

# The Relationship Between Students' Understanding and Interest in Mathematics Subject Through The Use of Augmented Reality

Mohd Jasmy Abd Rahman, Azam bin Abd Aziz & Fakharudin Bin Shahudin

Faculty of Education, National University of Malaysia (UKM)

Email: mjas@ukm.edu.my, p121239@siswa.ukm.edu.my & p116996@siswa.ukm.edu.my

To Link this Article: <http://dx.doi.org/10.6007/IJARBS/v13-i12/20305> DOI:10.6007/IJARBS/v13-i12/20305

**Published Date:** 28 December 2023

## Abstract

Education today has changed with the advances of time and technology. The former environment of teacher-centric pedagogy has turned into a multi-faceted one. More interactive learning becomes an option for use in the classroom. Including mathematics subjects, digital-based education contributes to the effectiveness of teaching and learning methods. Mathematics is a subject that is less sought by students due to a variety of factors, including boring topics and abstract and complex concepts. The unchanged and unattractive methods of teaching also make students uninterested in this subject. With the help of the latest technologies such as augmented reality (AR), education is becoming more effective and creating a more interactive and entertaining atmosphere. Learning about abstract concepts in mathematical subjects can be simplified and better demonstrated through AR technology. This study aims determine the level of understanding and interest, in addition to identifying the relationship between the understanding level and the interest of students in mathematics subjects through the use of AR. A survey method using a set of questionnaire was conducted on 27 Form 2 students at a school in Temerloh, Pahang to get their views on the use of AR in their learning at school. The study finds that the level of understanding and interest is at a high level, and there is a significant correlation between the levels of understanding with the student's interest in the subject of mathematics through the use of AR. The implications of this study can help teachers to diversify teaching methods, especially by integrating technologies such as AR into teaching and learning to ensure more interactive and effective learning.

**Keywords:** Augmented Reality, Mathematics, Digital Education

## Introduction

In accordance with the Falsafah Pendidikan Kebangsaan, mathematics curriculum provides comprehensive mathematical knowledge and skills in dealing with challenges in real real realities in line with the rapid development of modern science and technology (KPM, 2013)

According to the Standard Dokumen Standard Kurikulum Dan Pentaksiran (DSKP), the implementation in the mathematics Curricula has the ability to provide space to establish a connection of conceptual knowledge with procedural knowledge among students as well as can associate topics in Mathematica in particular and associate math with other fields in general. This will enhance students' understanding of mathematics and make math more clear, meaningful and interesting.

In conjunction with KSSM goal to equipt students with 21st Century learning, mainly focusing on thinking skills as well as life skills and careers that are based on practices of pure value. 21st Century Skills aims to produce students who have the characteristics of superior student profiles to be able to compete globally. According to Mantihal & Maat (2020) learning in the 21st century can increase students' interest in mathematics subjects. Among the technologies seen to offer interactive and student-interested learning is the use of Augmented Reality (AR). AR technology has been widely used in education to create a better learning environment in the classroom (Liu et al., 2020). The interactive learning atmosphere resulting from the integration of AR in the classroom is able to attract the interest of students. This proves through Belani & Parnami (2020) that through the use of AR technology in the classroom can increase the motivation of students and make the learning atmosphere more exciting and fun.

The objective of the study is to determine the level of understanding and interest, in addition to identifying the relationship between the understanding level and the interest of students in mathematics subjects through the use of AR.

Objectives of this study are:

- i. Identify the level of students' understanding of mathematics subjects through the use of AR
- ii. Identify the student's level of interest in mathematics subjects through the use of AR.
- iii. Identify the relationship between the level of understanding and student interest in mathematics subjects through the use of AR.

The question of this study is as follows:

- i. What is the level of students' understanding of mathematical subjects through the use of AR?
- ii. What is the level of students' interest in mathematical subjects through the use of AR?
- iii. Is there a significant relationship between student understanding and interest in mathematical subjects through the use of AR?

While the hypothesis for this study is:

$H_{01}$  : There was no significant relationship between the student's understanding of maths and interest in maths through the use of AR.

