THE EFFECT OF USING REAL-OBJECT MEDIA ON THE STUDENTS' INTEREST IN COST ESTIMATION LEARNING

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ABSTRACT

The rapid development of construction industry is fostering the construction service companies to hire sufficient and competent professional cost estimators who are mainly graduated from universities. This study aims to examine the students' interest in contraction cost estimating and the effect of using real-object media and PowerPoints media in learning achievement of cost estimation. The method of this study was quasi-experimental conducted with a 2 x 2 factorial design using 40 samples. The instruments consisted of learning outcomes assesment and students' interest testing with reliability coefficients of 0.92 and 0.81 respectively. The hypothesis was tested through variance analysis and Tukey test techniques. The research findings showed that there are interactions between the implementation of real object media and the students' interests. For the students with high level of interest to learn, the implemetation of real object media did not give significant differences compared to the use of PowerPoints media. In the other hand, for the students with relatively low level of interest to learn, the real-object media is more effective than PowerPoints media. This finding is very useful for lecturers to improve learning achievement in cost estimation learning thus the graduates have the competence and expertise in the construction service industry.

Keywords: cost estimators, interest, learning achievement, real-object media

INTRODUCTION

The rapid development of construction today makes construction service companies need more professional human resources. A contractor is a construction service company that acts as the executor of construction. One of the professionals in charge of the contractor is an estimator. Generally, estimators in a construction service company are assigned to calculate the area of building work; the volume of work; the volume of reinforced concrete iron work; the materials needed in each item of building work; and check the use of material whether it is in accordance with the calculation. The position of the estimator in the contractor is generally filled by Civil Engineering graduates. Therefore, it provides a great opportunity for graduates of Civil Engineering to find a job that is suitable to their expertise.

Cost estimation is one of the compulsory subjects for the Civil Engineering study program at the Faculty of Engineering, Universitas Negeri Medan. The expected competencies is that the students are able to carry out cost estimator tasks. However, based on the last three years data, the students' achievement did not meet the expectation. Based on the formative master data from 2015 to 2017 [1], most of the students did not achieve the desired competence. In 2015, the students who were categorized as competent were only 16% and the rest of

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them (24% and 60%) were solely categorized as quite competent and incompetent respectively. Similarly, in 2016, the percentages of the students who were incompetent, quite competent, competent and very competent were 18%, 52%, 26%, and 4% respectively. Whereas in 2017, the percentages of the students who were incompetent, quite competent, competent and very competent were 20%, 47%, 31%, and 2% respectively. Based on the aforementioned data, it can be concluded that 20.67% of the average student are incompetent and only 24.33% of the average student is competent. Therefore, it is very crucial to increase the students' learning achievement in the cost estimation course. In addition, the researcher observed the classroom activities at Civil Engineering study program, Faculty of Engineering, Universitas Negeri Medan, and find out that most of the students have difficulty to calculate the area and volume of construction work because they cannot imagine the actual shape of the building.

The ability to describe images in cost estimation courses is very important and students must be able to imagine the actual shape of the building. The learning media used currently are PowerPoint Media that display images of building objects on the projectors. Therefore, further efforts are needed to improve the learning process by using more concrete learning media, namely real-object media. Munadi [2] explains that there are three kinds of original objects, namely: (1) unmodified real thing; (2) modified real thing; and (3) samples (specimens). The media used in this study are artificial objects (models). Artificial object media is a simplified modified real thing, which is made only of important parts (not completely) for the purpose of learning.

Additionally, learning can be defined as behavioral changes that can produce an ability from learning experiences and interactions between students and their environment [3]. Capabilities generated from learning estimated costs are: (1) able to apply cost estimates to the value of building work contracts; (2) skilled in calculating non-volume work structures, structures, sub-structures, and upper structures; (3) skilled in calculating the volume of sanitation work and installation; (4) skilled in calculating the volume of finishing work; (5) skilled in analyzing work unit prices and cost recapitulation; and (6) able to compile a computerized budget [4].

