

The Effectiveness of Design Thinking Course in Promoting Critical Thinking Skills

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Abstract -- Design Thinking course is believed to enhance students' critical thinking skills; thus, this paper seeks to examine the correlation between Design Thinking course and critical thinking skills among undergraduate students. This research adapted Design Thinking framework developed by Hasso-Plattner Institute of Design at Stanford. This study uses questionnaire on 114 undergraduates of a private university in Malaysia. The result shows that Design Thinking course does help to enhance critical thinking skills, in which the implication brings positive impact on teaching and learning in higher education Malaysia.

Keywords -- Design Thinking course, Critical Thinking skills, problem solving skills, teaching & learning

I. INTRODUCTION

Critical thinking skills is essential in the 21st century learning movement. The Malaysian Education Blueprint (2015-2025) establishes critical thinking skills as one of the six primary attributes of student aspirations; hence presenting it as the core of the most intellectual activity in learning. This attribute aims to produce graduates who are able to recognize and develop an argument based on valid evidences, draw rational conclusions and use information to solve problems (Ministry of Education Malaysia, 2015).

Ennis (2011) defines critical thinking as a reflective and reasonable thinking on a decision, in which reflects what we need to believe or do. Wallace & Jefferson (2015) on the other hand describes critical thinking as a process to generate commonsensical assessments by employing logical and multi-faceted points or arguments. It involves "skilled judgment or observation" in analyzing information, devising problems, interpreting abstract ideas and communicating with people effectively. Hence, it is imperative that students must be actively involved in the purposeful and logical critical thinking processes and go beyond content knowledge to be able to come up with practical and creative solutions to the presented problems (Lipman, 2003; Bassham et al.,

2013). This allows them to use mind to its maximum potential, which in turn exposes the students to personal enrichment and empowerment (Bassham et al., 2013).

Critical thinking is a prominent element of investigation, innovation and problem-solving (Alatas, 2014). Students who possess critical thinking will consequently have the ability to propose creative alternatives in order to solve problems. It is worth noting, problem solving is one of the most important competencies students must have. It is a critical disposition especially once they enter workforce, as they need to become capable of responding reflexively to complex problems (Quint & Condliffe, 2018). Therefore, it is fundamental that the problem-solving activities are integrated into the learning process, to expose students to critical thinking through deliberate practice. Nonetheless, it is observed that critical thinking skills is rarely taught explicitly.

Thus, Design Thinking curriculum is developed in a private university in an attempt to enhance students' critical thinking skills. Design Thinking can be defined as an iterative process that includes the processes of understanding the target users, questioning the problem, questioning the assumptions and questioning the solutions. These processes involve in depth interest of the design thinker, as they are to develop empathy with the target user for whom they are designing the products or services (Razzouk, et al., 2012).

At the beginning of the course, students are exposed to current real-world problems – the seventeen global goals of Sustainable Development Goals (United Nation, n.d.). Some of the goals include no poverty, zero hunger, good health and well-being and good education. Based on these goals, students have unlimited opportunities to re-frame the problem, identify alternative strategies and provide effective solutions in human-centric ways. On top of that, design thinkers are exposed to hands-on approaches, such as prototyping, testing and ongoing experimentation. It is worth noting, Design Thinking is a cross disciplinary process, in which it can be incorporated into any disciplines (Razzouk, et al., 2012) – art, business, IT, Engineering etcetera.

Design Thinking Framework

It is fundamental to integrate critical thinking skills through effective learning strategies. To prepare students for the 21st century skills, the chalk and talk teaching model should be shifted to the current pedagogical paradigms that are more meaningful for learning (Howard, et al., 2015).

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Hence, the implementation of Design Thinking course is modified from the basic Design Thinking curriculum taught by the Hasso Plattner Institute of Design at Stanford University in 2010, which emphasizes learner-centric processes and activities. This supports constructivist approaches to education, that knowledge is actively constructed through direct involvement in learning and making connections to prior learning (Vygotsky, 1978)

The course is stretched to 14-weeks of 2-hour weekly workshops and 1-hour weekly online learning tool (Learning Management Tool). The online tool provides Design Thinking notes and examples of projects. The notes include the definition of Design Thinking and the explanation of each phase. Examples are also given to support students' understanding. By doing this, students are able to go through the online materials before coming to classes; hence in-class lecturing is kept to a minimum. This is important to 'force' the students to be more analytical, and experimental so as to see challenges that they are facing in a more open condition in developing potential solutions.

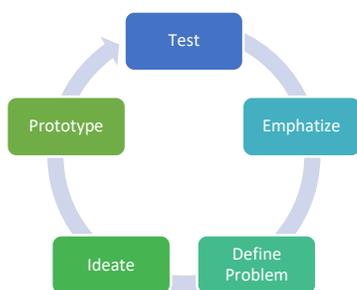


Figure 1. The Design Thinking Innovation Process

The Design Thinking course implements Design Thinking Innovation Process, which is represented by five phases (refer to Figure 1). It is important to note that these phases are not always sequential (Dam & Siang, 2018). They are iterative in the sense that it can occur in parallel and repetitive that contributes to an innovative project. In this course, the first stage that is introduced to students is **empathize**, which is for students to examine the nature of a problem through observation or interview. This is the part which students need to understand the underlying emotions or needs of the target user. Secondly is **define**, which students need to identify and reframe unknown or ill-defined problem so that becomes concrete and workable statement. From there, students brainstorm as many possible solutions as possible to the problem – this phase is called **ideation**. At this point, students are given a mentor from the industry to gain some insights from a professional perspective. Then, students create a **prototype**, a physical representation of their idea, and finally to **test** the prototype to get feedback from the target users.

