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Exploring the Potential of Model Making in Developing Students Understanding and Creativity in Structural Studies

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ABSTRACT

Nowadays, developing students understanding and creativity through traditional instruction may need an extensive consideration. In recent years, expeditiously increasing needs in flexibility of learning which involved interaction in between convergent and divergent thinking. In order to encourage students' attentiveness and understanding on building structural studies, a prototype model so called Doll House Project has been introduced. The student needs to build the doll house by integrating mathematical formulae and building construction syllabus. This research intends to study on the potential of model making in developing students understanding and creativity in structural studies. Therefore, an experimental study has been conducted for 30 numbers of architecture students and divided into six (6) groups. Thus, the impacts of this prototype on the achievement will be measured and identify how well the students truly understand the course material. The method to develop a structural design understanding is by constructing a model of a dollhouse by each group and prepares reports individually on preparation and calculation of the dollhouse. The outcome from this exercise is that the students understand mathematics theory and application through scaled model. Hence, the students' performance in understanding reinforced concrete structural design is improved with the experimental learning the mathematics and injection of creativity.

Key Words: *Model Making, Dollhouse, Building Structural Studies, Creativity.*

1. INTRODUCTION

Today, educators are facing the challenge in developing students understanding in structural design and the application in practicality especially for architecture students. Students are having difficulties in understanding on the principle-structure and tend to memorize the principle-formula and restrict their cognitive skills, process of problem solving and expressing ideas in creative ways. This statement has been supported by Inan (2013), came out with the experimental result of students with considered having difficulties in understanding on the application of calculation formulae for the struggle are firstly lack of motivation and secondly, lack of conceptual abstractness (as cited in Durmus, 2004). Therefore, it was suggested by Nayak,D.K (2007), the most significance alternative in improving students' performance in calculation are by changing the focus of classroom from teacher centered-learning into student-centered using a constructive approach.

Introducing model making approach in order to understand the application of structural theories will encourage students cognitive and improved on problem solving performance. As mentioned by Crengu,(2014) interactive-creative learning can be achieved by generates multiple information through

a process of creating meaning of new and prior knowledge, student's involvement in cognitive structure and the significance of student engagement in knowledge development. Therefore, in order to develop creativity, is related to the fine-drawn of research idea in the mind of an individual. Teaching practices will be more successful by giving students opportunity to explore and emphasize on their understanding into practicality (Nayak,2007). As an educator, limitation existed over the nature but much can practice in the point of nurturing the creative potential of the students. Therefore, to increase creativity Jarmon, Traphagan, and Mayrath (2008) reviewed the literature on the use of 3D virtual worlds for teaching and learning and supporting this statement, citing a great deal of research (e.g., Craig, 2007; Dede, Clarke, Ketelut, Nelson, & Bowman, 2005), mentioned in studied of project- based learning will increase student motivation, explorative study, social interaction, teamwork, creativity and generates explorative learning style.

1.1. Problem Statement

Thinking creatively is not simply about evaluating the correct answer but somehow creative potential that stimulate contribution of both nature and nurture (Simonton, 2000). Most of Malaysia educational practices applied structured learning which requires student to memorized instead of given opportunity of exploration and accentuate their understanding into applications (Zanzali, N. A. A, 2000). In order to expand student's potential towards creativity, the significance approach to improved students' performance and understanding need to be improved.

1.2. Novelty

This research has been proof read for the originality and partially supported by Research Management Institute (RMI) of University of Technology MARA.

1.3. Purpose of Study

The purpose of study is to explore the potential of model making in developing students understanding and creativity in structural studies which involved mathematical based formulae among architecture students.

1.4. Objective of Study

The objective of this research is using a dollhouse prototype which develops by students as a medium for learning building structural studies.

2. LITERATURE REVIEW

Inan (2013) claims that visual materials play a role in expanding exploration and storing organizing in the long-term memories (as cited in Erkan, 2006).In order to make it work, the physical scale model involved authentic learning that is take closely replicate the real activity (Wilson,1995).The dollhouse prototype is a fusion in between art and replicating model. Whenever architectural simulation is making communication to make public to understand the blueprints of the physical design, a scale model will be the centerpiece of design education and tools to make it works in small-scale (Morris.2006). As an educator, limitation existed over to ensure as much as can practice in the point of nurturing the creative potential of the students. Improving students' interest and performance through the art of replicate the dollhouse has the ability to generates explorative study, social interaction, teamwork, creativity and generates explorative style (Jarmon, Traphagan, and Mayrath, 2008). Therefore, both connections in between motivating conditions and creative learners can be injected through model making application of learning approach.

