Implementation. Teaching and Teacher Education 11(1): 33-49

Hayes, D. (2014). Let's stop trying to teach students critical thinking. Retrieved from http://theconversation.com/lets-stop-trying-to-teach-students-critical-thinking-30321

Hegeman, J. (2008). The thinking behind design (Unpublished master's thesis). School of Design, Carnegie Mellon University, Pittsburgh, Pennsylvania.

Henderson, K., Napan K. & Monteiro, S. (2004). Encouraging reflective learning: An online challenge. In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds), Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference (pp. 357-364).

Heskett, J. (2008). Creating economic value by design. International Journal of Design, 3(1), 71-84.

Hickson, H. (2011). Critical reflection: Reflecting on learning to be reflective. Reflective Practice: International and Multidisciplinary Perspectives, 12(6), pp. 829-839.

Hickson, H. (2012). Reflective practice online–Exploring the ways social workers used an online blog for reflection. Journal of Technology in Human Services, 30, pp. 32-48.

Hiemstra, R. (2001). Use and benefits of journal writing. New Directions for Adult and Continuing Education, 90: pp. 19-26.

Higgins, D. (2011). Editorial: Why reflect? Recognizing the link between learning and reflection. Journal of Reflective Practice, 12(5), pp. 583-584.

Hinett, K. (2002). Improving learning through reflection–part one. The Higher Education Academy. Retrieved 15 Jan 2013 from http://www.heacademy.ac.uk/assets/documents/resources/database/id485_improving_learning_part_one.pdf

Hoadley, C. (2012). What is a community of practice and how can we support it? In D. H. Jonassen & S. M. Land (Eds.), Theoretical foundations of learning environments (Second ed., pp. 287-300). New York: Routledge.

Hobbs, V. (2007). Faking it or hating it: can reflective practice be forced? Reflective Practice, 8: 405–417.

Hoepfl, M. C. (1997). Choosing qualitative research: A primer for technology education researchers. Journal of Technology Education, 9(1). Retrieved January 22, 2008 from http://scholar.lib.vt.edu/ejournals/JTE/v9n1/hoepfl.html

Hokanson, B. (2012). The design critique as a model for distributed learning, in Huett, J. & Moeller, L., New directions in distance learning. Springer-Verlag.

Holloway, I., wheeler, S. (2002). Qualitative Research in Nursing (2nd ed). oxford: Blackwell.

Holyoak, K. J., & Morrison, R. G. (2012). Thinking and reasoning: A reader's guide. In K. J. Holyoak & R. G. Morrison (Eds.), The Oxford handbook of thinking and reasoning. New York: Oxford University Press.

Hubbs, D. L., & Brand, C. F. (2005). The paper mirror: Understanding reflective journaling. Journal of Experiential Education. 28(1): pp. 60-71.

Hutson, A., Ristic, M. & Tregloan, K. (2013). The role of the reflective journal and critique in early design education, Critique 2013: An International Conference Reflecting on Creative Practice in Art, Architecture, and Design, 26 November 2013 to 28 November 2013, University of South Australia, Adelaide SA Australia, pp. 157-167.

Hyett, N., Kenny, A., & Dickson-Swift, V. (2014). Methodology or method? A critical review of qualitative case study report. International Journal of Qualitative Studies on Health and Well-being, 9, pp. 1-12.

Ip, Y. K. (2003). Knowing is not the same as understanding: What is understanding? Retrieved from http://www.cdtl.nus.edu.sg/success/sl20.htm.

Jago, C. (2014). Writing is taught, not caught. Educational Leadership, 71(7): pp. 16-21.

Jessop, J. L. P. (2002). Expanding our students' brainpower: idea generation and critical thinking skills. Antennas and Propagation Magazine, IEEE, 44(6), 140-144.

Johns, C. (1994). Nuances of reflection. Journal of Clinical Nursing, 3: 71-75.

Johns, C. (1995). Framing learning through reflection within Carper's fundamental ways of knowing in nursing. Journal of Advanced Nursing, 22: 226-234

Jones, C. (2004) Becoming a reflective practitioner. (2nd). Oxford, UK; Malden, MA: Blackwell Publishing.

Johnson, R. H., & Hamby, B. (2015). A meta-level approach to the problem of defining 'critical thinking'. Argumentation: An International Journal on Reasoning. Advance online publication. doi: 10.1007/s10503-015-9356-4

Jonas, W. (Spring, 2001). A scenario for design. Design Issues, 17(2): pp. 64-80.

