Feasibility Study on Engineering Drawing Computer Animated Module (CAM)

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Abstract:- The aim of the paper is to discuss the analysis done on the developed Engineering Drawing module using animation for student's learning. The feasibility study was conducted to 110 high school students. The samples were asked to evaluate the module on its content, its ability to enhance their understanding, motivation, self-confident and interest in Engineering Drawing using questionnaire. The module was developed using *Microsoft Office PowerPoint*. The teachers and students rated the module very positively and believed that the module is one kind of innovation in teaching and learning that suitable and able to promote interest and hence increase student's understanding and competence in Engineering Drawing.

Key-Words: Computer Animation, Engineering Drawing, Computer Aided Instruction, Educational Technology.

1 Introduction

Engineering Drawing (ED) is one of the elective subjects in the Secondary School Integrated Curriculum (KBSM) for form four in Malaysian high school. ED is a communication media with graphic based which widely used in engineering. Its communicate using simple and exact symbols, conventions with its own procedures and standards.

Most Literatures on computer animation in teaching and learning shown positive effect on enhancing student's achievement, motivation and understanding of the concepts learned [1-6] especially those of the abstract and difficult concepts. In addition, study by [7-8] confirmed that the application of animation helps the teaching and learning processes.

2 Problem Formulation

Based on the earlier studies done by the researcher and others [9-13] the main problem faced by the students was difficulty in understanding the fundamental concepts in ED. In general ED requires student to have high ability to imagine, think creatively and observe precisely. In the syllabi of ED there are many concepts students need to understand and master in before they are able to understand, define and solve ED problem because by not having these ability will deter them from explaining the phenomena given correctly [12][9]. In the studies done by [13][10] they also shown that students lack of motivation, less interest and self-confident. In the teachers part they found that they were having difficulty in allocating appropriate materials for the teaching and learning of engineering drawing.

Based on the above mentioned problems, it is timely to plan, design and try out the systematic and innovative way of teaching and learning ED to address the problems faced by the students and teachers. Hence the paper is aim to present the analysis of the assessment done by the students and the teachers on the feasibility of the module in the pursuit to obtain its outcomes.

3 Methodology

There were three phases in the study which were need analysis (phase 1), development of computer animated software (phase 2) and the feasibility study (pahse 3).

3.1 Phase 1: Need Analysis

At this stage the researcher employed a questionnaire looking for problem faced by students and teachers in the process of learning engineering

drawing to guide the research in focusing and prioritizing the problem to be solved.

3.2 Phase 2: Development of Computer Animated Engineering Drawing Module.

The development of the software was done on the topics of Tangent, Ellipe and Parabolic (TEP) where most students having difficulty in understanding its concept in ED. A specific animation was used to explain the processes of drawing TEP. The *Microsoft Office PowerPoint* animation application was used in the development. The animation used had the purpose to assist the teacher in explaining better the processes to the students thus enhance students' understanding. Using the animation application, teachers and students were able to replay the steps in the processes of drawing the concepts in TEP topics until they are confident they had had the concept and competency. Teacher can also reduce the time in repeating the drawing manually.

The 2D linear animation was used because it is simple and does not require a high computer capability. Figure 1 shown the development model that employed two types of animation namely cell animation (frame by frame) and path animation (true time animation). To make the program more interesting all drawing equiptments were developed as close as real objects.

3.3 Phase 2: The Feasibility Study.

The quantitative survey and qualitative approach of open ended questionnaire were employed in getting the data from 110 students and 5 teachers that taught six different classes in a technical school. The questionnaires used were teachers' and students' evaluation questionnaire on the animation application and the questionnaires on students' and teachers' perception on the ability of the module to improve students understanding on the concepts, motivation and self- confident. The reliability measure of the questionnaire is considered high of Alpha Cronbach between 0.731 and 0.913. The descriptive statistics of frequency, percentages, means, and standard-deviations were used in the analysis.