In developing students' creativity, they need to see how the structural principle was develop and

perceived that creative thought will be generates through the shapes of mathematical knowledge. According to Idris and Nor (2010), the mathematical knowledge lies in its beauty and it's intellectual Exploring the Potential of Model Making in Developing Students Understanding and challenge. Therefore, in order to develop creativity, is related to the fine-drawn of research idea in the mind of an individual. Teaching practices will be more successful by giving students opportunity to explore and emphasize on their understanding into practicality (Nayak,2007). Learning approach not only stop at certain stages, but being develop through problem-based learning process and the experience gained from the activities.

The syllabus had stated the outcome for building structure studies is to ensure students to understand the applications and to signify the capability of the subject learn to be applied when the going out for industrial training next semester. Therefore, the application of prototype is actually giving and imaginary on the real site application rather than purpose of the sitting for examination. Therefore, students will be able to build their understanding and creativity through critical thinking and problem-solving process by injecting ideas and engaging themselves with their peers. This will construct knowledge from experience, mental structures and beliefs that are used to interpret object and event (Jonassen,1992).

3. TOOLS AND METHOD

This research was prepared for second semester, third year architecture students of Universiti Teknologi MARA (Perak). The experimental study has been conducted to 30 respondents which later been divided into six (6) groups. The respondents were instructed to build varies physical model scaling from 1:10 to 1:25 based on their understanding of the building structure syllabus on that particular semester. At the early stage, respondents were furnished with the mathematics theoretically knowledge regarding building structure and components. In this case, the physical model will be evaluated based on the respondent understanding on the principles and rules structure of building in developing a structural design. The theory and calculation from the semester syllabus will be measured in translating and applying the information to the model that will be constructed.

The semester schedule of fourteen weeks has been organized into two stages. The first stage was a series of lecture in delivering the information, knowledge and fundamental in building structure to the respondents. On the second stage, respondents were required to apply the information into their project. Four weeks were allocated for the respondents to propose and designing their building that later will be constructed. The building proposed should not exceed 9meter in height and the building area shall be less than 2500 sqm. During these four weeks of the second stage, respondents were required to specify and calculate the building liveloads and deadloads. Educators were responsible to assist and guide the respondents in developing their structural design of the building. The respondents were expected to construct and complete the model according to the calculated structural design in two weeks' time and the final week will be the presentation seminars of all groups and every group must document the process into a report. At the end of the experiment, a Torrance Creativity Test are measured to ensure the successful of the experimental studies.

4. RESULT

In developing and construct the dollhouse, 87% is achieved for respondents' dollhouse making and 86% is achieved for respondents' presentation and report writing.

Table 1: Achievement on dollhouse making

Criterion	Achivement scale					Points possible	Score
	1	2	3	4	5		
Design -Develop structural design						30	24
Appropriate design used in model -Provide implementation of structural design in model						35	28
Creativity -Provide suitable miniature for the designed building						25	25
Workmanship - Deliver quality of construction						10	10
Total Score						100	87
Total Score coursework (group)						20	17.4

Table 2: Achievement in presentation and report writing

Criterion	Achivement scale					Points possible	Score
	1	2	3	4	5		
Presentation - Verbal presentation about the model						20	20
Knowledge / Understanding -Demonstrate and understanding of the task given						25	20
Mathematical Work -Solutions and terminology						45	36
Neatness and Organisation -deliver quality report						10	10
Total Score						100	86
Total Score coursework (individual)						20	17.2

Dollhouse prototype project helps students to improved collaborative skill, working among colleague and encourages to develop their communication skill during transferring knowledge among themselves. The structural members have been identified at the early stages of project by dividing work load among peers. Thus, the time consuming can be reduce and build the doll house within the time given. Based on the feedback from students, they manage to demonstrate the understanding by using the right scale, proportion and applied the structured based on the solution found during the model making process. In future, the students request to have the packaging will be included for storage and most of them feel this process making were fun and remind them of childhood memory. The students agreed this project give advantageous for their examination.

5. CONCLUSION

The potential of model making in developing students understanding integrating mathematics solution with creativity, has made the students developed knowledge rather than exam-oriented paper. The outcome from this exercise is that the students understand mathematics theory and application through scaled model. The coursework achieved more than 85% from the overall score. From this result, it shows that students develop understanding with fun learning. Hence, the students' performance in understanding reinforced concrete structural design is improved with the experimental learning the mathematics and injection of creativity. Due to rigorous development of the dollhouse, the awareness created by knowing the importance in learning reinforced concrete structural subject. Teaching the students with fun environment, develop grit for them to finish up their project. Furthermore, with

thorough understanding will help students in designing better for the future. It also develops quality technical knowledge of reinforced concrete structures. Besides that, Doll House Prototype highly recommended as tools of learning and has a high potential commercialization. This dollhouse is also recommended to be integrated with other subject for second semester, third year architecture students. Thus, the better understanding will be portrayed during their upper year design projects. We hope, this prototype might help others learner to develops their skill in understanding the structural principle and lead to a better design in future.

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