Jung, J. (2011). Reflective writing's synecdochic imperative: Process descriptions redescribed. College English, 73(6): pp. 628-647.

Kember, D., McKay, J., Sinclair, K., & Wong, F. K. Y. (2008, August). A four-category scheme for coding and assessing the level of reflection in written work. Assessment & Evaluation in Higher Education, 33(4), 363-379.

Kim, H. S. (1999). Critical Reflective inquiry for Knowledge Development of nursing practice. Journal of Advanced Nursing 29(5): pp. 1205-12

Kim, A. K. (2013). Reflective journal assessment: The application of good feedback practice to facilitating self-directed learning. Journal of Hospitality, Leisure, Sport & Tourism Education, 13: 255-259.

King, P., & Kitchener, K. (1981). Developing reflective judgment. San Francisco, C.A.: Jossey-Bass.

Kirby, G. R., & Goodpaster, J. R. (2007). Thinking: An interdisciplinary approach to critical and creative thought (4th ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.

Klein, G., Phillips, J. K., Rall, E. L., & Peluso, D. A. (2007). A data-frame theory of sensemaking. In R. R. Hoffman (ed.), Expertise out of context: Proceedings of the sixth international conference on naturalistic decision making. New York: Lawrence Erlbaum.

Knipfer, K., Kump, B., Wessel, D., & Cress, U. (2013). Reflection as a catalyst for organizational learning. Studies in Continuing Education, 35(1): pp. 30-48.

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ: Prentice Hall.

Kolko, J. (2010a). Abductive thinking and sensemaking: The drivers of design synthesis. Design Issues, 26(1): pp. 15-28.

Kolko, J. (2010b). Sensemaking and framing: A theoretical reflection on perspective in design synthesis. Design Research Society, conference proceedings. Retrieved from http://www.designresearchsociety.org/docs-procs/DRS2010/PDF/067.pdf

Kolko, J. (March & April, 2011). Endless nights: Learning from design studio critique. Interactions Magazine, 18(2): pp. 80-81.

Krathwohl, D. R. (2002). A revision of Bloom's Taxonomy: An overview. Theory Into Practice, 41(4): 212-218

Ku, K. (2009). Assessing students' critical thinking performance: Urging for measures using multi-response form. Thinking skills and creativity, 4, pp. 70-76.

Kumar, V. (2012). 101 design methods: A structured approach for driving innovation in your organization. Chichester, UK: Wiley.

Lai, E.R. (2011). Critical Thinking: A Literature Review. Pearson Assessments. Retrieved from http://www.pearsonassessments.com/hai/images/tmrs/criticalthinkingreviewfinal.pdf.

Lancy, D. F. (1993). Qualitative research in education: An introduction to the major traditions. New York: Longman.

Lau, J. Y. F. (2011). An introduction to critical thinking and creativity: Think more, think better. Hoboken, N.J.: Wiley.

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge, UK: Cambridge University Press.

Lawson, B. (2006). How designers think: The design process demystified (4th ed.). New York, New York: Architectural Press.

Lawson, B. & Dorst, K. (2009). Design expertise. Oxford [England]: Architectural Press.

Leise. C. (2010). Improving Quality of Reflecting on Performance International Journal of Process Education, 2(1): 65-74. Retrieved from http://www.processeducation.org/ijpe/2010/reflectingh.pdf

Levick-Parkin, M. (2014). Creativity, the muse of innovation: How art and design pedagogy can further entrepreneurship. Industry and Higher Education, 28(3): pp. 163-169.

Levin, K. A. (2006). Study design III: Cross-sectional studies. Evidence-Based Dentistry, 7, pp. 24-25. doi:10.1038/sj.ebd.6400375.

Lew, D. N. M., & Schmidt, H. G. (2011) Writing to learn: can reflection journals be used to promote self-reflection and learning? Higher Education Research & Development, 30(4): 519-532.

Lewis, A., & Smith, D. (1993). Defining higher order thinking. Theory into Practice, 32(3): 131–137.

Lewis, W. P., & Bonollo, E. (2002). An analysis of professional skills in design: Implications for education and research. Design Studies, 23(4): 385-406.

Libarkin, J. C., & Kurdziel, J. P. (2002). Research methodologies in Science Education: The quantitative-qualitative debate. Journal of Geoscience Education, 50(1), 78-86.