Bashir & Thomson [5] explain the project estimation model based on several key questions, namely: How is the project design needed? What is the project cost? How much human resources are needed? How long does the project work? Can the project be done easily? Likewise Ahiaga-Dagbui & Smith [6] explain that each estimate of construction costs must be based on specific parameters, such as type of project, material costs, design changes, soil conditions, duration, project size, and auction method. Therefore, estimation cost course requires the students to be competent in calculating the estimated cost of a construction building. If the estimated cost of a construction project is miscalculated, it will create problems in the implementation of the project. Albogamy et al. [7] explain that inaccurate cost estimation will lead to problems, such as changes in schedules and even delays in construction. It might reduces the profit of the consutruction business service [8].

In addition, Daryanto [9] explains that learning achievement is a learning outcome that is drawn in the form of a score, after students take lectures. Students' learning achievement in cost estimation in terms of cognitive area consists of the ability to calculate the volume of work, the materials, and the budget for covering the roof of the building. Students' learning achievement in this course might be enhanced using real-object media.

According to Djamarah and Zain [10] learning media are learning aids used as a channel for learning information to achieve learning goals. Learning media is something to convey and deliver thus the recipient can understand and carry out efficient and effective learning processes. Learning media are designed and arranged with the aim of: (1) Providing learning media that are in accordance with the demands of the curriculum by considering the needs of students; (2) Helping students to obtain alternative teaching materials in addition to textbooks; (3) Facilitating teachers in carrying out learning. Al Sanaky [11] states that learning media is a tool that functions and can be used as a communication tool between learners, instructors and teaching materials. Aqib [12] suggests that learning media is everything that can be used to deliver messages and stimulate the learning process of the students. In addition, Munadi [2] explaines that learning media are all things that can convey and send messages from planned sources to create a conducive learning environment where the recipient can efficiently and effectively carry out the learning process. The use of learning media should enact the objects being discussed from abstract to more concrete [3]. It is explained in details in Figure 1.

Concrete					Abstract		
Real Condition	Simulation	Demonstration	Presentation	Video	Visual	Audio	Text
(direct participation)		(observation)			(listen and read)		
Active					Passive		

Figure 1. The Continuum of Learning from More Realistic to Abstract

In conclusion, the use of instructional media must be able to clarify students' understanding, shape students' learning experiences from abstract learning towards more real learning, even though the learning process is in the classroom. Learning media that are in accordance with the description above are real-object media. Original objects and real objects are visual based learning media. Arsyad [13] explains visual-based media plays a very important role in the learning process because it facilitates understanding and strengthens memory. In terms of relevance, Munadi [2] explains the characteristics of visual media are visual messages, delivering verbal-nonverbal-graphic visual messages, and original objects and real objects. Munadi [2] explains further that there were three kinds of original objects, namely: (1) unmodified real thing; (2) modified real thing; and (3) samples (specimens). Unmodified real thing is an actual object without change, except it is only moved from its original place; while the modified real thing is a simplified original, which is only an important part (not entirely); and the sample (specimen) is an unmodified

specimen and is usually part of the environment.

The original objects and real objects (models) are one of the most effective visual media used in learning because they can concretize the abstract and attract the attention of students in the learning process. Real-object media is a real object, or a model object that is very similar to an actual object, that will provide a very important stimulus for students. Rivai & Sudjana [14] explain that real objects can play an important role to improve the teaching and learning process. In a related case, Ibrahim [15] explain that real-body media include learning resources specifically developed to facilitate formal and planned learning.

In this study, the real-object media used in the subject of cost estimation was the foundation model, the combined model of columns, beams, and 3-dimensional house walls, iron installation model, and roof truss. The effectiveness of real-object media (real plants) in learning has been investigated by Liu et al. [16] who found that using real-object media can motivate students to learn and verify the knowledge available on mobile devices.