II. METHOD

A mini-scale exploratory research was conducted at a private university in Malaysia, INTI International University, to analyze the correlation between the Design Thinking course and critical thinking skills among undergraduate students. The study was conducted using the quantitative research method, which can be defined as an explanation of phenomena by analyzing numerical data using mathematical based method. For this study, students' feedback was collected through a self-administered Likertscale online survey from 114 students of various disciplines. The online survey consists of twelve statements, which was distributed to students at the end of the course via Google form The data was analyzed using sample testing for mean and standard deviation, through data analysis tool pack of MS Excel.

Therefore, the purpose of this study is to investigate the correlation between Design Thinking course and critical thinking skills in undergraduate programs. Hence, the following research question will be looked into:

1. To what extent does Design Thinking course enhance students' critical thinking skills among undergraduate students?

Also, this paper will suggest other possible areas for future research on how to effectively integrate critical thinking skills into students' learning.

III. RESULTS

The results of the questionnaires were interpreted and conclusions were drawn. Table 1 shows the analysis of responses given by the students.

TABLE I: THE MEAN RESPONSES GIVEN BY UNDERGRADUATE STUDENTS

Statements	Mean	Standard Deviation
Generating Solutions		
1. My team managed to relate to real world issues in order to generate problem statements.	4.23	0.73
2. My team provided effective solutions to my group's problem statement.	4.15	0.88
3. We made appropriate inferences before generating ideas for the proposal	4.18	0.76
Analyzing Data		
4. We managed to analyze data that we obtained from the primary and secondary research.	4.11	0.73
Innovating Prototype		
5. My team can visualize my product/service after I completed the Design Challenge Proposal.	4.16	0.78
6. My team managed to invent a prototype based on the	4.19	0.87

visualization that we had from the Design Challenge proposal.

Scaling up Potential

7. We compared our product/service ideas with existing products/services in the current market and we scaled up the potential of our product/service ideas.	4.12	0.8
8. My instructor encouraged students to predict the cost structure and revenue of my product/service.	4.24	0.79

Design Thinking Experience

9. We followed the 5-steps Design Thinking process closely: Discover, Define, Develop, Deliver & Iterate.	4.20	0.77
10. Through this Design Thinking course, I can actively participate in creative and critical thinking-based activities.	4.21	0.75
11. Thinking skills help students solve problem quickly.	4.28	0.71
12. This course allows me to express ideas and give opinions.	4.15	0.72

Overall Mean

4.185

Based on Table 1 above, this study revealed that Design Thinking course has positive effect on critical thinking skills. This is evident from the overall mean for 12 statements, which is 4.185 (N=114). Positive ratings (i.e. values that exceeded 3.00) were obtained for all statements, which can be categorized into the following areas: generating solutions to problems, analyzing data, realizing ideas through prototype innovation, scaling up potential of the solutions and the overall Design Thinking experience. It is also worth highlighting, we found that students integrated critical thinking skills into business perspectives. This is well demonstrated as students compared their innovation ideas with existing products and services in the market (mean = 4.12). They also predicted the cost structure and revenue of the innovation (mean = 4.24). Moreover, the data revealed that students agreed that Design Thinking course allows active participation in critical thinking activities (mean = 4.21).

IV. DISCUSSION & RECOMMENDATION

Findings from the hypothesis revealed that Design Thinking course have a high significant effect on students' critical thinking skills. This is reflected through the positive average scores from the online survey. It is found that the problem solving skills were well demonstrated when the students identified problems by putting themselves in the target user's position to develop empathy. This allows the students to present point of views in a structured, well-reasoned and clear way that convinced others. Thus, they were able to make proper inferences before producing effective strategies to solve the problems. Furthermore, students evaluated evidences from their primary and secondary research in order to draw conclusions as to

whether their arguments were valid and justifiable. Critical thinking skills were also exhibited when students had to realize their ideas into a working prototype and to test their ideas; hence, this shows that students critical thinking was actively put to test throughout the course. On top of that, students had the opportunities to relate their innovation ideas to commercialization, in which students compared with the existing market and they predicted the cost and the revenue of the product. All these experiences are in consonance with their Design Thinking experience result survey, as they agreed that Design Thinking course allows them opportunities to participate in critical thinking activities.

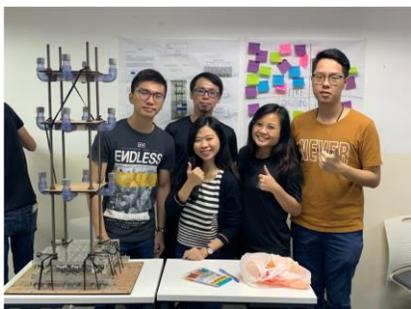
The implication of this finding is that the design of the curriculum of the Design Thinking course largely affects the extent to which Design Thinking students develop problem solving skills by generating practical solutions to specific problems, which facilitates students' receptiveness to real-world issues. Consequently, students will be equipped with 21st century skills which are useful for future jobs once they graduate.

Thus, Design Thinking should not only be a course that stands by itself, but it should be a pedagogy that is integrated in all classrooms in all disciplines (Vanada, 2014). Design thinking pedagogy challenges the teacher-centered teaching style and narrow and rigid processes of traditional learning as Design Thinking allows autonomy and self-directed learning. Through the five phases of Design Thinking innovation process, students are exposed to learner-centered principles as they construct knowledge through inquiry, make connections, solve problems empathically, make mistakes and eventually become more self-directed in learning (Vanada, 2014). This enhances students' critical thinking skills; thus preparing them to be career-ready.

Image 1: Students' presentation during ideation phase



Image 2: Students and their prototype during test phase



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