

The Effectiveness of Multimedia Courseware in Learning Data Modelling Concepts

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ABSTRACT

Data modelling is a tough topic for students to learn in database courses or database related courses. The use of multimedia courseware with student-centred learning capability can help to enhance students learning and improve achievement on the subject matter. Accordingly, the objective of this paper is to evaluate the effectiveness of using multimedia courseware as a supplemental tool to enhance students learning in data modelling concepts among Bachelor of Information Technology students at Universiti Teknologi MARA, Perlis Branch. To achieve this objective, multimedia courseware was developed with three main sections: pre-test, tutorial and post-test. The courseware then tested on 20 students that have previously learned about data modelling. From the findings, it is discovered that the students' post-test marks increased after learning using the tutorial courseware when compared with their pre-test marks. The finding results also showed a significant statistical difference between pre-test and post-test marks after using the tutorial. These findings indicate that the students have made significant improvement after learning with the multimedia courseware. As a conclusion, the multimedia courseware indeed can be effective to be used as a supplemental learning tool to enhance students learning and achievement in data modelling concepts thus, overcome the limitations of teacher-centred learning in a classroom environment.

Keywords: data modelling, multimedia courseware, student-centred

INTRODUCTION

Databases study is one of the important pillars in the academic discipline of Information Technology for the undergraduate degree program (ACM, 2008). To be able to design and implement database system using database management languages, it is very imperative for students to first learn and understand about data modelling (Czenky, 2015). Data modelling comprises in database principles main topics consist of data modelling concepts, relational model characteristics, entity relationship diagram (ERD) and normalization of database design (Coronel, Morris & Rob, 2013). Students' thorough grasp of data modelling concepts is an essential first step to enable them to later wholly and correctly visualize real-world relational database design with the use of ERD and further evaluating the design with normalization process before the design could be implemented. Nevertheless, many studies have shown that data modelling topic is complicated and difficult for students (Czensky, 2015; Chilton, McHaney & Chae, 2006; Smith, 2004). It is complicated because many students lack the ability to use abstraction techniques in data modelling (Czensky, 2015; Smith, 2004). Consequently, this weakness leads to the difficulty to apply data modelling concepts for identifying the correct entities, relationships and attributes in solving real-world database problem (Chilton, McHaney & Chae, 2006; Drake 2005).

Despite the importance and limitations of typical teacher-centred learning settings in the classroom, the educators are taking advantage of computer technology to make innovations for students to use outside of the classroom. Computer-based learning is one of the suitable methods for novice modellers like students to learn about data modelling (Smith, 2004). Hence, the challenges in learning data modelling could be resolved with the use of multimedia courseware. Multimedia courseware brings many benefits to students because it can provide student-centred learning, allow active participation and facilitate experiential learning (Wathore, 2012) which cannot be entirely delivered in the classroom. Additionally, courseware with these three mentioned multimedia capabilities not only provide an alternative approach to learning but also are suitable for revising previously learned concepts (Wathore, 2012) from the classroom.

Interestingly, multimedia courseware can be used by students in applying the concepts learned to solve real-world problems (Sankar & Raju, 2014). Many multimedia educational programs have been found to be useful, practical and successful to improve learning in various academic disciplines (Almara'beh, Amer & Sulieman, 2015; Malik & Agarwal, 2012). On the contrary, many studies have shown different results about the effectiveness of using multimedia in improving students' academic achievement when compared with traditional classroom method (Aloraini, 2012). Most importantly, specific studies believe that the current emphasis on multimedia courseware and applications should be viewed as to supplement learning in providing an alternative learning experience, promoting positive learning outcomes and improving student achievement (Babiker, 2015; Thangapragasam & Ramanathan, 2012) rather than as a replacement or enhancement to classroom method.

In light of the above, multimedia courseware was developed in student-centred learning mode to facilitate self-exploration, encourage active learning and learning by doing. This paper aims to evaluate the effectiveness of the developed multimedia courseware as a supplemental learning tool in enhancing students learning of data modelling concepts by examining students' achievement before and after studying the multimedia courseware.

