

Technology Integrated in Interactive Entrepreneurship Activity to Enhance Students Mastery in Mathematics Concept for Active Mathematics Teaching



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Abstract: *This study aims to examine the effectiveness of interactive entrepreneurship activity in mathematics learning towards students' mastery in mathematics concepts. The objective is to look at the impact of implementing an active learning strategy combined with technology on mastery of mathematics concepts after engaging in a learning activity. The combination of technology in interactive learning and games kits in the form of interactive entrepreneurship activity has resulted in the innovation of learning strategies to enhance the learning interest, enjoyment and to influence the mastery of students' mathematics concepts. The effectiveness study of the strategy was conducted using an experimental study design that involved 109 students from 2 secondary schools who had participated in a 4-week mathematics learning treatment session. The experiment group was exposed to interactive entrepreneurship activity through the use of a learning kit while the control group followed conventional learning for a selected mathematics topic. Post-test were conducted to see differences in understanding and achievement of mathematics concepts for both groups of students. The results show that there is a significant difference between the mastery of mathematics concept of the experiment group students and the control group students. This shows that the integration of technology in learning activities has a positive impact on student learning. The implications of the study indicate that teachers need to constantly improve pedagogical knowledge based on current technological developments and improve teaching strategies in order to improve student competencies. The parties also need to provide the latest technology to improve the quality of education in line with global developments.*

Keywords: *active mathematics learning, interactive entrepreneurship activity, mathematics concept, students' mastery, technology integrated.*

I. INTRODUCTION

The purpose of implementation of learning activities for

Manuscript received on February 10, 2020.

Revised Manuscript received on February 20, 2020.

Manuscript published on March 30, 2020.

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each mathematics learning session is to assist and stimulate students' cognitive and metacognitive aspects [9][22][27][33]. Through activities that are collaborative and interactive, students' interest and enjoyment can be enhanced [11] [23]. According to Smith & Mancy [40], when these interests and pleasures are realized, students themselves will be encouraged to engage in learning and open-mindedness and be prepared to think especially when confronted with tasks or questions that require higher thinking skills. Therefore, the implementation of interactive and fun activities is highly recommended as a mediator to produce active and effective learning [7]. Good cognitive preparedness and metacognitive skills through active learning strategies implemented using the activity medium can increase students' mastery of effective mathematical learning [30][37].

Technology advancements have led to discoveries and research finding, at the same time, teaching and learning innovations were developed for a variety of purposes [3]. The integration of technology has facilitated and positively impacted teaching techniques [41]. Research is being conducted to look at the effectiveness of the technology and teaching approaches that have been innovated and modified to meet the curriculum needs and to achieve the goal of improving student competency. As the findings of studied by Radovic, Maric & Passey [35], Eyyam & Yaratana [15], Clarebout et al [10], Gurbin [21], Smith, Shin, Kim & Zawodniak [41] and Borba et al [5], have reported that the results of the technology integration and improvement of traditional approach has influenced and had a significant impact on student achievement. According to Mistretta [28], Mat Sina, Talib & Norishaha [26], Brakoniecki, Amador & Glassmeyer [6] and Gurbin [21], most technology products are widely applied and used in learning, such as gadgets like tabs and smartphones, learning aids likes graphic-scientific calculators, web-based, apps, internet-based and more. According to Mistretta [28], teachers who pursue training in the field of teaching with technology are found to be more interested in modifying teaching and are highly motivated to integrate technology in producing teaching and learning activities. For example, teachers are very positive about using computers in producing simulation-based teaching techniques, learning applications, and technology games in mathematical learning.

Training, knowledge and skills in designing technology-integrated teaching should always be disclosed especially to new teachers as a means of preparing teachers who can produce active learning and can design learning interventions in mathematics [3][28].

In this context, there is a need for research to develop mathematics learning activities that can be integrated with technology.