Litchman, M. (2010). Qualitative research in education: A user's guide. Los Angeles: SAGE.

Lockwood, T. (2010). Design thinking: Integrating innovation, customer experience and brand value. New York, NY: Allworth Press.

Loughran, J. J. (2002). Effective reflective practice: In search of meaning in learning about teaching. Journal of Teacher Education, 53(1), pp. 33-44.

Lowe, G. M., Prout, P., & Murcia, K. (2013). I see, I think I wonder: An evaluation of journaling as a critical reflective practice tool for aiding teachers in challenging or confronting Contexts. Australian Journal of Teacher Education, 38(6). http://dx.doi.org/10.14221/ajte.2013v38n6.6

Löwgren, J., & Stolterman, E. (2004). Thoughtful interaction design: A design perspective on Information Technology. The MIT Press.

Luck, L., Jackson, D., & Usher, K. (2006). Case study: A bridge across the paradigms. Nursing Inquiry, 13(2), pp. 103-109.

MacKinnon, D. W. (2005). IPAR's contributions to the conceptualization and study of creativity. In Tyalor, I. A. & Getzels, J. W. (Eds). Perspectives in creativity. Chicago, IL: Aldine Publishing Company.

Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. Issues in Educational Research, 16(2), 193-205. Retrieved February 20, 2008 from http://www.iier.org.au/iier16/mackenzie.html

Magolda, B. (2001). Making their own way: Narratives for transforming higher education to promote self-development. Sterling, V.A.: Stylus Publishing.

Maloney, P. (2007). Blogs, Reflective Practice and Autonomous Learning in Graphic Design Communication. In: ALT-C 2007: Be- yond Control, learning technology for the social network generation, 4-6 September 2007, Nottingham UK.

Mandell, A., & Herman, L. (2009). Mentoring: When learners making the learning. In J. Mezirow, E. W. Taylor, & Associates (Eds.), Transformative learning in practice: Insights from community, workplace, and higher education (pp. 172-181). San Francisco: Jossey-Bass.

Mann, C. J. (2003). Observational research methods. Research design II: Cohort, cross sectional, and case-control studies. Emergency Medicine Journal, 20, pp. 54-60.

Manolopoulou, Y. (2005). Unformed drawing: Notes, sketches and diagrams. The Journal of Architecture, 10(5), 517-525.

Martin, R. (2009). Design of business: Why design thinking is the next competitive advantage. Boston, Mass.: Harvard Business Press.

Mason, M. (2007). Critical thinking and learning. Educational Philosophy and Theory, 39(4), pp. 339-349.

Mason, M. (2008). Critical thinking and learning. In M. Mason (Ed.), Critical thinking and learning (pp. 1-11). Malden, MA: Blackwell Publishing.

Mayer, R. E. (2002). Rote versus meaningful learning. Theory into Practice, 41(4): 226-332.

McCallum, D. D. (2013). Journal writing as an active learning tool in history education. Caribbean Teaching Scholar, 3(1): pp. 23-39.

McDrury, J., & Alterio, M. (2002). Learnng through storytelling in higher education using reflection and experience to improve learning. London, U.K.: The Higher Education Academy, Kogan Page.

Mehta, S. R. , & Al-Mahrooqi, R. (2015). Can thinking be taught? Linking critical thinking and writing in EFL context. RELC Journal, 46(1), pp. 23-36.

Merriam, S. B. (2009). Qualitative research: A guide to design and implementation (3rd ed). San Francisco, CA: Jossey-Bass.

Meyer, C. B. (2001). A case in case study methodology. Field Methods, 13(4), pp. 329-352.

Mezirow, J. (2009). Transformative learning theory. In J. Mezirow, E. W. Taylor, & Associates (Eds.), Transformative learning in practice: Insights from community, workplace, and higher education (pp. 18-32). San Francisco: Jossey-Bass.

Michlewski, K. (2008). Uncovering design attitude: Inside the culture of designers. Organization Studies, 29(3), pp. 373-392.

Moon, J. (2006). Learning journals: A handbook for reflective practice and professional development (2nd ed.). London; New York: Routledge.

Moon, J. (2013). Reflection in Learning and Professional Development: Theory and Practice. New York: Routledge Falmer.

Moore, T. (2004). The critical thinking debate: How general are general thinking skills? Higher Education Research & Development, 23(1), pp. 3-18.