MULTIMEDIA COURSEWARE CONTENTS DESIGN

The developed multimedia courseware follows the content design as illustrated in Figure 1. The courseware is divided into three main sections which are pre-test, tutorial and post-test sections and ended with pre-test and post-test total marks results for comparison.

In this courseware, data modelling concepts topic focuses on the identification of entities, the relationship between entities and attributes (which includes a selection of primary key and foreign key). In the tutorial section, each of the concepts is defined and explained and to further promote active learning and learning by doing, exercises on each topic are given. Pre-test and post-test sections display the same real-world scenario and questions before the total marks for each section is displayed. The difference between the two is that each of post-test questions is given feedback to inform whether the answer is correct or incorrect while not for pre-test questions.

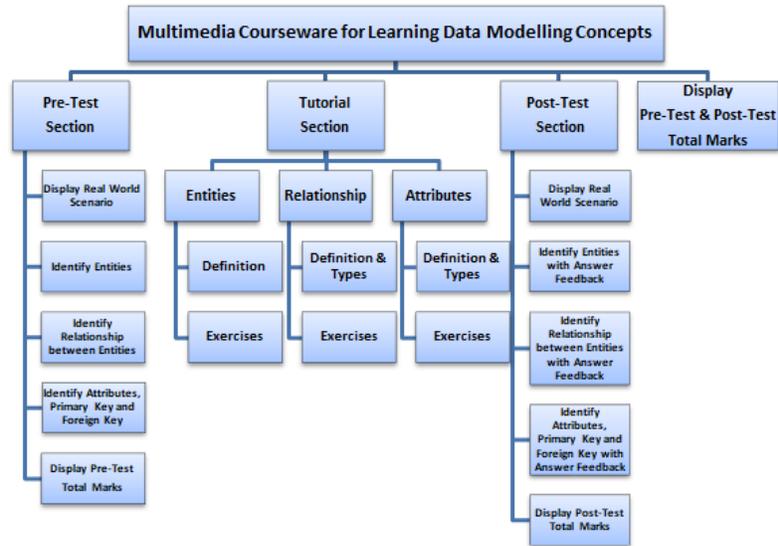


Figure 1: Content Design of Multimedia Courseware for Learning Data Modelling Concepts

METHODOLOGY

At Universiti Teknologi MARA, Perlis Branch, Bachelor of Information Technology students are introduced with data modelling topic in System Analysis and Design course in Semester 1. Subsequently, in Semester 3, the topic is once again highlighted even in more details in Database Management Systems course. In order to evaluate the effectiveness of the multimedia courseware as a supplemental learning tool, students who have previously learned about data modelling concepts need to be selected as participants. Therefore, participants were recruited using convenience sampling involving 20 students from Semester 1, 2 and 3. As a supplement learning tool that is self-explored, this courseware offers flexibility for students to use it during their own time and at any place. Therefore, appointments were made with the participants after class sessions during their free time. Each participant explored the multimedia courseware to answer pre-test questions, go through the tutorial section and answer post-test questions before both pre-test and post-test results were displayed to the participants.

FINDINGS AND DISCUSSION

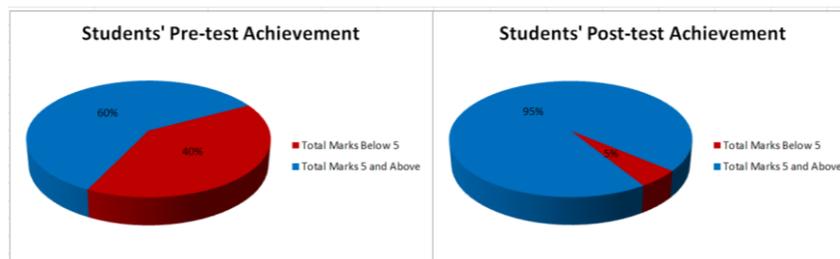


Figure 2: Comparison Analysis of Students' Achievement between Pre-test and Post-test Totals Marks