These activities need to be selected based on the impact on student achievement and the potential for innovation with technology [3]. Interactive and collaborative activities are very influential to train students' metacognitive skills [40]. According to Mantell et al [25] and Goh [19], entrepreneurship activities are basic training and form the cognitive coordination of children. Schraw & Moshman [37] suggest that learning activities that help students manage their metacognitive impairment are most effective in improving students' understanding. Mat Sina, Talib & Norishaha [26] argue that, with the help of appropriate technology, teaching design will have a greater impact on student motivation, engagement and achievement. Based on these statements, researchers take the initiative to restructure and develop entrepreneurship activities by injecting technology elements to better impact on students' cognitive and metacognitive aspects and can be used as an active learning medium to positively impact students' mastery of mathematics concepts. Weaknesses of entrepreneurship activity are overcome so that their applications are not confined to topics related to money, sales or entrepreneurship. Even when integrated with technology, the implementation will be more interactive and applicable to all topics in mathematics. Therefore, a study of the effectiveness of students' mastery should be done.

A. Interactive Entrepreneurship Activity with Technology Integrated

In this regard, the researcher developed a learning activity that ensures optimum active learning and interaction through simulation of entrepreneurship activity involving the game of buying and selling. In this activity, the researcher provides special interactive kits to create a real entrepreneurial situation, among the contents of the kit are money samples, sales product samples, graphic-scientific calculators and sales notes. As a result of the modification of similar game activities introduced by Eka Rahmawati [14], researchers have enhanced their activities with technology integrated to achieve the purpose of active learning. Researchers choose entrepreneurship activity as these activities can stimulate interaction. In everyday life, interaction and collaboration are very broad and much influenced by entrepreneurial activity.

In fact, this entrepreneurship activity is also applied mathematics. According to Palmer & Johansson [31], entrepreneurship skills are very important in developing mathematical competencies that expose individuals to thinking. Mantell et al [25] argues that entrepreneurship is a child's play activity and according to Goh [19], it is a cognitive requirement in which the ability to coordinate problem-solving occurs during the purchase and production of learning. Buying and selling as an entrepreneurial foundation have created a unique experience for everyone. According to Dagarin [11], in contextual theory, learning becomes faster and more meaningful when structured from one's own experience. The experience is built upon existing knowledge and will be used during learning [13]. According to Nelson & Narens [30] and later supported by Schraw & Moshman [37] and Pantiwati & Husamah [32], each individual has a metacognitive experience that will serve as a site for building new knowledge. Student learning becomes active when this metacognitive experience can be regulated by motivational through fun activities. Palmer & Johansson [31], Shanklin & Ehlen [38], Almahry, Sarea & Hamdan [2] and Eka Rahmawati [14] have reported in their study that selling activities can increase motivation, focus, active engagement and significantly influence student achievement.

II. METHODOLOGY

The objective of this study was to evaluate the effectiveness of implementing interactive entrepreneurship activities with technology integrated on student mathematics concepts. A pre-post-test experimental design was used which involved 109 students from two secondary schools in the Pasir Gudang district of Johor, Malaysia. Using purposive sampling techniques, students with similar characteristics in terms of mathematics achievement, cultural sociology and equivalent learning environment were selected and divided into two groups. The experiment group consisted of 61 students, while the control group consisted of 48 students. The control group maintained the conventional learning method, while the experiment group students were exposed to the learning method through interactive entrepreneurship activities. First, the teachers involved were provided with in-house training, discussing topics, lesson plans and the duration of treatment. Before the start of the treatment session, both groups took the pre-test to determine their current level of mastery and knowledge based on the mathematics topics they had learned. The table shows the design of the experimental study.

Table-I: Research Design

	Pre-test	Treatment Session			Post-test
Experiment Group	√	X1	X2	X3	√
Control Group	√	O	O	O	√

X: treatment session, O: no treatment, √: pre-post-test

Source: Darussalam & Hussin [12]



Then, after approximately 4 weeks of treatment sessions, both groups of students were given another test to determine their mastery of the concept. The data from the mastery test scores were computerized through descriptive and inference tests, using the *Statistical Package for the Social Sciences* (SPSS) application, version 23.

III. RESULT

The following data shows the achievement test results for both pre and post-test of both groups.

