Students' Perception on 3D Mock-Up Model Approached in Teaching and Learning of Construction Technology Course

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Abstract: This paper aims to propose 3D Mock-up Model approach in teaching and learning construction technology course for quantity surveying students. Objectives of the study are to focus on perception of the students in terms of improving their visualisation, identifying construction components, improving students understanding, attention, and interest towards the implementation of 3D Mock-up Model in teaching and learning. Methods adopted in this study are distribution of questionnaire survey and observation of 64 numbers of diploma students in quantity surveying programme. Based on the findings, 3D Mock-up Model approached improves understanding of the students, make easier for students to identify construction components, improves the visualisation of students, grabs attention of the students and sparks the students' interests. One of added advantages of the 3D Mock-up Model approach is to make easier for the students to do sketches. Thus, 3D Mock-up Model can be proposed as one of the alternatives in teaching and learning construction technology course.

Keywords: 3D Model, teaching, learning, construction technology, Mock-up Model

1. INTRODUCTION

Education is the platform to produce knowledgeable and skilful graduates that should meet the needs of employers and industries. Employers and industries always target for graduates that have both great intellectual performance and skills. However, according to Yusop, Derus, Saberi and Abdullah, (2018) current skills of graduates in quantity surveying is lack of ability to draw 2D and 3D sketches, and unable to understand construction components which reflect to the performance of quantity surveyors during quantification of work. As a quantity surveyor, technical skills are very important to determine the quality of work particularly quantification works (Yusop et. al., 2018). Based on research done by Yusop et. al., (2018), 3D Mock-up Model get the highest suggested by the practitioner and education as an alternative to overcome the lack of skills and knowledge of current graduates' quantity surveyor, teaching and learning by using team. As recommended by previous researcher on 3D Mock-up Model in teaching and

learning, this paper is to get perception of quantity surveying students on the implementation of 3D Mock-up Model in teaching and learning for Construction Technology course. The perception on the students to be focused are on understanding and knowledge gain, visualisation (Yusop et. al., (2018), attention and interest (Duncan, 2009; Ishkov and Leontiev, 2015).

Construction Technology course selected becauseit is an introduction course to the knowledge of construction methods of buildings and infrastructures, building elements and components, construction processes, technologies, and activities in construction industry. The knowledge supplied in construction technology course is very essential for the students to learn construction measurement and estimating course, particularly during quantification works and estimation of construction projects. However, it has been discovered by Yusop et. al., (2018) that, the graduates are poor in quantification works due to unable to understand construction components due lack of ability to visualize 2D to 3D. Lee (2009), also mentioned that, teaching to make students understand from 2D and 3D is very difficult. Even though, current education programme has structured the program through course learning outcome which to develop skills in sketching of components and buildings elements but due to the comments from the industry, some new approach need to be used to improve the learning and teaching methods. Poor image visual or visualization is one of the factors that affect the performance of students in understanding construction methods and components as well as affect the sketching skills of the students. 3D Mock-up model is one of the teaching and learning methods proposed by the agreement of practitioner and education people. However, there is lack of study on assessing how far perception of the approach among the students.

Since there is commented and recommendation on the quality of current graduates, it shows some improvement need to be done at the education level. The comments should be addressed for a betterment of the education field. In order to provide potential graduates with better knowledge and skills that meet the industry and the employer's needs, current teaching and learning methods should be focused to improve and overcome the lacking of current graduates quantity surveyors. The methods of teaching and learning should be evolved parallel with the generation. Current teaching and learning should be improved for millennial students in the twenty first century particularly on the communication, collaboration, expertise in technology, innovative thinking and problem solving (Larson and Miller, 2011). According to them, lecturers need to get familiar with the 21st century skills and should have adequate skills to integrate the skills of the students throughout the curriculum. Instead of academic learning such as reading, writing which associated with passive learning, Duncan (2009) mentioned that, the skills that the demand is increasingly are creativity, perseverance, and problem solving should be blended and integrated in the teaching programme.

The 21st century teaching and learning is differently with the traditional techniques that more focused on the transmission of information from the lecturers to the students (Ishkov and Leontiev, 2015). Thus, it is a challenge for the education team to think of the techniques of teaching and learning method not only to easily deliver the knowledge that the students should gain, but to think of the way that can attract the attention of the students to learn. Thus, it is where 3D Mock-up Model approached can be implemented since it is an active learning as a method that require learners to any creative search efforts rather than just listen to a lecture. Active learning is learning that allows the students to learn from joint activities, the learning will be influenced by the learning environment and the techniques of learning focused on discussions, small group work, case studies or games (Ishkov and Leontiev, 2015).