## **Literature Review**

### ***Augmented reality (AR)***

In the digital world, new technologies like AR are gaining place. AR is a technology that integrates the virtual world as well as the real world, by integrating multimedia, 3D modeling, interaction intelligence, and also sensing. (Chen et al., 2019). AR technology also combines three important features, which are, accurate 3D identification of virtual and real objects, real time interaction and the combination of the physical and digital worlds. (Microsoft, n.d). AR

also used to combine digital components and 3D objects, and perceived by humans in the real world (Alexander, 2020). This technology is has been used in various sectors of life. With the sophistication of technology, the world of reality and virtual can be combined and beneficial to humans, in addition to helping improve the quality of life.

### **AR in Education**

Augmented reality is one of the latest technologies that is increasingly popular in today's world, including in the field of education. AR is almost the same technology as virtual reality (VR), but AR is more of an interface in 2D and 3D virtual form, as well as adding additional information in digital form to the real world. (Elmqaddem, 2019). AR provides a new experience for students by enabling them to see the digital form of learning content in the real world with a method of streamlining that learning content around them. (Bulut & Borromeo Ferri, 2023). This creates a more exciting and active learning atmosphere. According to Ahmad & Junaini (2020) there are three benefits that can be obtained through the use of AR in mathematics subjects which are creating interactive learning, improving visualization and increasing student confidence and understanding. Therefore, AR technology is a very significant technology to be used in mathematics learning in this multi-digital world.

### **Problem Statement**

Mathematics is a fundamental subject that is essential for student success in a variety of fields. However, many students struggle with learning mathematics, and this has raised concerns among educators and researchers. This leads many students to be uninterested in mathematical subjects. In addition to learning based on books and worksheets merely causes students not to be interested in mathematics subjects (Matlan & Maat, 2021). Though many are desperate because they believe that mathematics is a boring subject. (Porferio et al., 2019).

In addition, the teaching and learning methods also play a role in contributing to students' interest in mathematics subjects. Students have different learning styles, and traditional mathematics teaching methods may not work for all students. Some students are more inclined to learn through visual aid, while others prefer learning through hands-on activities. Teachers need to recognize different student learning styles and use a variety of teaching methods to ensure that each student can understand and learn the concept. By dealing with this challenge, students can develop a better understanding of mathematics. Consequently, an interesting learning approach can enhance motivation, interest and further master the concepts and understanding of mathematical skills well. The learning approach through digital education is seen to address these issues and problems.

### **Methodology**

This study uses survey method which is a set of questionnaire as study instrument. The survey question used has been modified from Mohamad Zufadzli & Noor Anida (2023). This data will be analyzed quantitatively. The questionnaire consists of three sections: Part A that collects demographic information of respondents, Part B that gathers information about the level of students' understanding of mathematics through the use of AR, Part C that gathered information about students' level of interest in mathematical subjects through the application of AR. Parts B and C use the Likert scale method. All data collected will be analyzed using SPSS software. The data analysis was obtained by means of a descriptive method with levels of evaluation categorized into three levels: low (0.00-1.66), medium

(1.67-3.33) and high (3.34-5.00). (Fathen Suriati, 2017). Respondents were 27 form two students from one of the secondary schools in Temerloh, Pahang. The data obtained from the survey was analyzed using percentage statistics and the Statistical Package for Social Science (SPSS) software version 22.

## Finding

### Respondent Demographic Analysis

Based on the survey, 27 respondents responded to the survey. According to the demographics of the respondents, there were 51.85% of respondents were women and 48.15% were men. 27 respondents consisting of form two students in secondary school have completed the questionnaire through the Google Form.

Table 1

*Gender dispersion of respondents*

Item	Frequency	Percent (%)
Male	13	48.17
Female	14	51.85
Total	27	100

### Students' understanding of mathematical subjects through the use of AR

Table 2

*The level of students' understanding of mathematical subjects through the use of AR*

Construct	Min	Level
Understanding	3.43	High

The results of the analysis found that students' understanding of the use of AR applications was also high, with a min score of 3.43. This suggests that respondents agree that using an AR application can help students understand and learn their learning more effectively and better. Ahmad & Junaidi, (2022) through their study formulated the use of AR applications based on card game activity succeeded in improving student math skills.