Moore, W. E., McCann, H. & McCann, J. (1985). Creative and Critical Thinking. Boston New Jersey: Houghton Mifflin Company.

Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business school. Hoboken, N.J.: John Wiley & Sons Inc.

Mulnix, J. W. (2010). Thinking critically about critical thinking. Educational Philosophy and Theory, 44(5): pp. 464-479.

National Research Council (2000). How People Learn: Brain, Mind, Experience, and School. Washington, DC: National Academies Press.

Neuman, W. L. (2004). Basics of social research: Qualitative and quantitative approaches. Boston: Pearson Education.

Newton, J. (2004). Learning to reflect: A journey. Reflective Practice: International and Multidisciplinary Perspectives, 5(2), pp. 155-166.

Nickerson, R. S. (1987). Why teach thinking? In J. B. Baron, and R. J. Sternberg (Eds.), Teaching thinking skills: Theory and practice (pp. 41-61). New York: W. H. Freeman & Company.

Nickerson, R.S. (1999). Enhancing Creativity. In R. J. Sternberg (Ed.), Handbook of Creativity (pp. 392-430). New York, USA: Cambridge University Press.

Nilson, L. (2014). Unlocking the mystery of critical thinking. Retrieved from http://www.facultyfocus.com/articles/Instructional-design/unlocking-mystery-critical-thinking/

Orland-Barak, L. (2005). Portfolios as eveidence of reflective practice: What remains 'untold'. Educational Research, 47(1), pp. 25-44.

Oxman, R. (2004). Think-maps: Teaching design thinking in design education. Design Studies, 25: 63-91.

Parahoo K. (1997). Nursing research: Principles, process and issues. Basingstoke: Macmillan.

Park, J. Y. (2009). Redefining the student-teacher relationship through online sharing activities. International Journal of Technology, Knowledge and Society, 5(4), pp. 125-134.

Pascarella, E., & Terenzini, P. (1991). How college affects students: Findings and insights from twenty years of research. San Francisco, CA: Jossey Bass.

Paton, M.J. (2008). Reflective journals and critical thinking. In Intercultural Communications across University Set- tings - Myths and Realities "refereed proceedings of the 6th Communication Skills in University Education Conference", ed. J van Rij-Heyligers, Pearson Education New Zealand, Rosedale, New Zealand, 201-9.

Patton, M. Q. (2002). Qualitative Research & Evaluation Methods (3 ed.). Thousand Oaks, CA: Sage.

Paul, R. (1993). Critical thinking: What every person needs to survive in a rapidly changing world. Santa Rosa, CA: Foundation for Critical Thinking.

Paul, R. (2004). The state of critical thinking today. Retrieved 25 Jul 2010 from http://www.criticalthinking.org/pages/the-state-of-critical-thinking-today/523.

Paul, R. (2005). The state of critical thinking today. In C. M. McMahon (ed.), Critical thinking: Unfinished business. New Directions for Community Colleges, no. 130, San Francisco: Jossey-Bass.

Paul, R., & Elder, L. (2005). A guide for educators to critical thinking competency standards: Standards, principles, and outcomes with a critical thinking master rubric. CA, USA: Foundation for Critical Thinking.

Paul, R., & Elder, L. (2006). Critical thinking: Tools for taking charge of your learning and your life (2nd ed.). Upper Saddle River, NJ: Pearson/Prentice Hall.

Paul, R. & Elder, L. (2007). The miniature guide to critical thinking: Concepts and tools. Dillon Beach, CA: Foundation for Critical Thinking Press.

Paul, R., & Elder, L. (2008). The thinker's guide to the nature and foundations of critical and creative thinking. CA, USA: Foundation for Critical Thinking.

Paul, R., & Elder, L. (2011a). Critical thinking: Competency standards essential for the cultivation of intellectual skills, Part 2. Journal of Developmental Education, 35(1), pp. 36-37.

Paul, R., & Elder, L. (2011b). Critical thinking: Competency standards essential for the cultivation of intellectual skills, Part 3. Journal of Developmental Education, 35(2), pp. 34-35.

Paul, R., & Elder, L. (2013). Critical thinking: Intellectual standards essential to reasoning well within every domain of human thought, part 2. Journal of Developmental Education, 37(1): pp. 32-33, 36.

Paul, R., Elder, L., & Bartell, T. (1997). California teacher preparation for instruction in critical thinking: Research findings and policy recommendations. Sacramento: California Commission on Teacher Credentialing.