It is clear that the use of real-object media can improve learning achievement in cost estimation learning. However, if it is studied further, the students' interest on cost estimation learning can also affect their learning achievement. Interest is one of the human psychological aspects that drives human to achieve a goal. Individuals who have an interest in an object tend to give greater attention to the object. Interest is the personal will, desire or preference of the individual. Sary [17] explains that interest is a power from within and appears outside as a gesture in carrying out its functions. Interest is closely related to thoughts and feelings. If interest factors are associated with the learning process, the students who are interest to be cost estimators for contractors will have more efforts to study the cost estimation.

Khairani [18] explains the results of psychological research shows that a lack of interest in learning can result in a lack of interest in a particular field, and can even generate attitude of rejection to the lecturer. Furthermore, if interest factors are associated with learning and work, Hidi & Renninger [19] explain the development model of four-phase interests, namely triggered situational interest, maintained situational interest, less developed individual interests, and well-developed individual interests.

Whereas Djaali [20] explains that interest can be divided into six types, namely: (1) realistic, (2) investigative, (3) artistic, (4) social, (5) enterprising, and (6) conventional. Realistic people are generally practical, have good and skilled muscle coordination, and tend to like artisan work. In the other hand, investigative people include people who are scientifically oriented, and tend to like work in chemistry or writers. Whereas, artistic people like things that are not structured, and tend to like work as authors, musicians, or stage organizers. Social people are socially social and work in groups, and tend to be social workers or educators. Enterprising people tend to master or lead, and tend to like work as company leaders or traders. The last are conventional people who like a very orderly environment, and tend to like work as goods inspectors and accountants.

In matters related, Telvisia & Tommi [21] explain that interest is a feeling that states that an activity and work are valuable to individuals. Based on the description above, it can be concluded that individual's

interest appear from likes or dislikes, happy or unhappy about an object. Interest is directly related to work. Students who are interested in becoming cost estimators for contractors will more seriously study the cost estimation course, because this course directly contributes to the estimator work on the contractor they are interested in. Koller et al. [22] and Walkington [23] revealed findings that interest factors directly influence learning achievement. Heince et al. [24] explain their findings that interest in mathematics is the best predictor of mathematical abilities. Likewise, Kpolovie et al. [25] explain their findings that students' interest in learning contributes to encouraging their academic performance. Hong et al. [26] found background information on the struggle of scientists to increase students' interest in learning science. Based on the findings above, it can be concluded that interest factors into estimators in contractors will affect students' learning achievement in cost estimation subjects.

Learning achievement can be defined as learning outcomes that show the extent to which students have been able to achieve specified learning goals [25]. Therefore, it can be concluded that the effect of the use of real-object media and the students' interest towards learning achievement of cost estimation is very important to be studied through this study. Based on the description above, several problems arise, namely: (1) Does the use of real-object media provide higher learning achievement compared to the use of PowerPoints media? (2) Do students who have a high interest get high academic achievement? (3) For students with high interest, does the use of PowerPoints media provide higher learning achievement than the use of real-object media? and (4) For students with low interest, does the use of real-object media provide higher learning achievement than using PowerPoints media?

METHOD

This study used a quasi-experimental method with 2 x 2 factorial design. This method is very suitable to compare the effectiveness between the use of real-object media and PowerPoints media and interest factors on students' achievement in the subject of cost estimation. The sample consists of 40 civil engineering students from Faculty of Engineering, Universitas Negeri Medan which are divided into two groups, namely the experimental group with 20 students treated with real-object media, and the control group that consists of 20 students treated using PowerPoints media. Treatment for the experimental group was carried out 4 times with the same learning material as the control group. The sample is determined by strata technique, namely students' interest to be cost estimators are categorized as high and low. The research design is presented in Table 1.

