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Meta-Analysis: The Impact of Quantum Learning-Based Digital Media on Student Motivation and Mathematics Learning Activities

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Abstract: Learning with the quantum learning model is one of the learning methods in its implementatied Learning with the quantum learning model is one of the learning methods in its implementation enjoy being more active in discussing and working together in class. This study aims to determine the effect of the application of the quantum learning model on increasing student motivation and learning activities. This research is experimental quantitative research consisting of two classes, namely the control class and the experimental class. Data collection instruments used questionnaires.Data analysis used in this study is a descriptive test, normality test, and paired sample test. The results of the normality test (Shapiro-Wilk) for learning motivation of the control class and experimental class amounted to 0.147 greater than 0.05 and for learning activities of the control class and experimental class amounted to 0.362 greater than 0.05. T-test for learning motivation showed that the improvement of the experimental class was higher than the control class (t = -0.785 p = 0.220 > 0.05) and the SE value of Cohen's d (0.317). The T-test for learning activities showed that the increase in learning motivation of the experimental class was higher than that of the control class (t = -2.506 p = 0.009 < 0.05) and the SE Cohen's d value (0.194). That's why based on the results shows that the quantum learning model can increase student learning motivation and student learning activities in mathematics.

Keywords: digital media, learning motivation, learning activities, quantum learning

Abstrak: *Pembelajaran dengan model pembelajaran kuantum merupakan salah satu metode pembelajaran yang dalam pelaksanaannya siswa lebih aktif dalam berdiskusi dan bekerja sama di kelas. Penelitian ini bertujuan untuk mengetahui pengaruh penerapan model pembelajaran quantum learning terhadap peningkatan motivasi dan aktivitas belajar siswa. Penelitian ini merupakan penelitian kuantitatif eksperimental yang terdiri dari dua kelas, yaitu kelas kontrol dan kelas eksperimen. Instrumen pengumpulan data menggunakan angket, analisis data yang digunakan dalam penelitian ini adalah uji deskriptif, uji normalitas, dan uji paired sample t-test. Hasil uji normalitas (Shapiro-Wilk) untuk motivasi belajar kelas kontrol dan kelas eksperimen sebesar 0,147 lebih besar dari 0,05 dan untuk aktivitas belajar kelas kontrol dan kelas eksperimen sebesar 0,362 lebih besar dari 0,05. Uji-t untuk motivasi belajar menunjukkan bahwa peningkatan kelas eksperimen lebih tinggi dibandingkan kelas kontrol (t = -0,785 p = 0,220 > 0,05) dan nilai SE cohen's d (0,317). Uji-t untuk aktivitas belajar menunjukkan bahwa peningkatan motivasi belajar kelas eksperimen lebih tinggi dibandingkan kelas kontrol (t = -2,506 p = 0,009 < 0,05) dan nilai SE cohen's d (0,194). Oleh karena itu berdasarkan hasil penelitian menunjukkan bahwa model pembelajaran quantum learning dapat meningkatkan motivasi belajar siswa dan aktifitas belajar siswa dalam matematika.*

Kata kunci: *digital media, motivasi belajar, aktifitas belajar, quantum learning*

INTRODUCTION

Learning is one of the activities that is always carried out by every individual in the world of education. Education is very important for the progress of a country, so all educational institutions or institutions must direct all activities in their schools to achieve these goals (Samad, 2017). Harfiana et al. (2018) stated that in the process, learning occurs because of the

encouragement of needs and goals to be achieved. The achievement of a goal will be seen in the learning outcomes obtained. The learning model is an entire series of material presentations that include all aspects of learning by educators, as well as all facilities used directly or indirectly in the teaching and learning process. One of the models that can be used in learning is quantum learning(Anggara & Rakimahwati, 2021). Quantum learning is a learning model that organizes various learning process interactions that increase student achievement to get rid of learning obstacles through the use of appropriate methods and tools (Suwarno, 2016). According to Marsela (2016), the Quantum Learning strategy can improve achievement, positive attitudes, self-confidence, student motivation, and student learning activities. Education in school institutions often occurs obstacles in learning services, namely the existence of a problem with low student learning motivation (Antariksa, 2021).