Table-II: Results of Mastery Test

Group	Pre-test		Post-test	
	Mean	Sd.	Mean	Sd.
Control n = 48	55.56	15.229	52.92	15.067
Experiment n = 61	46.90	11.716	62.61	16.665

Based on Table-II, the results showed that the control group's pre-test scores were higher than the experiment group with a mean of 55.56 and Sd. value of 15,229 over the mean of the experiment group of 46.90 and Sd. value is 11.716. For the post-test, the experiment group's mastery score was higher with a mean value of 62.61 and Sd. of 16.665. For the control

group, the mean obtained in the post-test was 52.92 and Sd. 15.067. There was an increase in the mastery scores of the experiment group and a decrease in the control group. Next, statistics inference tests were performed to see if there were any significant differences between the mastery scores of the two groups.

Table-III: Mann Whitney Test Analysis for Comparison of Pre and Post-test mastery scores Between Groups

Test	Group	Mean Rank	Sum of Rank	Z	Asymp. Sig. (2-tailed)
Pre-test	Control n = 48	65.55	3146.50	- 3.093	0.002*
	Experiment n = 61	46.70	2848.50		
Post-test	Control n = 48	43.93	2108.50	- 3.248	0.001*
	Experiment n = 61	63.71	3886.50		

*p < 0.05

The results showed that there was a significant difference between the mastery scores of the experiment group and the control group for both tests, with a value of p = 0.002 for the pre-test and p = 0.001 for the post-test, which was p-value is

smaller than the significance level of 0.05. To obtain more detailed information on the mastery scores, a comparison of scores was performed by a group against pre and post scores.

Table-IV: Wilcoxon Test Analysis for Comparison of Pre Test and Post Test Mastery Scores by Group

Group	Mastery Score	Min Rank	Sum of Rank	Z	Asymp. Sig (2-tailed)
Control	Pre Test	23.82	667.00	- 0.810	0.418
	Post-test	25.45	509.00		
Experiment	Pre Test	33.76	1620.50	- 4. 849	0.000*
	Post-test	20.81	270.50		

*p < 0.05

The results indicate that for the experiment group only, there was a significant difference between pre and post mastery scores with p = 0.000, that is smaller than the significance value of 0.05.

group (p = 0.001, <0.05) and it was also found that the students' mastery of the experiment group increased and there was a significant difference after learning sessions with interactive entrepreneurship activities (p = 0.000, < 0.05). This study achieves the objectives and can demonstrate the impact of the learning approach with the technology integrated on the learning environment and student mastery.

IV. DISCUSSION AND IMPLICATIONS

This study is an experimental study involving 106 students to see the effectiveness of interactive entrepreneurship activities on students' mastery of mathematics concepts. The results showed that there was a significant difference between the mastery of students in experiment group and the control



In line with the findings of Gordon [20] and Festus [16] which also demonstrates instructional technology and incorporating interactive multimedia and materials in learning can enhance student achievement. The findings of this study are also in line with previous research such as Celik [7], Festus [16], Suriyon, Inprasitha & Sangaroon [43], Du Toit & Du Toit [13], Smith & Mancy [40], Benders [4], Cera, Mancini & Antonietti [8], Su, Ricci & Mnatsakanian [42] and Adnan & Arsad Bahri [1], report that there has been an increase in interest,

more active engagement, concept understanding and achievement thus far than ever before the using the innovative approach with technology integrated. However, these studies differ only in the form of interventions presented, for example by Festus [16] using an activity-based learning approach and their intervention using teaching aids. Meanwhile, the study by Benders [4] used group activities through a computer-assisted cooperative learning activity approach.