Table 1. Research Design

Variable	Real Object Media	PowerPoints media
High level of interest	P1	P2
Low level of interest	P3	P4

P1 = the implementation of real-object media for the students with high level of interest
P2 = the implementation of PowerPoints media for the students with high level of interest
P3 = the implementation of real-object media for the students with low level of interest
P4 = the implementation of PowerPoints media for the students with low level of interest

The students interest was measured using interest assessment whose reliability coefficient is 0.92 and the students' learning achievement was measured by the learning achievement test of cost estimation whose reliability coefficient is 0.81. Data were analyzed using Karl Pearson product moment correlation techniques [27], Alpha coefficients [28], Kuder-Richardson (KR20) test, Kolmogorov-Simirnov Test [29], Levene's test [30] and the Tukey Test [31]. Product moment is used to analyze the validity of the instrument. Alpha coefficient calculates the reliability test coefficient of interest. Kuder-Richardson (KR20) is used to assess the reliability coefficient of cost estimation test. Kolmogorof-Smirnov tests the normality. Levene's test is used to test homogeneity and Tukey test is used to test the hypothesis.

RESULTS AND DISCUSSION

Based on the results of the descriptive analysis, it was found that the percentages of the students who have very high level, high level, and low level of interest to be cost estimators are 13.95%, 65.12%, and 20.93% respectively. While the overall learning achievement with the use of real-object media, with a range of scores between 0 and 20, has the lowest score of 10 and the highest score of 19. The average score and the standard deviation are 15.30 and 2.47 respectively. While the overall learning achievement with the use of powerpoint media, with a range of scores between 0 and 20, has the lowest score of 8 and the highest score of 19. The average score and the standard deviation are 13.60 and 3.42. respectively.

Learning achievement with the use of real-object media for students who have high level of interest, with a range of scores between 0 and 20, have the lowest score of 12 and the highest score of 19. The average score and the standard deviation are 16.10 and 2.42 respectively. While the learning achievement of cost estimation with the use of real-object media for students who have low level of interest, with a range of scores between 0 and 20, has the lowest score of 10 and the highest score of 17. The average score and the standard deviation are 14.50 and 2.36 respectively.

Learning achievement with the use of powerpoint media for students who have high level of interest, with a range of scores between 0 and 20, has the lowest score of 15 and the highest score of 19. The average score and standard deviation are 16.50 and 1.43 respectively. While the learning achievement of cost estimation with the use of powerpoint media for students who have low level of interest, with a range of scores between 0 and 20, has the lowest score of 8 and the highest score of 14. The average score and the standard deviation are 10.70 and 2.00 respectively.

The descriptive analysis results show that the average score of learning achievement using real-object media is higher compared to the average score of learning achievement using powerpoint media. In both implementation of real-object media and powerpoint media, the average score of learning achievement of students with high level of interest is greater than the students with low level of interest. Before testing the hypothesis, the analysis requirements test is carried out first, namely the data normality test and homogeneity test. The data normality test and the homogeneity test are shown in Table 2 and Table 3 respectively.

Table 2. Kolmogorov-Simirnov Test Results NPar Tests

One-Sample Kolmogorov-Smirnov Test

		Real object Media	Power point Media	High interest	Low interest	Real object with high interest	Real object with low interest	Power point With high interest	Power point with low interest
N		20	20	20	20	10	10	10	10
Normal Parameters[a,b]	Mean	15.30	13.60	16.30	12.60	16.10	14.50	16.50	10.70
	Std. Deviation	2.473	3.424	1.949	2.891	2.424	2.369	1.434	2.003
Most Extreme Differences	Absolute	.161	.159	.139	.160	.184	.216	.236	.160
	Positive	.096	.126	.111	.160	.116	.146	.236	.140
	Negative	-.161	-.159	-.139	-.136	-.184	-.216	-.152	-.160
Kolmogorov-Smirnov Z		.722	.710	.621	.716	.580	.684	.747	.504
Asymp. Sig. (2-tailed)		.674	.695	.835	.685	.889	.737	.631	.961

a. Test distribution is Normal. b. Calculated from data.

Table 3. Levene's Test Results

Levene's Test of Equality of Error Variances[a]

Dependent Variable:Value

F	df1	df2	Sig.
.687	3	36	.566

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + Media + Interest + Media * Interest

Table 2 shows the assumptions of normality have been fulfilled. Table 3 shows the assumption of homogeneity has also been fulfilled. Based on the hypothesis testing of four hypotheses, all null hypotheses (Ho) were successfully rejected. The summary of the results of hypothesis testing is presented in Table 4.