Paulhus, D. L., & Vazire, S. (2007). The self-report method. In R.W. Robins, R.C. Fraley, & R.F. Krueger (Eds.), Handbook of research methods in personality psychology (pp. 224-239). New York: Guilford.

Pavlovich, K., Collins, E., & Jones, G. (2009). Developing students' skills in reflective practice: Design and assessment. Journal of Management Education, 33(1): 37-58.

Payne, J. (2013, August). Design analysis and synthesis: A palette of approaches. Paper presented at the IDSA 2013 Education Symposium, Chicago, USA. Retrieved from http://www.idsa.org/sites/default/files /Payne-Paper_Design_Analysis_and_Synthesis.pdf

Penkauskienė, D. (2010). Integration of critical thinking principles into the curriculum of secondary schools: Lithuania's case (Research report). Retrieved from http://www.sdcentras.lt/pr_ctp/Report.pdf

Perkins, D. (1993). Teaching for understanding. American Educator: The Professional Journal of the American Federation of Teachers, 17(3), pp. 8,28-35.

Perkins, D. (1998). What is understanding? In M. S. Wiske (Ed.), Teaching for understanding: Linking research with practice. San Francisco, CA: Jossey-Bass Publishers.

Perkins, D., & Blythe, T. (1994). Putting Understanding up-front. Educational Leadership. 51 (5): 4-7.

Perkins, D. N., & Ritchhart, R. (2004). When is good thinking? In D. Y. Dai & R. Sternberg (Eds.) Motivation, emotion, and cognition: Integrative perspectives on intellectual functioning and development. Mawah, NJ: Erlbaum.

Phillips, V., & Bond, C. (2004). Undergraduates' experiences of critical thinking. Higher Education Research & Development, 23(3), pp. 277-294.

Pink, D. H. (2006). A whole new mind: Moving from the information age to the conceptual age. New York: Riverhead Books.

Piotrowski, C. (2011). Problem solving and critical thinking for designers. Hoboken, N.J.: Wiley.

Price, A. (2004). Encouraging reflection and critical thinking in practice. Nursing Standard, 18(47), pp. 46-54.

Pring, R. (2000). The 'false dualism' of educational research. Journal of Philosophy of Education, 34(2), 247-260.

Poggenpohl, S. H. (2004). Plain talk about learning and a life – in design. AIGA Education: Design Education. Retrieved on January 28, 2008 from http://www.aiga.org/content.cfm/plain-talk-about-learning-and-a-life-in-design

Poggenpohl, S. H. (2009). Time for change: Building a design discipline. In S. H. Poggenpohl, and K. Sato (eds.). Design integrations: Research and collaboration. Chicago: Intellect, the University of Chicago Press.

Pohl, M. (2000). Teaching Complex Thinking: Critical, Creative, Caring [E-reader version]. Retrieved from https://bookshelf.vitalsource.com/#/books/9781743308530/cfi/6/18[;vnd.vst.idref=section_1]!/4/2/2[AA4].

Polanyi, M. (1967). The Growth of Science in Society. Minerva 5(4): 533-545.

Polite, K. (2004). Thinking about design education. AIGA Education: Design Education. Retrieved on January 28, 2008 from http://www.aiga.org/content.cfm/thinking-about-design-education

Potter, N. (1980; 2002). What is a designer: Things, places, messages. London: Hyphen Press.

Press, M., & Cooper, R. (2003). The design experience: The role of design and designers in the twenty-first century. Aldershot, Hants, England ; Burlington, VT: Ashgate.

Pyc, M., & Rawson, K. (2010, November). How testing improves memory. Science News, 178(10), p. 16.

Quitadamo, I. J., & Kurtz, M. J. (2007). Learning to improve: Using writing to increase critical thinking performance in general education biology. CBE–Life Sciences Education, 6(2), pp. 140–154.

Race, P. (2006, Nov, 15). Evidencing reflection: Putting the 'w' into reflection. ESCalate Resources. Retrieved 20 Jul 2013 from http://escalate.ac.uk/resources/reflection/

Ralston, P. A., & Bays, C. L. (2013). Enhancing critical thinking across the undergraduate experience: An exemplar from engineering. American Journal of Engineering Education, 4(2): pp. 119-126.

Rau, H. (2012, April). Student reflective practice. China-USA Business Review, 11(4), pp. 564-580.