According to Prashant et al., (2018), new effective learning should have the element of create, engage, learn, improve and share as it helps to improve the learning environment as well as the

students' motivation. Peacock (1997), defined motivation as interest in, enthusiasm for materials used in class, persistence with the learning task, as indicated by levels of attention or action for an extended duration, and levels of concentration and enjoyment. Thus this paper intent to get the perception of the students on teaching and learning 3D Mock-up Model whether it can improve their learning environment so do their motivation. 3D Mock-up Model approach has been applied by Chen (2019), and Gregory (2011). Both of the studies are for architecture students. It has been discovered that very limited research studying this method in teaching and learning construction technology for quantity surveying students. Thus, this paper will get the perception of the students in terms the knowledge gain and to observe the class environment and students' interest and attention.

2. METHODOLOGY

2.1 Study Design

The method of the study adapted and modified based on the study approached by Gregory (2011), Peacock (1997), Odu (2011) and Tian Lee (2013). Their methods combined together but some of the elements modified to suit the syllabus of construction technology course for quantity surveying diploma first and second year students. Few factors such as budget allocation, safety, facilities and time allocation are also need to take into consideration while conducting the research. The research was conducted within 6 months, from August 2019 until February 2020. The subjects covered were Construction Technology 2 and 3. The data collection was conducted in Semester 1, Session 2019/2020 and Semester 2, Session 2019/2020. The targeted respondents were diplomas quantity surveying students in first year and second year. Total numbers of respondents were 64.

The 3D Mock-up Models were created by the students. Students were given groups works to produce mock-up models and presented in the class. Once teaching and learning finished, sets of questionnaire survey were distributed to the students to get their perception on this type of method in learning.

2.2 Mock-up Model

Several topics selected for the groups works to create mock-up models for both first year and second year students. The criteria of the topics selected due to more than one components or elements, complexity of joints of the elements and difficulty imagined by poor imagination ability. Table 1 shows the selected topic appropriates for the development of 3D Mock-Up models. Six topics and six groups formed for first year students and five topics and 5 groups formed for second year students to produce 3D Mock-up Models. Materials for 3D Mock-up models for second year students supplied by the lecturer but for first year were subjected to claim.

Table 1 : Topics for 3D Mock-up Model

Bil	Course	Year of Program	Total students	Total groups	Topics
1	Construction Technology 2	Year One	37	6	1. Putlog scaffolding 2. Circular cofferdam 3. Formwork for footing and column stump 4. Beam and base underpinning 5. Raking shore 6. Single wall cofferdam
2	Construction Technology 3	Year Two	27	5	1. Precast cantilever wall 2. Counterfort Retaining wall 3. Mass Concrete Retaining wall 4. Gabion Wall 5. Rubble Wall

The group works of 3D Mock-up Model assessed as Tutorial 1 which carried 5% marks. The elements to be assessed were labelling of the components, the neatness of the 3D Mock-up models and report. Table 2 shows 3D Mock-up Models produced by the students as teaching and learning construction technology course.

Table 2 : 3D Mock-up Model produced for Teaching and Learning Construction Technology Course

Model 1 : Scaffolding	Model 2: Circular cofferdam
Model 3: Single Wall Cofferdam	Model 4: Formwork for Pad footing and column stump

Model 5: Raking Shore	Model 6: Beam and Base Underpinning
Model 7: Counterfort Retaining Wall	Model 8: Gabion Wall
Model 9: Precast Cantilever Wall	Model 10: Mass Concrete Retaining Wall
Model 11: Rubble Wall	

2.3 Questionnaire Survey

The method used to collect data was questionnaire survey. Stratified sampling method was used to distribute 64 sets of questionnaire survey for both first year and second year students. Table 3 shows the detail of respondents which 37 numbers were first year students and 27 numbers were second year students. Overall respondent rate was 97% with 62 sets of questionnaire survey were returned.

Table 3: Detail of respondents

Bil	Course	Level of program	Total student	Response rate (%)
1	Construction Technology 2	Students Year One	37	100%
2	Construction Technology 3	Students Year Two	27	93%

The questionnaire survey was divided into three sections: Section A, B and C. Section A asked about the demographics and backgrounds of the respondents, Section B about their level of perception towards the teaching and learning by using 3D Mock-up Model, and Section C to ask their opinions and recommendations on teaching and learning by using 3D Mock-up Model. The questionnaire used a Likert 5-point scale in Section B, as shown in Table 4.