4 Findings

The findings are based on teachers' and students' evaluation of the feasibility of the developed module- Computer Animated Module (CAM). The evaluation is based on three criteria: a) the appropriateness of the content of CAM, b) the suitability of CAM in terms of enhancing students' understanding, motivation, interest and self-esteem towards learning Engineering Drawing and c) the overall suitability of CAM. Teachers and students were also asked to respond open ended questions regarding CAM. Table 1 presents teachers' and students' view on the appropriateness of the content of the developed CAM.

	Views on the appropriateness of animation		Teacher			Student			
			SD	Level	Μ	SD	Level		
1.	Object introduced in animation is able to relate to the concept	4.23	0.440	EH	4.24	0.736	EH		
2.	The graphic is appropriate and easy to view	4.23	0.436	EH	4.28	0.688	EH		
3.	'Step by step' method for constructing the diagram is easy to understand	4.23	0.431	EH	4.30	0.658	EH		
4.	Animation related to construction of steps is able to enhance students' interest in learning ED	4.41	0.506	EH	4.29	0.703	EH		
5.	The animation is as in the real situations	4.42	0.534	EH	4.27	0.673	EH		
6.	Animation related to construction of steps is able to enhance students' confidence in learning ED	4.43	0.520	EH	4.20	0.720	EH		
7.	Learning objectives are stated clearly	4.44	0.517	EH	4.15	0.697	Т		
8.	Students' prior knowledge is clearly stated	4.44	0.517	EH	4.20	0.732	EH		
9.	Concept of diagram construction shown through animation is able to explain the method of diagram construction clearly	4.46	0.509	EH	4.24	0.663	EH		
10.	This animation can be used by teachers in teaching and learning sessions	4.47	0.468	EH	4.33	0.665	EH		

Table 1: Teachers and Students views on the appropriateness of the content of CAM

11.	The animation is able to focus students' attention on learning ED	4.49	0.482	EH	4.24	0.767	EH	
12.	Animation related to steps in construction shown can enhance students' motivation in learning LK.	4.61	0.416	EH	4.27	0.697	EH	
13.	Animation related to steps in construction shown is able to achieve the learning objectives	4.63	0.482	EH	4.29	0.705	EH	
14. 15.	Moral values to be achieved were clearly stated Animation related to steps in construction	4.67	0.472	EH	4.17	0.717	Т	
	shown is able to promote students' understanding on the concepts of TEP	4.87	0.253	EH	4.31	0.673	EH	
	Total Mean	4.47	0.470	EH	4.25	0.700	EH	
T / N								

Note * H= High EH= Extremely high.

Based on Table 1, both teachers and students regard the content of CAM is highly appropriate, with mean score between 4.15 to 4.87. This indicates that both the teachers and students consider CAM to be an appropriate and it is seen as an effective learning and teaching aid. Table 2 shows teachers' and students' view on the overall feasibility of CAM.

	Items -		Teacher			Student			
			SD	Level	Μ	SD	level		
1.	This module can increase students' achievement in ED subject	3.80	0.447	High	4.06	0.685	High		
2.	This module can promote students' confidence in learning ED	3.80	0.447	High	4.01	0.732	High		
3.	This module can increase students' motivation in learning ED	4.00	0.707	High	3.94	0.837	High		
4.	This module is able to promote students' interest to learn ED	4.00	0.707	High	4.10	0.679	High		
5.	This module helps students to understand the concepts of TEP	4.00	0.707	High	4.12	0.700	High		
6.	This module is able to enhance students' TEP problem solving skills	4.00	0.707	High	4.08	0.722	High		
7.	The content of the module can be implemented appropriately	4.20	0.447	EH	3.94	0.762	High		
8.	The content of the module is appropriate to the given time	4.20	0.837	EH	3.77	0.859	High		
9.	The content of the module is appropriate to be used during learning and teaching session in	4.20	0.837	EH	4.02	0.737	High		
10.	classroom. This module is able enhance students' understanding of the concepts learned	4.40	0.894	EH	4.10	0.691	High		
11.	The content of this module meets the learning objectives of ED	4.60	0.548	EH	4.10	0.630	High		
	Total mean	4.11	0.660	High	4.02	0.730	High		

Table 2: Teachers' and students' overall view of CAM

Note * H= High EH= Extremely high.