Tabel 4. Hypotheses Test Results

No	Factor	Mean	Q_{count}	Q_{table}	Remarks
1	Real object	15.30	5.13	2.86	Significant
	PowerPoints media	13.60			
2	High interest	16.30	11.17	2.86	Significant
	Low interest	12.60			
3	Real object with high interest	16.10	0.85	2.97	No Significant
	PowerPoints media with high interest	16.50			
4	Real object with low interest	14.50	8.11	2.97	Significant
	PowerPoints media with low interest	10.70			

Table 4 shows that the use of real object media provides higher learning achievement compared to the use PowerPoints media (Q is 5.13 which is higher than Qtable of 2.86). This finding supports Nuanmeesri & Jamorn mongkolpilai [32] who found that the use of virtual media can provide a more effective learning process. This finding also supports the theory of Smaldino et al. [3] which explains that the media that can be demonstrated is more effective than the images media, because media that can be demonstrated are more concrete, compared to images. However, Marsudi [32] found that the application of constructivist models with media in three-dimensional images can improve learning achievement.

Furthermore, students who have high level of interest obtain higher achievement compared to students eith low level of interest (Q is 11.17 which is higher than Qtable of 2.86). This finding supports Lee et al. [33] and Harackiewicz & Hulleman [34] who found that interest in learning contributed positively and significantly to learning achievement. This finding also supports Alhamdu [35] who explained that interest is positively correlated with reading motivation.

The students with high level of interest perform insignificantly different learning achievement with the implementation of real-object media and PowerPoints media (Q is 0.85 which is lower than Qtable = 2.97). This shows that for students who are highly interested in being estimators do not experience the problems of decreasing learning achievement, even though they are taught using real-object media or PowerPoints media media.

However, for students with low level of interest, the use of real-object media provides better learning achievement compared to the use of PowerPoints media (Q is 8.11 which is more than Qtable of 2.97). This shows that for students who are low interested in being an estimator, it is better to use real object media in cost estimation learning. Based on Table 4, it can also be concluded that there is an interaction between the use of real-object media and the interest in being an estimator that influences the learning achievements of civil engineering students in cost estimation. The interaction is presented in Figure 2.

This finding is very useful for lecturers as an effort to improve the learning process of students in the subject of construction cost estimation. However, it is possible that these findings can apply more broadly to students' learning in other subjects. This finding can also be an input for construction contractors and consultants. The learning media that is closer to the real condition is a simulation learning media. Using simulation media will be able to simulate project conditions in the classroom [36]–[38]. Building Information Models (BIM) simulation media, real-world process modeling simulations can help students learn various methods integrated project management, various instruments and work tools in physical experiments. Therefore, the next researcher can continue this research, for example using BIM Application simulation in learning construction cost estimation.

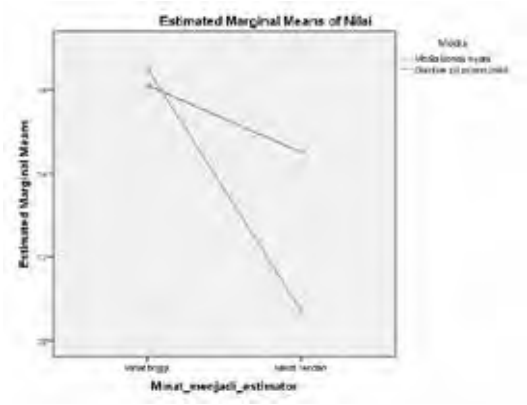

Figure 2. Interaction of Real-Object Media and Interest to be Estimators

CONCLUSION

The results proved that the use of real-object media is more effective than using PowerPoint Media in learning construction cost estimation. There is an interaction between the use of real-object media and interests to be construction cost estimators. For students whose interest in construction cost estimation is high, learning achievement with the use of real-object media is not significantly different compared to the use of PowerPoint Media.

However, for students whose interest in construction cost estimation is low, the use of real-object media is proved to be more effective.

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