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Exploring the Effectiveness of Synectics Model on Creative Problem-Solving Skills in Industrial Design Course

[1]Ong Ei Lin, [2]Tan Wee Chuen

[1]Southern University College, Johor, Malaysia, [2]Raffles University, Johor, Malaysia

Corresponding Author: elong@sc.edu.my

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Abstract

Researchers have stressed the need of creative problem solving in students at different levels for today's rapidly changing world. Malaysia Higher Education Blueprint has emphasized that one of the higher education system outcomes on student aspiration is to thinking skills. Graduates who lacked creative problem solving are facing challenges such as difficulty in differentiations, solving complex problems, lacking innovative thinking a work. The purpose of this study was to determine the effectiveness of teaching and learning using Synectics model in identifying problems on user need in the initial stage of Industrial design process. ID-Sync model, where Synectics model integrated into Industrial design process was applied in the experiment. Mixed method sequential explanatory research was employed with 26 participants in one of the universities in Johor Bahru. Students who perceived ID-Sync model teaching and learning have a better understanding in identifying problems in the initial stage of Industrial design process. Results show that participants in experimental group who perceived higher scored in the initial stage, scored higher marks in the following processes as well as the total scores. Although the findings were unconvincing in the effectiveness of Synectics model in the application of teaching and learning in Industrial design process. However, the interview reflected that model should be implemented gradually from the beginning of the program.

Keywords: Creative Thinking, Industrial Design Process, Creative Problem Solving, Synectics Model

Introduction

Industrial Design course is a 'practice-based' learning program which practical learning environment is essential whereby students learn to create products and system by considering their function, value and appearance that able to improve our living environment. Students solve design problems based on their knowledge and skill as well as their analytical thinking throughout the design learning process. Therefore, creativity and innovative are important elements in the development of innovative idea and problem solving (Serikbayeva

& Beisenbayeva, 2020; Setiana, et al., 2021). Researchers claimed that creativity is crucial in design process to achieve some effective design solutions (Cross, 2024). Hence, it is important for educators to develop and enhance student's creative thinking skills in Industrial Design course. Industrial Design courses required both theoretical and practical skills with the combination of current technology knowledge, especially in Studio Project module. This module nurtures their thinking and develop problem-solving skills as well as to train their practical skills so that they are industry ready. This gap necessitates the exploration of effective pedagogical approaches that can foster creativity and enhance students' ability to tackle complex design challenges.

Problem Statement

Researchers claimed that most of Malaysian students lacked creative thinking as their teachers in secondary schools failed to integrate high order thinking in their teaching to develop problem-solving skills (Amran, et al.,2020; Meyer & Norman, 2020). For higher education level, graduates should be able to think critically and innovative, problem-solving initiative and an entrepreneurial mindset (MOE, 2013). MQA Program Standards for Art and Design (MQA, 2020) stressed design courses should focus on aesthetic, functionality, concepts, creativity and innovative through various teaching and learning. Graduates who are lacking creative thinking and problem-solving skills tend to be unable to identify problems, make decision and solve problem (Dumas, 2000), which lead to the increased number of unemployed graduates (Nadarajah, 2021). Therefore, the initial Industrial design process stage is crucial where problems need to be identified with creative problem-solving skills (Puccio, et al., 2020). Design ideas and concepts are generated when design process involves bringing new concepts and unexpected solutions together based on user requirements (Tang, et al., 2020). This is utmost important in Industrial design process.

Hence, this study aims to examine the effectiveness of using Synectics model to enhance Industrial Design student's creative problem-solving skills in the initial stage of design process. The initial stage of Industrial design process in this study consists of Examine and Understand phases, which determines the performance towards the outcomes. Synectics model was applied in this study to examine students' creative problem-solving skills in identifying problems towards users' needs in the initial stage of Industrial design process. The significant difference between using Synectics model and conventional teaching and learning in student's performance of creative problem solving in the Industrial design process for Industrial Design (ID) Studio Project.

Scope of Study

This study aims to examine the effectiveness of Synectics model in the teaching and learning of Industrial Design process in the initial stage. The importance of this study lies in its focus on the Synectics model, a creative problem-solving method that encourages students to approach problems from new perspectives through analogical thinking. Hence, the research focused on the application of Strategy One (Creating something new) and Strategy Two (Making the strange familiar) of Synectics model in the teaching and learning process using analogies.

Student performance was measured to evaluate the effectiveness of the model in developing students' creative problem-solving skills at the initial stage of Industrial design process.