Table 4: Likert- five point scale indicator

Scale	Section B – level of perception
1	Strongly Disagree (SDA)
2	Disagree (DA)
3	Fair (F)
4	Agree (A)
5	Strongly Agree (SA)

3. RESULTS AND DISCUSSION

3.1 Demographic

Table 5 shows the demographic of the respondents. 60% of the respondents were female and 40% were female. Majority of the respondents were from first year students with 60% and only 40% were from second year students. Most of the respondents were students taking Construction Technology 2 with 60% and the remaining 40% were students taking Construction Technology 3.

Table 5: Demographic

	Item	Percentage (%)
Gender	Male	40%
	Female	60%
	Total	100%
Level of Study	Year One	60%
	Year Two	40%
	Total	100%
Level of Course	Construction Technology 2	60%
	Construction Technology 3	40%
	Total	100%

3.2 Observation of Classroom Environment during Teaching and Learning Session by using 3D Mock-up Model

From the observation, Table 6 shows that the students enjoying the group works and improving the learning environment and motivations.

Table 6: Photos gallery of students during teaching and learning by using 3D Mock-up Model

Bil	Course	Year of Program	Photos
1	Construction Technology 2	Year One	

3.3 Respondents Perceptions in Teaching and Learning by using 3D Mock-up Model

Table 7 shows the perception of students in learning by using 3D Mock-up Model. Based on Table 7 it was proven that students agree with the six perceptions of the implementation of 3D Mock-up Model in teaching and learning construction technology course because all of the mean value were more than 3.00. Based on the mean value with 4.6129, sparks interest is the highest elements teaching and learning by using 3D Mock-up Model. This means that teaching and learning construction technology course by using 3D Mock-up Model enable to sparks the students' interest in the class.

Table 7: Students Perception in Teaching and Learning by using 3D Mock-up Model

No.	Students' perception	Mean	Ranking
1	To improve understanding	4.5323	4
2	Easier to identify construction components	4.5968	3
3	To improve visualization	4.5968	2
4	To make easier to do sketch	4.3548	5
5	Grab attention	4.3065	6
6	Sparks interest	4.6129	1

The second higher mean values, sharing two perceptions, which are the students' perception on improving their visualisation and makes them easier to identify construction components with mean value 4.5948. This means that teaching and learning construction technology course by using 3D Mock-up Model enable to improve the visualization of the students in which it helps in facing the difficulties teaching of 2D and leads the students imagine in the 3D form. As visualization improved, it helps the student to easily identify the components of the construction elements. The fourth mean value is to improve understanding of students followed by the fifth, to make students easier to do sketch works and the sixth is to sparks students interest in teaching and learning of Construction Technology Course by using 3D Mock-up Model.

3.4 Respondents Recommendations in Teaching and Learning Construction Technology Course

Table 8 shows the results of open-ended questionnaire survey. This part was to get opinion of the students on teaching and learning Construction Technology Course. The students response positively and twelve themes formulated based on the content analysis. It can be summarized that, from the students perceptions, the teaching and learning of Construction Technology Course should have more activities in the class, outdoor activities, and innovation of teaching tools which provide the element of audio, visual and activities. The activities in the class are such as questions and answers, quizzes, games, group works (tutorials). However, the outdoor activities are such as site visits, and case studies.

Table 8: Students Opinion in Teaching and Learning of Construction Technology Course

No.	Students' opinion
1	To have more questions and answers
2	To have more group works
3	To have more quiz
4	To have more games such as online games (kahoot), crossword puzzles
5	To have more activities instead of seating and learning
6	To have more 3D Mock-up Model
7	To have site visit
8	To do case studies
9	To provide real constructions components/material such as cement, sand, bricks etc
10	To provide more videos
11	To use audio, visual and other forms of teaching tools
12	To provide students with critical solving problems and let the students think

4. CONCLUSIONS

As a conclusion, 3D Mock-up Model approach in teaching and learning of Construction Technology Course improved students' understanding, make them easier to identify construction components, improve their visualization, make them easier to do sketch, grab their attentions and sparks their interests. Thus, 3D Mock-up Model can be proposed as one of the alternatives in teaching and learning of Construction Technology Course. However, some elements should be taken into consideration for the implementation of 3D Mock-up Model in teaching and learning such as the readiness of the lecturers, the budget and time allocations for the preparations in the class, and the assessment criteria should be tally with program learning outcome. The beneficial of this study is for knowledge dissemination in education feel to enhance the method of teaching and learning particularly to subject as commented by the industry people and to practical field is to improve quality of next QS graduates.

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