Learning activities really need motivation, because students will not learn if they do not have motivation in their learning. The existence of motivation in oneself will make student learning more passionate, enthusiastic, and happy when doing the learning process. Learning motivation has a significant contribution to the success of the learning process in the classroom. Without good learning motivation from students, the teaching and learning process will not run effectively (Rodiyana, 2018).The lack of teachers in applying learning models according to student needs then has an impact on low student learning outcomes which include student motivation and achievement. This is in line with what was found in class VII junior high school. Based on the results of observations, namely the low motivation of students and the lack of student learning activities in mathematics lessons that occur in the learning process is that the teacher applies a learning method that is only monotonous where students only receive and listen to information from the teacher. Learning activity is one of these internal factors, and its influence on learning success is important. This indicates that successful educators must be able to make how students participate in learning activities actively and also independently. Learning activity is an individual activity that can bring about changes for the better in individuals due to interactions between individuals and individuals and individuals with the environment (Nuraini et al., 2018).

In achieving educational goals, these problems need to be solved. Therefore, this study applies quantum learning-based learning methods to increase student motivation and learning achievement in mathematics, then measured using a questionnaire to determine the extent of student development in the learning process by using a quantum learning model. Quantum learning method is expected to increase students' learning motivation and learning activities. The quantum learning method is carried out by changing various interactions including by applying varied learning methods and conditioning a pleasant learning atmosphere so that it can build interest and foster student learning motivation (Hendriana, 2018).

According to (Trisnawati et al., 2019) to increase the creativity of the student learning process in mathematics lessons, it must be held interactively, inspiringly and the material must be designed in such a way that it is suitable for achieving the learning objectives that have been determined to be achieved. The quantum learning method is proven to be effective in increasing students' learning motivation and learning activities. Amiruddin (2019) In his research, the results showed that the application of quantum learning methods was effective on the learning motivation of SMA N 1 Pundong students by 47.3%. Quantum learning models play an important role in increasing student learning activities. (Goldstein et al., 2010), (Santoso, 2016). People who have high creativity will have the ability to think creatively. So that with a quantum learning approach learning can improve communication and student learning motivation

(Darkasyi et al., 2014). The Quantum Lerning learning model seeks to maximize all the elements contained in learning including all the potential and abilities that exist in students. (Maulidi, 2021).Research conducted by (Adhitama et al., 2015), (Haryono, 2016), (Riati & Farida, 2017), (Saputro, 2017), (Astutik, 2017),(P. Lestari & Hudaya, 2018), (Syafruddin & Jeranah, 2020), (Kabunggul et al., 2020), (Meida et al., 2020), (E. Lestari, 2021) found an influence on the Quantum learning model can affect learning motivation and student learning activities. Meanwhile, according to research (P. Lestari & Hudaya, 2018), (Windarti et al., 2020), (Indrayani et al., 2019), (E. Lestari, 2021), (Afriani & Nalim2, 2021), (Awaludin et al., 2019), Quantum learning model can improve student learning outcomes.

Based on the description of relevant research that has been presented, it is suggested that the Quantum learning model has a positive impact on student learning outcomes. The quantum learning model can be said to be better than conventional learning, While in the place where researchers conduct research, no one has applied the quantum learning model to increase student motivation and learning activities. Whether it's results that can be measured directly with letters and numbers or learning outcomes that can be seen in their application in everyday life (Acat & Ay, 2014). The research shows that the Quantum Learning model can contribute positivelyto student attitudes and learning outcomes. Based on the fact that the quantum learning-based learning model with visual resources is able to help students digest learning easily. The objectives of this research are; (1) Describe the learning motivation of seventh grade students whose learning uses quantum learning models and direct learning models, (2) Describe the learning activities of seventh grade students whose learning uses quantum learning models and direct learning models, and (3) analyze the effect of quantum learning models on learning motivation and learning activities of seventh grade students.