### Students' interest in mathematics subjects through the use of AR

Table 3

*Aspects of Student Interest In Mathematical Subjects Through The Use Of Ar*

Construct	Min	Level
Interest	3.55	High

Analysis showed students' interest in mathematics subjects through the use of AR applications was high with a min score of 3.55. This shows respondents agree that the AR application has attracted their interest in learning mathematics better. These findings are supported by studies (Cai et. Al 2020) which states that AR helps understanding in learning probability topics and boosts a positive learning interest. According to Shubham et al., (2018), AR technology helps students in inspiring learning and making the learning experience more enjoyable.

### The relationship between the level of understanding and student interest in mathematics subjects through the use of AR

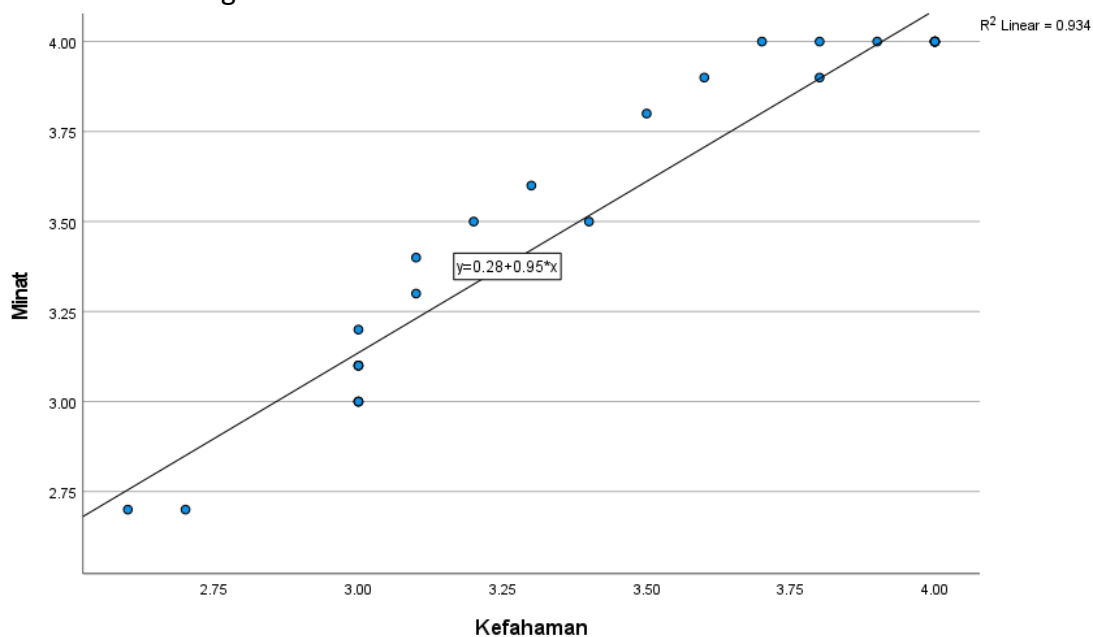
Table 4

Correlation analysis of students' level of understanding and interest in mathematical subjects through the use of AR

		Minat	Kefahaman
Minat	Pearson Correlation	1	.967**
	Sig. (2-tailed)		.000
	N	27	27
Kefahaman	Pearson Correlation	.967**	1
	Sig. (2-tailed)	.000	
	N	27	27

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Chart 1 : The relationship between students' understanding and interest in the subject of mathematics through the use of AR.



The data analysis study found that the Pearson correlation coefficient indicates the presence of a very strong and significant positive linear relationship between the interest scores and the understanding of AR-based learning [ $r(25) = 0.967$ ,  $p < 0.01$ ]. Through this prediction,  $r^2$  reveals that approximately 93.4% of the variance in interest scores can be predicted from the understanding of AR-based learning.