Figure 2 shows the comparison analysis of students’ achievement between pre-test and post-test total marks. In the pre-test section, students were given 10 questions to examine how far they have remembered the data modelling concepts that they have learned. Out of 20 students, even though 60% of students attained total marks of 5 and above still 40% students only acquired total marks below 5. The tutorial section was developed to enhance the learning experience for learning better about data modelling concepts. The post-test questions that are the same questions as the pre-test were given to evaluate if the tutorial can improve students’ marks. It is found that the students’ post-test totals marks increase with 95% students achieved total marks of 5 and above and only 5% with total marks below 5. The result shows that when comparing both tests, the achievement of students’ total marks increases after using the multimedia courseware.

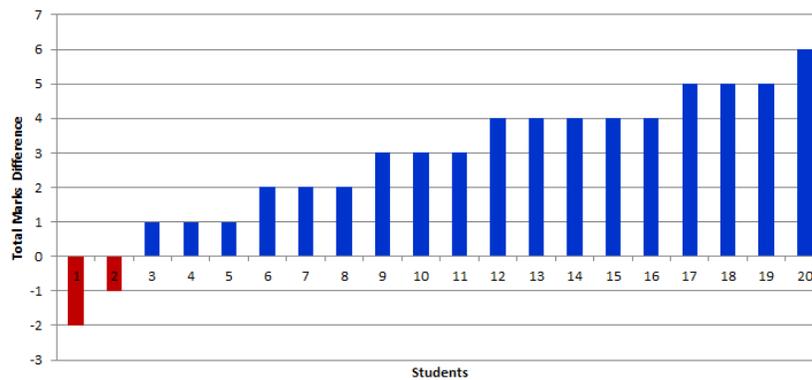


Figure 3: The Difference between Post-test and Pre-test Total Marks Among Students

Figure 3 displays the difference of either increase or decrease in total marks for each of the students when comparing post-test with pre-test total marks. Two students experienced a decrease in total marks with the lowest difference is -2 marks while eighteen students achieved an increase in total marks with the highest difference is 6 marks. Even though two of the students revealed the decremented result, the other eighteen students achieved an increment in total marks comparison. Overall, this indicates a positive outcome between learning progress and students’ achievement with an increase in total marks after using the multimedia courseware.

The findings of this study were also analysed using quantitative data gathered from the pre-test and post-test results using the mean of both tests. In the Paired Samples Statistics, as shown in Table 1, it demonstrates results of Mean and Standard Deviation for all of the students (N). The mean for the pre-test and post-test is 5.05 and 7.85, respectively. This finding shows that post-test has a higher result compared to the pre-test result which further proved that the multimedia courseware is effective in enhancing students’ learning and increasing their achievement of test marks.

Table 1: Paired Samples Statistics

	N	Mean	Std. Deviation
Pre-test	20	5.05	1.43
Post-test	20	7.85	1.46

Table 2: Paired Samples T-Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pretest-Posttest	-2.80000	2.06729	.46226	-3.76752	-1.83248	-6.057	19	.000008

In order to ensure the significance between the difference in means for both tests, further analysis on the pre-test and post-test results were statistically carried out using a paired sample T-test. For the analysis, statistical significance is accepted when the Sig. (2-tailed), that is often referred to as the p value is less than 0.05 ($P < 0.05$). Table 2 tabulates the Paired Samples T-Test that shows statistical significance is 0.000008. Therefore, there is a statistically significant difference between pre-test and post-test results. The finding demonstrated that the students indeed had experienced significant improvement in their learning progress and test results achievement after using the multimedia courseware.

CONCLUSION AND RECOMMENDATION

All the findings have shown that with the use of the developed multimedia courseware, it benefited the students to enrich their learning and improve achievement in attaining higher marks. The results indicate that the multimedia courseware is effective to be used as a supplemental learning tool in enhancing students' learning and achievement in data modelling concepts topic. Furthermore, the multimedia courseware can encourage student-centred learning outside from classroom sessions to improve understanding and doing revision of the topic. For future works, the multimedia courseware could be extended to include other main topics of data modelling such as the relational model, ERD and normalization.

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