METHOD

The type of research used in this study is quantitative experimentation. The stages of the research are in Figure 1.

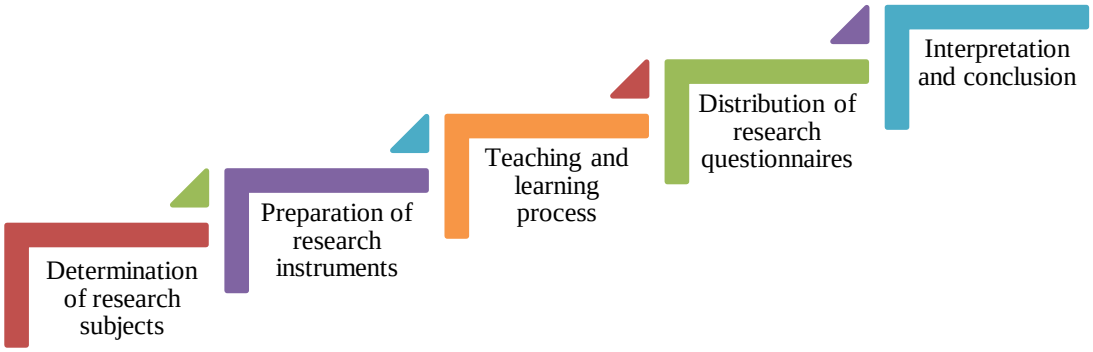

Figure 1. Research Flow Diagram

1. Subjects in the study

The subjects in this study were VII SMP classes totaling 71 students consisting of two classes namely X(a) 44 students and Y(b) 27 students. Based on the sources obtained by class VII, this research was conducted on two classes, namely the experimental class and the control class. The treatment given to the experimental class is by applying the quantum learning model accompanied by a speed test and in the control class by applying scientific approach learning.

2. Research instruments

Research instruments are measuring instruments used to obtain primary data. This research begins with the preparation stage by preparing a syllabus, preparing a lesson plan, preparing media, compiling research instruments in the form of questionnaires and which are used to measure learning motivation and learning activities. The preparation of research instruments in the form of a questionnaire has several indicators which are then developed into several forms of questions.

3. Teaching and learning process

The teaching and learning process activities were carried out 4 times a meeting in two classes using the quantum learning model. Where from the two classes there are control classes and experimental classes.

4. Distribution of questionnaires

For the distribution of questionnaires carried out at the 4th meeting using a paper sheet that already has several questions, which are filled in by control class students and experimental classes, As for collecting data, researchers use two types of questionnaires, namely questionnaires of student learning motivation and student learning activities with the number of questions each there are 20 questions where each question item consists of 4 choices, namely TS (Disagree) CS (Quite Agree) S (Agree) SS (Strongly Agree). Then giving the score in each item is TS = 1, CS = 2 S = 3, SS = 4. Next, the scores obtained by students are calculated using the formula according to (Widoyoko, 2017) that is

$$\text{Score} = \frac{X_i}{X_{max}} x\ 100 \qquad (1)$$

With X_i is score obtained, X_{max} is maximum score.Then to find out the category of students' mathematics learning motivation can be interpreted based on Table 1.

Table 1. Questionnaire Rating Category

Value (%)	Category
0 - 20	Verry Low
21 - 40	Low
41 - 60	Medium
61 - 80	High
81 - 100	Verry High

The data analysis technique uses JASP software. The T-test is used to compare whether the two data on motivation and learning activities of students whose learning uses the quantum learning model and the direct learning model are the same or different. The T-test used is a two-sample T-test, namely from the experimental class and control class.