### Discussion

The research findings indicate that students' understanding of mathematics improves alongside their level of interest in the subject through the use of AR-based applications. Through these AR applications, students' interest in mathematics becomes a catalyst for enhancing their understanding of math through AR usage. This connection is supported by Abdul Hanid et al (2022) as their study found that teaching geometry topics using AR-based technology resulted in higher student achievement compared to conventional methods that

use textbooks. This is further reinforced by Mohd Fadzil and Mohd Nihra (2019), who found that shifting from traditional teaching approaches to technology-based learning through smartphone applications can enhance the quality of learning. Therefore, AR technology plays a significant and beneficial role in helping students grasp complex and abstract concepts that require more in-depth explanations.

The current educational landscape has started to change and encompasses several aspects that reflect shifts in teaching methods, learning, and the overall focus of education. Among the key trends in education today that are evolving is the integration of technology in learning. Nowadays, the use of technology has a significant impact on education. The use of electronic devices such as computers, tablets, and smartphones has transformed how teachers teach and students learn. Educational technology such as e-learning, instructional videos, and online learning platforms has become more common. This enables access to a wider range of educational resources and supports self-directed learning. Consistent with previous studies that support the statement by Kamaluddin et al. (2021), the use of information and communication technology (ICT) as a teaching and learning aid can help teachers implement teaching more creatively and engage students while motivating them to learn.

### **Recommendation**

The author's proposal for further research is to investigate students' acceptance of the use of AR technology in mathematics education because students' acceptance levels can influence the effectiveness of teaching and learning methods in the classroom. Additionally, research should be conducted to examine the factors that influence the elements of AR application to ensure that the teaching and learning process runs smoothly and successfully achieves its learning objectives. Future researchers need to assess the correlation of each learning material produced through AR, as it has the potential to generate interest and enhance knowledge for students.

### **Conclusion**

The results of studies on the application of AR (Augmented Reality) in the teaching and learning process have provided many benefits and advantages to both students and teachers. The use of technology as an educational approach has become a growing trend, but it still needs continuous research because AR-based technology has not yet become a common practice among educators. Research on the effectiveness of AR usage needs to be studied and discussed so that it can become a popular approach in contemporary educational institutions. Ultimately, successful student performance enhances the quality and significance of the education system.

### **References**

- Abdul Hanid, M. F., Mohamad Said, M. N. H., Yahaya, N., & Abdullah, Z. (2022). Effects of augmented reality application integration with computational thinking in geometry topics. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-022-10994-w>
- Ahmad, N. I. N., & Junaini, S. N. (2020). Augmented Reality for Learning Mathematics: A Systematic Literature Review. *International Journal of Emerging Technologies in Learning*, 15(16), 106–122. <https://doi.org/10.3991/ijet.v15i16.14961>