The findings show that both teachers and students felt that CAM is highly suitable as a teaching aid for teaching and learning the subject of Engineering Drawing, with obtained mean value between 3.80 to 4.60. Table 3 displays the findings relating to the feasibility of CAM in enhancing students' understanding, motivation, interest and self-esteem towards learning the subject of Engineering Drawing.

Cada	Items	_	Teacher			Student		
Code		Μ	SD	Level	Μ	SD	Level	
1.	Comprehension	3.95	0.381	High	3.91	0.767	High	
2.	Motivation	4.00	0.342	High	3.91	0.771	High	
3.	Self-confidence	3.95	0.381	High	3.93	0.780	High	
4.	Interest	4.05	0.401	High	3.97	0.796	High	
Total mean		3.99	0.376	High	3.93	0.779	High	

 Table 3: Teachers' and students' views towards the use of CAM in the teaching and learning of Engineering Drawing in enhancing students' understanding, motivation, interest and self esteem.

Note * H= High EH= Extremely high.

As indicated in Table 1.3, the teachers' and students' mean score towards the use of CAM in increasing students' understanding, motivation, interest and self esteem is high (3.91-4.05), indicating that the developed CAM manage to improve the teaching and learning of ED.

Findings based on opened questions regarding the feasibility of the developed CAM also support the quantitative analysis. On the whole, teachers gave positive reaction to the usefulness of CAM it is able to facilitate namely students' understanding each basic concepts in Geometrical Plane Drawing through the effective animation found in CAM. The animation had help the students to learn step by step the techniques of Engineering Drawing, which also facilitated the explanation of the teachers. In addition the animation could be repeated for the students thus allowing the teachers to focus on helping the students to understand the concepts rather than spending time on drawing the diagrams manually.

The students also gave positive reaction to the usefulness of the developed CAM. In particular they found that the developed module was able to develop their skills in engineering drawing and their understanding of the basic concepts. The developed CAM also helped them to better solve problems related to the subject matter. In addition to acquring the related drawing skills (e.g. how to use the drawing instruments properly and ability to sketch), the students also said they found the subject to be more interesting since it is more easy to understand the subject matter through CAM. Eventually, their interest, motivation and self esteem in learning Engineerign Design subject increased.

5 Discussion and Conclusion

Outcome of both the teachers' and students' evaluation of the developed module is very encouraging. Teachers and students perceived that

CAM is highly suitable as a form of aid for teachers to use to teach the subject and for students to use in learning the subject. CAM was also found to increase students' interest and motivation towards learning Engineering Design subject.

The findings of the current study parallels with [14] which shows that effective use of multimedia courseware will lead to effective teaching and learning process. In particular, courseware when used effectively will be able to attract and increase students' interest in learning as well as facilitates learning. [15][16] also argue that effective use of multimedia will affect students' ability to interact socially. In addition according to [17] a learning module that is developed systematically, such as CAM, can acts as a tool that is able to guide and motivate students towards change of behaviour and achievement.

Elements of multimedia such animation [18-19] has shown to be able to improve students' attention towards learning a difficult and abstract subject thus making the subject more interesting. In addition the use of CAM has also increased teachers' confidence in their teaching of Engineering Design which also leads to high confidence of students' towards their teachers' teaching.

The current study also demonstrated that the use of computer animation in teaching and learning has positive impact on the students' motivation, interest and self esteem. Previous studies also showed that the use of animation has improved students' motivation in learning [15], lessen the occurrence of misconceptions which leads to meaningful learning [20], potential to increase students' understanding in various disciplines [4] and has significant effect on students' achievement [21]. It is believed that the usage of visualization object is able to assist students to understand easier of the concepts compare to reading from paper. The researchers further argued that teachers should use visualisation tool in their teaching and learning activities since it can give a positive impact on students' motivation and achievement. In conclusion, the developed CAM could be used as an effective teaching aid in the teaching and learning of Engineering Drawing subject and it is seen as an innovation in teaching and learning in Engineering Drawing at schools.

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