RESULT AND DISCUSSION

The results of this study are generally in the form of a description of the learning process, which consists of socialization of the implementation of quantum learning models to describe the activities at each meeting, the implementation of evaluations carried out at the end of the meeting, and filling out questionnaires and student responses to quantum learning models used during the study. This study consisted of two cycles and the first cycle consisted of the socialization of the quantum learning model. While for the second cycle consists of a lesson plan (RPP) which is carried out in 4 meetings, three times discussing the material and one

evaluation. The time allocation for each meeting is two lesson hours so that each meeting has 90 effective learning times. During one week there are two math learning meetings.

The planning stage includes activities (1) preparing lesson plans, (2) changing the object of U-shaped student seating, (3) preparing worksheets (LKS), (4) preparing learning materials, and (5) preparing questionnaires.Furthermore, researchers can collect data after the learning process where students fill out a questionnaire with a Likert 4 scale. Then the assessment results can prove learning motivation and learning activities in the control class that has not received treatment with the Quantum Learning model and the experimental class that has received treatment with the Quantum Learning model in Figure 2.

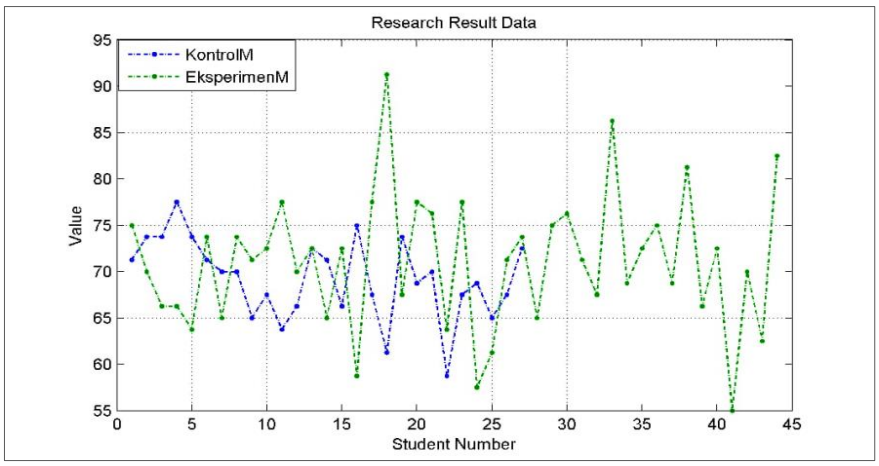

Figure 2. Motivation Questionnaire Data Results

Figure 2 shows that the results of the questionnaire of student learning motivation for the control class totaled 27 students with the blue line showing the lowest average value of 58.75% and the highest of 77.5%.Then the results of the student motivation questionnaire for the experimental class totaled 44 students with a green line showing the lowest average value of 55% and the highest was 91.25%. Due to the fact that the experimental group exhibits a higher percentage rate compared to the control group, this can be attributed to the implementation of the Quantum Learning teaching method in the experimental class. This approach aims to enhance learning motivation, mirroring previous research conducted by (Maulidi, 2022).