In this regard, the study also proved that the effectiveness of injection of learning kit elements with more interesting and interactive materials has attracted interest and created active mathematics learning. The targeted intervention is to students' mastery in mathematics concepts. These entrepreneurship activities produce better learning materials that are flexible and cost also effective. According to Eyyam & Yaratan [15], with technology, calculator products, geometry tools, measurement kits and interactive games aids can be produced in a more flexible form as learning media and easily available in the market at cheaper prices. These products have engineering and interactive elements that support positively the enhancement of student learning and competence [3][21][36]. Palmer & Johansson [31] claimed that entrepreneurship skills include thinking skills, such as, needs analysis skills and comparative differences were applied when buying or selling something. This skill will practice the thinking skills once implemented in the classroom together with mathematics problem solving. By improving thinking skills, the potential to coordinate problem-solving in learning by way of entrepreneurship and position as a seller or buyer will effect mastery in mathematics learning. According to Goh [19], knowledge and needs as a seller or buyer are successful as they evaluate how to think, plan, organize and take initiative or alternative to solve the mathematics problem during activity in learning. Researchers such as Franco & Haase [17], Rayung & Ambotang [34], Almahry, Sarea & Hamdan [2] and Khar [24], report that entrepreneurial practices, buying and selling, can improve student thinking skills.

It can be argued that technology and teaching design transformations lead to increased students' cognitive and metacognitive aspects and significant to deeper learning [20] [36]. Technology and interactive teaching approach also shape self-regulated skills where students are more active and focused on learning outcomes. Besides, interaction is also optimal, where students, students and teachers interact better when technology is used as a learning tool or mediator [10][20][21][39]. Through these interactions, students can develop skills and self-esteem such as metacognitive skills, thinking skills, problem-solving skills and so on [29]. In this regard, the findings of this study illustrate the discussion by

Smith & Mancy [40], who state that the implementation of technology strongly influences students' collaborative skills. This interactive entrepreneurship activity provides a space for students to collaborate with peers and teachers, while students focus more on the discussion. Additionally, students share more mathematics ideas and solutions. According to Rillero [36] and Festus [16], collaborative learning has a significant impact on improving student understanding and achievement.

Implications from this study indicate that it is important for teachers to constantly improve knowledge of the latest teaching technologies and can modify traditional teaching to make it more appropriate and practical to implement. It has been proven that the presence of technology is no longer unique to students. The results of the study by Smith, Shin, Kim & Zawodniak [41] show that the application of technology in classroom teaching is still modest and that students' use of technology in daily life is high, so this study is part of an initiative to enhance the integration of technology in teaching. Begin by defining the strengths of best practices that teachers constantly practice, and then injecting the elements of technology into their teaching design. According to Hasbullah [22], the complex and abstract nature of mathematics makes mathematics learning somewhat limited. Crish [9] also supports this view by arguing that the weakness of teaching techniques is also a factor in mathematics learning problems. Therefore, teachers are encouraged to take on the challenge of transforming teaching based on technological knowledge and willing to integrate with existing best practices. Stakeholders also need to act on the provision of programs for teachers to train and be the catalyst for the innovation of instructional technology for education development [28]. In line with these recommendations, the findings of this study will serve as a guide that will highlight many more practical teaching techniques and methods for mathematics learning intervention. It is essential to choose the best teaching practices that can be injected with the elements of technology, to impact the quality of mathematics learning and produce students with high knowledge and skills [15].

V. CONCLUSION

The results of this study show that interactive entrepreneurship activity can change the learning environment of mathematics. This practice can be used as a mathematics learning intervention. Injection technology can also produce a higher quality and impactful instructional design. With the advent of this interactive entrepreneurship activity, it can serve as a solution to address the weak issue of mathematics and make it difficult to determine the learning activities faced by most mathematics teachers. In conclusion, teachers can use this practice as an activity option in creating active mathematics learning. It is also recommended that teachers adapt these activities to their needs and suitability. In addition, it is also recommended that further studies be conducted to further strengthen the findings of this study. Future researchers can leverage this study promptly.

For example, develop a special model or teaching module that highlights entrepreneurship activities. Also, it is possible to carry out this interactive entrepreneurship activity on other subjects and see the impact it has on students in terms of understanding, performance, skills and so on. An in-depth study can also be conducted to see what elements or aspects of self-development occur for students to enhance their learning through this interactive entrepreneurship activity.

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