Reagan, T. G., Case, C. C., & Brubacher, J. W. (2000). Becoming a reflective educator: How to build a culture of inquiry in the schools (2nd ed). Thousand Oaks, CA: Corwin Press Inc.

Reed, J. H., & Kromrey, J. D. (2001). Teaching critical thinking in a community college history course: Empirical evidence from infusing Paul's model. College Student Journal, 35(2), pp. 201-215.

Renaud, R. D. and Murray, H. G. (2008). A comparison of a subject specific and a general measure of critical thinking. Thinking Skills and Creativity, 3(2): 85-93.

Rennie, J. (2013). Towards assessment transparency: Following on from 'the crit,' can a student's learning be enhanced by allowing them to witness their own formative and summative assessment event? In C. Brisbin & M. Thiessen (Eds.), Critique 2013: An International Conference Reflecting on Creative Practice in Art, Architecture, and Design, University of South Australia, Adelaide, 26-28 November, (pp. 295-304). Adelaide, South Australia: The University of South Australia.

Reymen, I. M. M. J. & Hammer, D. K. (2000). Design method supporting regular reflection on design situations. Proceedings of the Third International Symposium on Tools and Methods of Competitive Engineering, April 18-21, 2000, Delft, The Netherlands.

Richards, L. & Morse, J. M. (2007). Readme first for a user's guide to qualitative methods (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Rittel, H.W., & Webber, M.M. (1973). Dilemmas in a general theory of planning. Policy Sciences, 4(2): pp. 155-69.

Robinson, K. (2009). The element: How finding your passion changes everything. New York, NY: Viking.

Rodgers, C. (2002). Defining reflection: Another look at John Dewey and reflective thinking. Teachers College Record, 4(4): 842-866.

Rogers, C. (1951). Client-centered therapy: Its current practice, implications and theory. London: Constable.

Rogers, C. (2002). Defining reflection: Another look at John Dewey and reflective thinking. Teachers College Record, 104(4), pp. 842-866.

Rolfe, G., Freshwater, D., & Jasper, M. (2001). Critical reflection for nursing and the helping professions: A user guide. Basingstoke: Palgrave Macmillan.

Rossenwasser, D., & Stephen, J. (2015). Writing analytically (7th ed.). Stamford, CT: Cengage Learning.

Rubin, H., & Rubin, I. (2005). Qualitative interviewing: The art of hearing data. Thousand Oaks, CA: Sage.

Ryan, M. & Ryan M. (2013). Theorizing a model for teaching and assessing reflective learning in higher education. Higher Education Research & Development, 32(2), pp. 244-257.

Saavedra, A. R. & Opfer, V. D. (2012). Teaching and learning 21st Century Skills: Lessons from the learning sciences. New York: Asia Society.

Schön, D. A. (1983). The reflective practitioner: How professionals think in action. New York: Basic Books.

Schön, D. A. (1985) The design studio: an exploration of its traditions and potentials, London: RIBA Publications for RIBA Building Industry Trust.

Schön, D. A. (1987). Educating the reflective practitioner: Toward a new design for teaching and learning in the professions. San Francisco: Jossey-Bass.

Schön, D. A., & Wiggins, G. (1992). Kinds of seeing and their function in designing. Design Studies, 13, pp. 135-156.

Scriven, M. (1991). Evaluation thesaurus (4th ed.). Thousand Oaks, CA: Sage.

Seepersad, C., Schmidt, K., & Green, M. (2006). Learning journal as a cornerstone for effective experiential learning in undergraduate engineering design courses. Proceedings of the American Society for Engineering Education Annual Conference & Exposition. Chicago, IL. June 18-21.

Sempowicz, T., & Hudson, P. (2012, August). Mentoring pre-service teachers' reflective practices towards producing teaching outcomes. International Journal of Evidence Based Coaching and Mentoring, 10(2), pp. 52-64.

Silvia, B., Valerio, D., & Lorenza, G. (2013). The reflective journal: A tool for enhancing experience-based learning in nursing students in clinical practice. Journal of Nursing Education and Practice, 3(3): pp. 102-111.

Simon, H. A. (1996). The sciences of the artificial. Cambridge, Mass.: MIT Press.

Singh, P., & Minsky, M. (2004). An architecture for cognitive diversity. In D. N. Davis (Ed.), Vision of mind: Architecture for cognition and affect (pp. 312-331). Hershey, PA: Idea Group.

Smith, E. (2011). Teaching critical reflection. Teaching in Higher Education, 16(2), pp. 211-223.