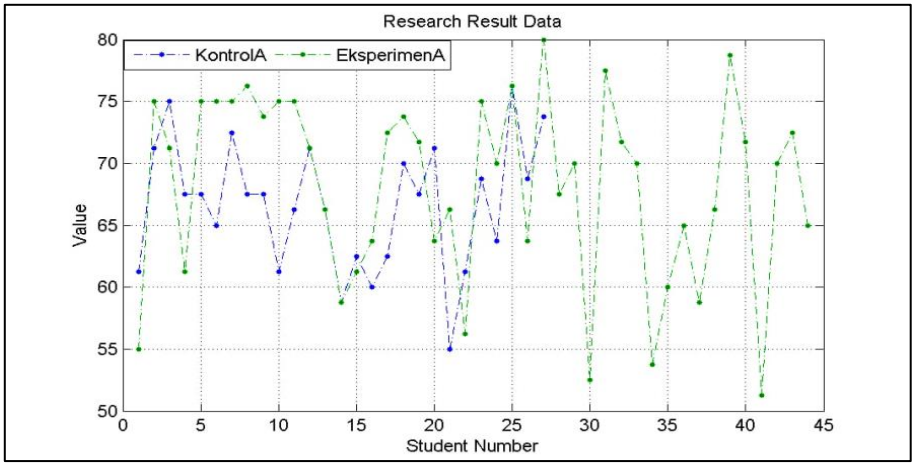

Figure 3. Activity Questionnaire Data Results

Figure 3 shows that the results of the questionnaire on student learning activities for the control class amounted to 27 students with the blue line showing the lowest average value of 55% and the highest 76.25% then the results of the student activity questionnaire for the experimental class totaled 44 students with a green line showing the lowest average value of 51.25% and the highest of 78.75%. Due to the fact that the experimental group exhibits a higher percentage rate than the control group, this can be attributed to the implementation of the Quantum Learning teaching method in the experimental class. The utilization of this teaching approach is aimed at enhancing learning engagement, drawing parallels with prior research conducted by (Anggara & Rakimahwati, 2021).

After data collection, the researchers then conducted descriptive statistical tests. The results of the descriptive statistical tests are in Table 2 and Table 3.

Table 2. Descriptive Statistics of Learning Motivation

		Control-M	**Exsperiment-M**
Valid		27	44
Missing		17	0
Mode	[a]	67.500	72.500
Median		70.000	71.250
Mean		69.259	71.023
Std. Error of Mean		0.834	1.093
Std. Deviation		4.334	7.250
Coefficient of variation		0.063	0.102
Kurtosis		0.149	0.716
Std. Error of Kurtosis		0.872	0.702
Shapiro-Wilk		0.977	0.984
P-value of Shapiro-Wilk		0.790	0.784
Minimum		58.750	55.000
Maximum		77.500	91.250

Based on the responses of 27 students in the control class and 44 students in the experimental class to the filled-in questionnaire, a statistical descriptive test was conducted, and the results are presented in Table 2. The JASP output indicates that the median value for the experimental class motivation questionnaire is 57,000, while the median value for the control class motivation questionnaire is 56,000. The mean values are also displayed in Table 1, revealing that the mean result for the experimental class motivation questionnaire is 56.818, and for the control class questionnaire, it is 55.407. Additionally, the mode values are reported, with 58,000 being the most frequently occurring value in the experimental class questionnaire results, and 54,000 being the mode value for creativity ability. Examining the range of values, the highest value for the experimental motivation questionnaire results is 73,000, and the lowest value is 47,000. In comparison, for the control class motivation questionnaire results, the highest value is 62,000, and the lowest value is 47,000.

Table3. Descriptive Test Results of Learning Activity Statistics

	X1-A	X2-A
Valid	27	44
Missing	17	0
Mode	54.000	60.000
Median	54.000	56.000
Mean	53.333	54.523
Std. Error of Mean	0.804	0.909
Std. Deviation	4.179	6.029
Coefficient of variation	0.078	0.111
Kurtosis	-0.378	-0.504
Std. Error of Kurtosis	0.872	0.702
Shapiro-Wilk	0.981	0.938
P-value of Shapiro-Wilk	0.892	0.021
Minimum	44.000	41.000
Maximum	61.000	64.000

Based on the responses of 27 students in the control class and 44 students in the experimental class on the filled-in questionnaire, a statistical descriptive test was performed, and the results are presented in Table 3. The JASP output reveals that the median value for the experimental class activity questionnaire is 56,000, while the median value for the control class activity questionnaire is 54,000. The mean values are also displayed in Table 2, indicating that the mean result for the experimental class activity questionnaire is 54.523, and for the control class questionnaire, it is 53.333. Additionally, the mode values are reported, with 60,000 being the most frequently occurring value in the experimental class questionnaire results, and 54,000 being the mode value for creativity ability. Examining the range of values, the highest value for the experimental activity questionnaire is 64,000, and the lowest value is 41,000. In comparison, for the control class questionnaire results, the highest value is 61,000, and the lowest value is 44,000. Following the descriptive test, the researcher proceeded to conduct a data normality test. The outcomes of the data normality test are presented in Table 3.The results of the data normality test can be seen in Table 4 and Table 5.