Strategy One and Two were applied in the initial stage of Industrial design process, which are Understanding and Examine phases. According to Kantorovitch, et al. (2017), the initial stage of Industrial design process is the most crucial phase on problem identification and idea exploration where the main concept idea derived from this stage. By integrating the Synectics model into the early stages of the Industrial Design process, this study aims to address these shortcomings by enhancing students' ability to identify problems, develop innovative solutions, and refine their creative thinking skills.

The respondents involved in this study are students of Diploma in Industrial Design in one of the universities in Johor Bahru. The targeted samples are Year Two students who currently taking Industrial Design Studio Project III where they required to design a product based on the given assignment brief. According to the given brief, students undergone the Industrial design process through problem identification and idea exploration, followed by design finalization. The experimental group received the teaching of Synectics model in the initial stage of the process while the control group received the conventional teaching method throughout the process of teaching and learning.

This study is particularly relevant for design educators, curriculum developers, and students in industrial design programs. Educators can adopt structured creativity-enhancing techniques to improve their teaching methodologies. In the other hand, students can benefit a more systematic approach to creative problem-solving particularly in Industrial Design process. Furthermore, industries seeking highly creative and problem-solving-oriented graduates will also gain from the development of a workforce capable of innovative thinking.

This research investigating the effectiveness of the ID-Sync model, which integrates the Synectics model into the Industrial Design process. The study provides valuable insights into the role of structured creativity in enhancing students' ability to conceptualize, experiment, and refine ideas in the design process. The findings of this study contribute to the broader discourse in design education by demonstrating creativity-focused teaching strategies that enhance student learning outcomes, improve design innovation, and better prepare graduates for industry demands.

Synectics Model

Synectics developed by William J. Gordon to increase problem-solving capacity, creative expression, empathy and insight to social relation (Joyce, et al., 2008). The main element of the procedure is the used of analogies where it led us into an illogical way of thinking (Joyce, et al., 2008). It creates an opportunity to see thing in different views and aspects, approaching problems, develop fresh way of thinking as well as in-depth understanding on an issue or object (Joyce, et al., 2008). The model is possible to train a person creativity by understanding the basis of creative process. With an appropriate lead and analogies applied, creativity could be enhanced by conscious analysis and procedures.

Synectics using metaphoric activities to help ideas connected from unfamiliar to familiar or view familiar content with new perspective. Three types of analogies are employed in the Synectics procedure (Joyce, et al., 2008):

1. *Personal analogy* - requires students to empathize with ideas or object where they become part of the physical element of the problem.
2. *Direct analogy* - the comparison of two objects or ideas where the real topic or problem situation transpose to another situation.
3. *Compressed conflict* - provide broadest insight into new subject where two frames of reference incorporated into single item.

There are two strategies of teaching models in Synectics procedures. Although both strategies employed the same analogies, but their sequences, syntax, objectives, and reactions are different (Joyce, et al., 2008).

Strategy One - Creating Something New

Strategy One (Creating Something New) is designed to help students seeing existing or old products, ideas, and problem in new perspective way of creative thinking. The objective of the strategy is to develop a new understanding to solve problem, improve existing ideas or products, and think of out the box (Joyce, et al., 2008). It stimulates students to see and feel the original ideas in variety of fresh new way of perceptions. By using this strategy, it helps to enhance students' creativity by applying different ideas in the development of design process.

Strategy Two - Making the Strange Familiar

In the other way, Strategy Two (Making the Strange Familiar) allowed students to explore deeply into things or problems that are not familiar or strange to them. Students able to understand and internalize difficult concepts or problems by this strategy for both analytic and convergent (Joyce, Weil, & Calhoun, 2008). By then, students able to make analysis and increase their understanding on the characteristics towards the subject matter as well as comparing and contrasting unfamiliar subjects by finding their gaps.

Research Methodology

The study employed the mixed method research design, where sequential explanatory design was applied in the research. In this study, two-group posttest on design was implemented to collect statistical data. Data were collected from students' performance in creative problem solving (CPS) skills and overall performance in a design project. Then, followed up by semi-structure interview to collect qualitative data (Creswell, 2021).