Smyth, J. (1989). Developing and sustaining critical reflection in teacher education. Journal of Teacher Education 40(2) 2-9

Sobek, D. K. II (2002). Use of journals to evaluate student design processes. Paper published in the proceedings of the 2002 American Society for Engineering Education Annual Conference and Exposition, June 16-19, 2002, Montreal, Quebec. Washington, D.C.: ASEE.

Spalding, E., & Wilson, A. (2002). Demystifying reflection: A study of pedagogical strategies that encourage reflective journal writing. Teachers College Record, 104, pp. 1393-1421.

Stake, R. E. (2010). Qualitative research. Studying how things work. New York: The Guilford Press.

Stead, N. (2003). Producing critical thinkers, designing critical objects: Re-examining the role of critique in architectural education. In S. Kaji-O'Grady & C. Newton (Eds.), Design + Research: Project Based Research in Architecture: Proceedings of the Second International Conference of the Association of Architecture Schools of Australasia, (pp. 3-12). Melbourne, Australia.

Sternberg, R.J. (1986). Critical thinking: Its nature, measurement, and improvement. National Institute of Education. Retrieved Aug, 2, 2013 from http://files.eric.ed.gov/fulltext/ED272882.pdf

Sternberg, R. J., & Williams, W. M. (1996). How to develop student creativity. Alexandria, VA: Association for Supervision and Curriculum Development.

Stevens, D. D., & Cooper, J. E. (2009). Journal keeping: How to use reflective writing for learning, teaching, professional insight, and positive change. Sterling, VA: Stylus Publishing, LLC.

Stiles, J. (2006). Knowing versus understanding: Teaching that goes beyond trivialities. Iowa Science Teacher Journal, 33(2), pp. 1-7.

Strampel, K., & Oliver, R. (2008). We've thrown away the pens, but are they learning? Using blogs in higher education. Paper presented at the ASCILITE, Melbourne, Australia.

Strauss, A., Corbin, J. (1998) Basics of qualitative research - Techniques and procedures for developing Grounded Theory. London, Sage.

Suri, J. F. (2008). Informing our intuition: Design research for radical innovation. Rotman Magazine, 52-57.

Swartz, R. and Perkins, D. (1990). Teaching thinking: Issues and approaches. Pacific Grove, CA: Midwest Publications.

Taura, T., Nagai, Y. (2009). A definition of designs and its creative features. Retrieved from http://www.research.kobe-u.ac.jp/eng-mech-design/taura/img/taura_pub/72.pdf

Taylor M., & McCormack C. (2008) What happens when design feedback moves across the digital divide? Paper presented at the Australian Council of University Art and Design Schools (ACUADS) Annual Conference.

Taylor, S. S. (2010). Negative judgments: Reflections on teaching reflective practice. Organization Management Journal, 7, pp. 5-12.

Tellis, W. (1997). Introduction to case study. The Qualitative Report, 3(2). Retrieved 16 October 2013 from http://www.nova.edu/ssss/QR/QR3-2/tellis1.html.

ten Dam, G. & Volman, M. (2004). Critical thinking as a citizenship competence: Teaching strategies. Learning and Instruction 14, pp. 359-379.

Thomas, G. (2010). Doing case study: Abduction no induction, phronesis not theory. Qualitative Inquiry, 17(6), pp. 511-521.

Thomas, T. A. (2011). Developing first year students' critical thinking skills. Asian Social Science, 7(4): pp. 26-35. Retrieved from http://www.ccsenet.org/journal/index.php/ass/article/view/9389/7128.

Thompson, C. (2011, July). Critical thinking across the curriculum: Process over output. International Journal of Humanities and Social Science, 1(9): pp. 1-7.

Thompson, N., & Pascal, J. (2012, April). Developing critically reflective practice. Reflective Practice, 13(2), pp. 311-325.

Thompson, R. M., Irmer, B. E., & Tang, T. (2012). Teaching and assessing critical thinking: The interaction of student approaches to learning and teaching approaches. In Mortimer, R. (Ed.) 15th International First Year in Higher Education Conference: New Horizons, 26-29 June 2012, Sofitel Brisbane Central, Brisbane, QLD. Retrieved 30 July 2013 from http://eprints.qut.edu.au/52055/2/52055.pdf.

Thomson, S. and Thomson, N. (2008) The critically reflective practitioner. Houndmills: Palgrave MacMillan.