Table 4. Normality Test Results of Learning Motivation

		W	P
Control-M	Experiment-M	0.943	0.147

Based on the Normality Test Table, in the Shapiro-Wilk test section, the sig value for Control-Motivation and Experiment-Motivation (questionnaire learning motivation) control and experimental classes is 0.147. Because the sig value is greater than 0.05, it is concluded that the data from the learning motivation questionnaire of the control class and experimental class are normally distributed. So the normality requirement in the paired sample T-test has been fulfilled.

Table 5. Learning Activity Normality Test Results

		W	P
Control-A	Experiment -A	0.960	0.362

Based on the Normality Test table, in the Shapiro-Wilk test section, the sig value for the Control-Activity and Experiment-activity (questionnaire learning motivation) control and Experiment classes is 0.362. Because the sig value is greater than 0.05, it is concluded that the data from the questionnaire on the learning motivation on the control class and experimental class are normally distributed. So the normality requirements in the paired sample T-test have been met.The results of the paired sample T-test data analysis motivation using JASP can be seen in Table 6 below.

Table 6. Paired Samples T-Test Motivation

Measure 1	Measure 2	t	df	P	Cohen's d	SE Cohen's d
Control-M	Experiment-M	-0.785	26	0.220	-0.151	0.317

Table 6 shows that the results of the calculation of the learning motivation questionnaire for the two classes (control class and experimental class) show that there is a significant statistical difference between the two classes. T-test shows that the increase in the experimental class is higher than the control class (t = 0.785 p=0.220>0.05). While the SE value of Cohen's d (0.317) shows that the experimental class has a greater effect than the control class. This is in accordance with his research (Akihary & Apituley, 2022) which states that the quantum learning model can increase learning motivation 16.249. The results of the paired sample T-test data analysis of learning activities using JASP can be seen in Table 7.

Table 7. Paired Samples T-Test Learning Activity

Measure 1	Measure 2	T	df	P	Cohen's d	SE Cohen's d
Control-A	- Experiment-A	-2.520	26	0.009	-0.485	0.194

Table 7 shows that the results of the calculation of the learning activities questionnaire for the two classes (control class and experimental class) show that there is a significant statistical difference between the two classes. T-test shows that the increase in the experimental class is higher than the control class (t = -2.506 p = 0.009 <0.05). While the SE value of Cohen's d (0.194) shows that the experimental class has a greater effect than the control class.Based on the research results obtained, the quantum learning model can increase student motivation and learning activities in learning mathematics. In addition, according to (Ismawarti & Hidayati, 2022) it shows that the effect of the quantum learning model on the experimental class is 16.875% and in the control class 7.9695%.

CONCLUSION

After the researchers took the data to the school, the researchers then conducted a normality test with the Test of Normality (Shapiro-Wilk) so that it could be seen that the data was normal, then the Paired Samples T-Test test was conducted. The results of the normality test for learning motivation of the control class and experimental class were 0.147 greater than 0.05 and for learning activities of the control class and experimental class were 0.362 greater than 0.05. T-test for learning motivation shows that the experimental class improvement is higher than the control class (t = -0.785 p = 0.220 > 0.05) and the SE value of Cohen's d (0.317). T-test for learning activities showed that the experimental class improvement was

higher than the control class (t = -2.506 p = 0.009 < 0.05) and the SE Cohen's d value (0.194). Indicating that the experimental class had a greater effect than the control class. This research was conducted on VII students at SMP, with a total of 71 students, where class VII was divided into two classes, 44 students for class X (a) and 27 students for class Y (b).Based on research conducted, the quantum learning model has been shown to enhance student motivation and learning activities. This is evident from the experimental class achieving higher scores compared to the control class.

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