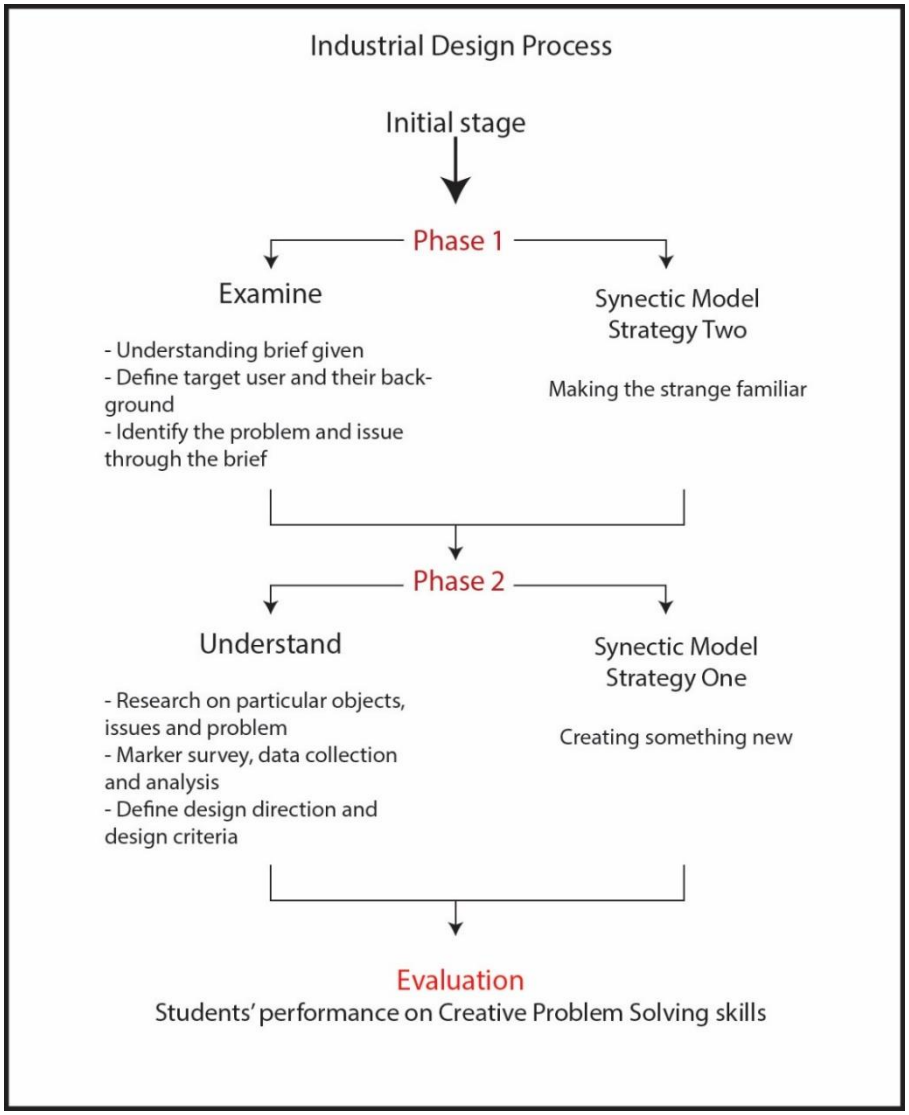

Figure 1: Conceptual framework of the study – ID-Sync Model.

Figure 1 shows the the conceptual framework for the study to examine the effectiveness of CPS model in the initial stage of Industrial design process. The model used in developing ID-Sync is adapted from Synectics models, which includes: (1) Strategy One – creating something new, and (2) Strategy Two – making the strange familiar (Joyce, et al., 2008). Both strategies are applied in Phase One and Phase Two of Industrial design process, which consists of: (1) Examine phase, and (2) Understand phase.

For the quantitative research, the two-group posttest-only design was implemented to determine the effectiveness of Synectics model on students' CPS skills in identifying problems on user needs. In this study, ID-Sync model, where Synectics model integrated into Industrial design process was applied in the experiment. Two groups consist of both experimental and control groups who were students from Year 2 in Diploma in Industrial Design. The experiment was conducted during the Industrial Design (ID) Studio Project III module.

In the following phase of research, qualitative research consists of open-ended information was collected using interview. The purpose of conducting interviews was to collect an insight data that support the quantitative data in the study. Semi-structured interview was employed

in this study to gather the open-ended information. Results from interview provided meaning, experiences and views towards the study after the evaluation session in quantitative phase.

Data collection was divided into two phases. First phase was quantitative data collected in post-test on both control and experimental groups. All participants were given an assignment to design an eco-product according to their findings in the initial stage of design process where the product shall solve users' problem. At the end of the project, students' work were assessed using Sync-CPS scoring rubrics by three assessors.

The second phase was qualitative data collection. Based on the data collected in quantitative phase, students from experimental and control groups were selected for interview in second phase. Semi-structured interview was used to select respondents based on the quantitative results as qualitative samples (Creswell, 2021). A semi-structure interview does not limit respondents to a set of pre-determined answers.