Tilbury, C., Osmond, J., & Scott, T. (2010). Teaching critical thinking in social work education: A literature review. Advances in Social Work and Welfare Education, 11(1), pp. 31-50.

Tight, M. (2010). The curious case of case study: A viewpoint. International Journal of Social Research Methodology, 13(4), pp. 329-229.

Tippey, B. (2008). Critical thinking is not discipline-specific: Teaching critical thinking to the beginning design student. Presented at the 24th National Conference on the Beginning Design Student Atlanta, GA: Georgia Institute of Technology.

Tobin, G. A., & Begley, C. M. (2004). Methodological rigour within a qualitative framework. Journal of Advanced Nursing, 48(4), 388-396.

Treffinger, D. J., Isaksen, S. G., & Stead-Dorval, K. B. (2006). Creative problem solving: An introduction (4th ed.). Waco, TX: Profrock Press.

Trejos, C.M.A. (2008). Using Journals for Learners' Reflection and Self-Assessment. [online]. Tersedia: http://iteslj.org/Techniques/Arciniegas-LearnersJournals.html [5 April 2011]

Treseler, M. (2015). In design, what we really need is critical thinking: More than reaction or direction, critique is the key to understanding the impact of design decisions. Retrieved from: http://radar.oreilly.com/print?print_bc=75657

Tsang, N. M. (2007). Reflection as dialogue. British Journal of Social Work, 37: pp. 681-694.

Uluoglu, B., & Taksim, T. (2000). Design knowledge communicated in studio critiques. Design Studies, 21: pp. 33-58.

Urquhart, C. (2013). Grounded theory for qualitative research: A practical guide. London: SAGE Publications.

van Manen, M. (1977). Linking ways of knowing with ways of being practical. Curriculum Inquiry, 6(3), pp. 205-228.

VanWynsberghe, R. & Khan, S. (2007). Redefining case study. International Journal of Qualitative Methods, 6(2), Article 6. Retrieved 30 June 2013 from http://www.ualberta.ca/~iiqm/backissues/6_2/vanwynsberghe.pdf

Vernava, T. (2002). Developing reflective practice in legal education. Coventry: UK Center for Legal Education.

Vissak, T. (2010). Recommendations for using the case study method in international business research. The Qualitive Report, 15(2), pp. 370-388. Retrieved 16 October 2013 from http://www.nova.edu/ssss/QR/QR15-2/vissak.pdf.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological process. Cambridge, MA: Harvard University Press.

Wade, C. (1995). Using writing to develop and assess critical thinking. Teaching of Psychology, 22(1), 24-28.

Walling, A., Shapiro, J., & Ast, T. (2013). What makes a good reflective paper? Family Medicine, 45(1): pp. 7-12.

Webster, H. (2001). The Design Diary: Promoting Reflective Practice in the Design Studio. Architectural Education Exchange, Cardiff, UK, Sept 2001. Retrieved 1 November 2010 from http://www.cebe.heacademy.ac.uk/aee/pdfs/websterh.pdf

Weick, K. E. (1995). Sensemaking in organizations. Thousand Oaks, CA: Sage.

Wenger, E. (1998). Communities of practice: Learning, meaning and identity. Cambridge, U.K.; New York, N. Y.: Cambridge University Press.

Whittington, J. (2004). The process of effective critiques. Computer & Graphic, 28: pp. 401-407.

Wiggins, G., and McTighe, J. (2005). Understanding by design. Upper Saddle River, N.J.: Pearson Education Inc.

Wilkinson, J. (1999). Implementing reflective practice. Nursing Standard, 13(21), pp. 36-40.

Willingham, D. T. (2007). Critical thinking: Why is it so hard to teach? American Educator, 31(2): 8-9.

Wong, H. L. H. (2011). Critique: A communicative event in design education–A qualitative research on western faculty and Asian students. Visible Language, 45(3): pp. 221-247.

Wood, J. (2013). Transformation through journal writing: The art of self-reflection for the helping professions. London: Jessica Kingsley.

Wurman, R. S. (2001). Information anxiety 2. Indianapolis, IN: Que.

Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research through design as a method for interaction design research in HCI. Retrieved from http://repository.cmu.edu/cgi/viewcontent.cgi?article=1041&context=hcii

Zmijewski, B. (2010). The role of critical thinking in the design process. Retrieved from http://zurb.com/article/390/the-role-of-critical-thinking-in-the-desi