- Ahmad, N. I. N., & Junaini, S. N. (2022). PrismAR: A Mobile Augmented Reality Mathematics Card Game for Learning Prism. *International Journal of Computing and Digital Systems*, 11(1), 217–225. <https://doi.org/10.12785/ijcds/110118>
- Alexander S. Gillis. (2020). Augmented Reality (AR). *WhatIs.com*.  
<https://www.techtarget.com/whatis/definition/augmented-reality-AR>  
<https://www.techtarget.com/whatis/definition/augmented-reality-AR>
- Belani, M., & Parnami, A. (2020, November). Augmented reality for vocational education training in K12 classrooms. In *2020 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)* (pp. 317-320). IEEE.
- Bulut, M., & Borromeo Ferri, R. (2023). A systematic literature review on augmented reality in mathematics education. *European Journal of Science and Mathematics Education*, 11(3), 556–572. <https://doi.org/10.30935/scimath/13124>
- Cai, S., Liu, E., Shen, Y., Liu, C., Li, S., & Shen, Y. (2020). Probability learning in mathematics using augmented reality: impact on student's learning gains and attitudes. *Interactive Learning Environments*, 28(5), 560–573. <https://doi.org/10.1080/10494820.2019.1696839>
- Capone, R., & Lepore, M. (2020). Augmented Reality to Increase Interaction and Participation: A Case Study of Undergraduate Students in Mathematics Class. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 7(2), 185–204. <https://doi.org/10.1007/978-3-030-58468-9>
- Chen, Y., Wang, Q., Chen, H., Song, X., Tang, H., & Tian, M. (2019). An overview of augmented reality technology. *Journal of Physics: Conference Series*, 1237(2), 022082. <https://doi.org/10.1088/1742-6596/1237/2/022082>
- Chen, Y. C. (2019). Effect of Mobile Augmented Reality on Learning Performance, Motivation, and Math Anxiety in a Math Course. *Journal of Educational Computing Research*, 57(7), 1695–1722. <https://doi.org/10.1177/0735633119854036>
- Elmqaddem, N. (2019). Augmented Reality and Virtual Reality in Education. Myth or Reality?. *International Journal of Emerging Technologies in Learning (IJET)*, 14(03), 234. <https://doi.org/10.3991/ijet.v14i03.9289>
- Hafizul, H. F., Zainuddin N. A., Mohd Faizal Nizam Lee Abdullah, M. F. N., Ibrahim, M. H. (2019). The Effectiveness of Teaching Aid for a Mathematics Subject Via Mobile Augmented Reality (MAR) for Standard Six Students. *International Journal of Recent Technology and Engineering*, 6S2(7), 2277-3878.
- Hanid, M. F. A., Mohamad Said, M. N. H., Yahaya, N., & Abdullah, Z. (2022). The Elements of Computational Thinking in Learning Geometry by Using Augmented Reality Application. *International Journal of Interactive Mobile Technologies*, 16(2), 28–41. <https://doi.org/10.3991/ijim.v16i02.27295>
- Kamaluddin, Nur Aisyah., Husnin, Hazrati. (2022). Penggunaan Teknologi Maklumat Dan Komunikasi (TMK) Dalam Pendidikan. *Jurnal Dunia Pendidikan*, [S.I.], v. 4, n. 2, p. 333-343, aug. 2022. ISSN 2682-826X
- Liu, Q., Geertshuis, S., & Grainger, R. (2020). Understanding academics' adoption of learning technologies: A systematic review. *Computers and Education*, 151(September 2019), 103857. <https://doi.org/10.1016/j.compedu.2020.103857>
- Mantihal, S., & Maat, S. (2020). Pengaruh Pembelajaran Abad Ke-21 (Pak21) Terhadap Minat Murid Dalam Pengajaran Dan Pembelajaran Matematik: Satu Tjauan Sistemik. *Jurnal Dunia Pendidikan*, 2(1), 82-91. Retrieved from <https://myjms.mohe.gov.my/index.php/jdpdp/article/view/8329>

- Matlan, S., & Maat, S. (2021). Penggunaan Aplikasi Quizizz Sebagai Alternatif Penilaian Formatif dalam Pengajaran dan Pembelajaran Matematik. *Jurnal Dunia Pendidikan*, 3(4), 217-227. Retrieved from <https://myjms.mohe.gov.my/index.php/jdpd/article/view/16270>
- Fadzil, M. A. H., & Haruzuan, M. N. M. S. (2019). Mobile Application for G-Suite Based on Multimedia Learning Cognitive Theory. *Innovative Teaching and Learning Journal*, 3(1), 55–60.
- Porferio, M. A. J., Etcuban, J. O., De Jose, C. G., & Almerino, J. G. F. (2019). Students' Affective Belief as the Component in Mathematical Disposition. *International Electronic Journal of Mathematics Education*, 14(3), 475–487. <https://doi.org/10.29333/iejme/5750>
- Shubham, Charan, P., & Murty, L. S. (2018). Organizational adoption of sustainable manufacturing practices in India: integrating institutional theory and corporate environmental responsibility. *International Journal of Sustainable Development and World Ecology*, 25(1), 23–34. <https://doi.org/10.1080/13504509.2016.1258373>