Findings

Quantitative Analysis

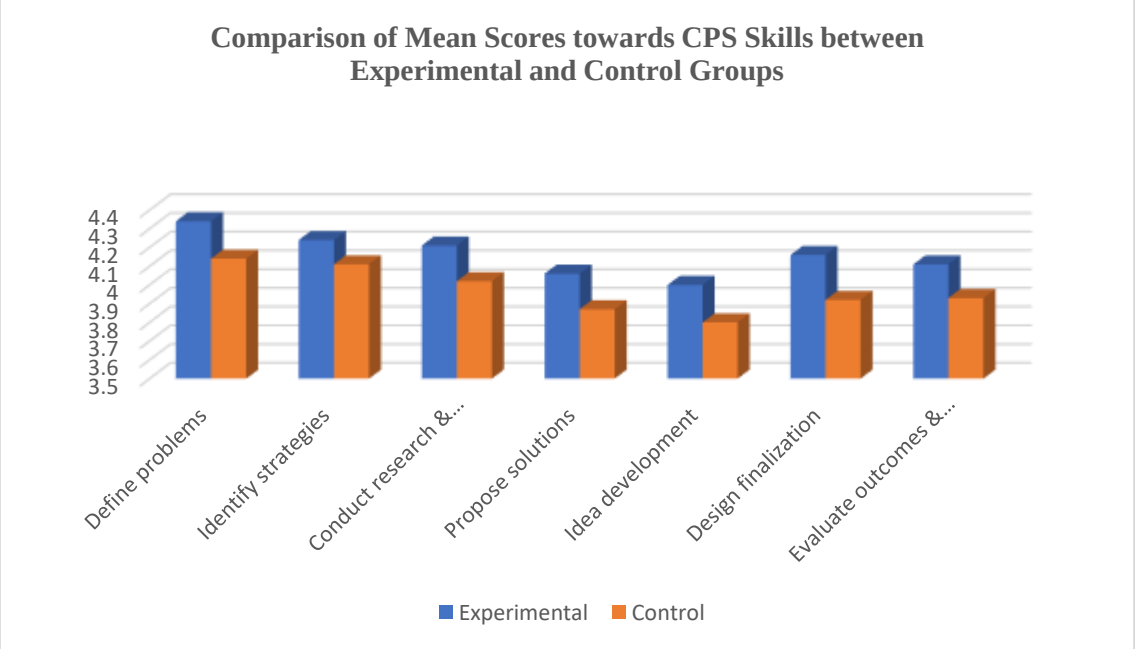

Figure 2: Comparison of Mean Scores towards CPS Skills between Experimental and Control Groups.

Looking at the above graph in Figure 2, experimental groups obtained higher mean scores on CPS skills than control group. Experimental group demonstrated highest scores in define problems, followed by identify strategies, conduct research & analyse information, and propose solutions. These are the CPS skills applied in the initial stage of design process in Examine and Understand phase of Industrial design process.

This study apposed the finding from Joyce, Weil, & Calhoun (2008) whereby perceived value shows the effectiveness of Synectics teaching model applied in the initial stage of Industrial design process. Although the statistical data result of this study in unconvincingly to conclude

that perceived value is significance differences between experimental and control group. However, mean scores in the graph had projected experimental group obtained higher scores in CPS skills compare to control group.

Qualitative Analysis

Qualitative data was collected and then interpret through thematic data analysis method. The purpose of conducting interviews was to support the insignificant results perceived in the quantitative phase. The analysis was categorized into four (4) themes consists of (1) Engagement of students in Industrial design process, (2) Problem identification in Industrial design process, (3) Problem solving in concept development, and (4) Reflection on perceived teaching methods. These interpretations perceived to support the quantitative result in the first phase of the study.

Results from qualitative data collected in the semi-structured interview shows that students claimed to have agreement towards the effectiveness of ID-Sync model in the teaching and learning in Industrial design process. They reflected that they have improved on problems identification, followed by the execution of the assignments in every Industrial design process.

Conclusion

Arising the findings of this study, this research contributed a useful educational implication on developing creative thinking tools in the education system. This study helps to develop strategies that able to foster creative individual that has the ability to solve problems. The implication mainly focused on design programs, as well as other educational program which required CPS tools. Furthermore, the application of Synectics model encourages students to think divergently as well as created interest and challenge on the subject matter.

Results shows the Synectics model effectively applied in the earlier stage of design process in identifying problems and proposing solutions. When these methodologies applied in school teaching and learning, it fulfils the high order thinking level where students able to identify problems through the knowledge they learned in the class. Then followed by proposing ideas or reflecting their thoughts.

The implication of Synectics model in Industrial design programs suggested starting in the early phase of the program were dedicated to studio project module. This study demonstrates students who received ID-Sync model teaching and learning have a better understanding in identifying problems in the initial stage of Industrial design process. Appropriate tools applied in the earlier stage of Industrial design process is crucial to enable student to “think out of the box” (Treffinger & Isaksen, 2023).

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