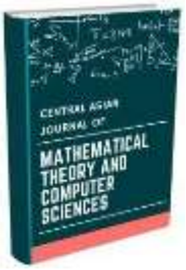

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Article

Interactive Technologies Via Smartphones and Their Impact on Motivating Mathematics Learning

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Abstract: This study aims to investigate the impact of using interactive technologies via smartphones on motivating mathematics learning among middle school students. The research adopted a quasi-experimental design, where an educational intervention was applied to an experimental group using interactive educational applications, and compared with a control group that relied on traditional teaching methods. Data were collected using a questionnaire composed of several items measuring students' levels of understanding, comprehension, active participation, and technical skills. The results indicated that students who used interactive applications demonstrated a positive level of motivation and understanding, along with increased participation and confidence in performing mathematical exercises, compared to the control group. The findings also revealed the need for additional support and continuous training to enhance students' proficiency in using the applications and to overcome certain practical difficulties in applying concepts to real mathematical problems. Based on these results, the study concluded that integrating interactive technologies into mathematics education is an effective means to promote active learning and necessitates the development of training programs and technical infrastructure to support the educational process.

Keywords: Interactive technologies, smartphones, learning motivation, mathematics learning, digital education, active participation.

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1. Introduction

Despite significant advances in the use of technology in education, students still face difficulty learning mathematics effectively and motivatingly. Mathematics is a subject that requires deep understanding and consistent practice, and students often feel bored or frustrated when relying on traditional teaching methods. In contrast, smartphones and interactive technologies offer new opportunities to make learning more dynamic and enjoyable, through educational applications that offer interactive content, quizzes, and educational games that encourage active student participation [1]. However, despite the widespread use of smartphones among students, there are insufficient studies to demonstrate the direct and tangible impact of these technologies on motivating mathematics learning. Therefore, there is a need to study the impact of interactive technologies via smartphones on students' motivation to learn mathematics, and to determine whether their use enhances interest, engagement, and a deeper understanding of mathematical concepts compared to traditional methods.

The importance of research

This study derives its importance from the growing role of interactive technologies and smartphones in enhancing mathematics learning. It seeks to develop the educational process, making it more interactive and engaging for students, and increasing their engagement and self-motivation to understand mathematical concepts. The study also provides practical guidance for teachers and decision-makers on the effectiveness of integrating interactive educational applications into school curricula. It contributes to bridging the research gap related to the impact of smartphones on mathematics learning in the Arab educational context, and encourages the optimal use of technology beyond entertainment to become an effective and innovative educational tool [2].

Research objective

The research aims to identifyInteractive technologies via smartphones and their impact on stimulating mathematics learning.

Research hypothesis

The use of interactive technologies via smartphones increases students' motivation to learn mathematics and improves their understanding of mathematical concepts compared to traditional methods.

Research limits

Objective limits:Interactive technologies via smartphones and their impact on stimulating mathematics learning.

Spatial boundaries: First Karkh Education Directorate

Time limits: The research was conducted in the academic year 2025 AD.

2. Materials and Methods

Chapter Two: Theoretical Framework and Previous Studies

First axis: theoretical framework

The concept of interactive technologies in education

Interactive technologies refer to technological tools and methods that allow learners to directly interact with educational content, whether through computers, tablets, or smartphones. These technologies are characterized by their ability to create an active learning environment, transforming the student from a passive recipient of information to an active participant in the educational process. Examples of these technologies include interactive simulations, educational games, question-and-answer activities, smart quizzes, and more [3].

Smartphones and their role in education

Smartphone use has become widespread among students and represents an effective platform for delivering educational content in innovative and engaging ways. Smartphones provide quick access to information, interaction with educational apps, and participation in group activities, promoting active learning and critical thinking. Researchers indicate that integrating smartphones into education goes beyond entertainment; they also contribute to improving students' understanding, engagement, and self-motivation [4].

Motivation to learn mathematics

Learning motivation is an internal state that drives a student to actively engage in educational activities and strive to achieve academic goals. Mathematics is a subject that requires high levels of concentration and consistent practice, making self-motivation a key factor in achieving success. Interactive technologies can enhance math learning motivation by offering challenges, competitions, and educational games that stimulate curiosity and exploration, increasing students' desire to learn and participate [5].

The impact of interactive technologies via smartphones on motivation and learning

Studies indicate that the use of smartphones and interactive educational applications contributes to:

1. Increase students' interest in academic subjects.
2. Promoting active participation in the classroom.
3. Improve understanding and comprehension of mathematical concepts.
4. Developing students' higher-order thinking skills such as analysis, interpretation, and problem solving.

This is achieved by providing engaging, multimedia content, immediate interaction, and the ability to repeat and practice as needed by the student [6].

Axis II: Previous studies

"Mobile Mathematics Learning Application as an Interactive Multimedia Tool"

Vera Mandalina, Siharudin, M. Firdaus, Abdullah, Debi Pramita, Habib Ratu Perwera Negara, 2019

Summary: This study aimed to develop and produce interactive multimedia for mathematics learning in a valid, practical, and effective manner. The researchers used a 4-D model, which includes four stages: definition, design, development, and dissemination. Data were collected using questionnaires to validate materials and media, student opinion surveys, and student evaluation tests. The results showed that the mobile mathematics learning application was effective in improving students' understanding of mathematical concepts and increasing their engagement with educational content.

“A mobile application for learning mathematics: Its effects on students’ self-perception, self-efficacy, and conceptual understanding” [7]

Summary: This study aimed to explore the effects of a mobile mathematics learning application (MALMath) on self-perception, self-efficacy, and conceptual understanding among eighth-grade students at San Jose High School in Valencia City, Bukidnon. The researchers used a quasi-experimental research design with a pre-test and post-test. The results showed a positive effect of using the application on improving students' self-perception, self-efficacy, and conceptual understanding [8].

3. Results and Discussion

Chapter Three: Research Procedures

First: Research methodology

In this study, the researcher adopted the quasi-experimental approach.(Quasi-Experimental Design) because it allows for studying the effect of using interactive technologies via smartphones on students' motivation to learn mathematics, by comparing an experimental group that used interactive educational applications with a control group that relied on traditional teaching methods. This approach is suitable for determining the relationship between the independent variable (interactive technologies via smartphones) and the dependent variable (motivation to learn mathematics).) [9]

Second: Research community

The research community consisted of middle school students in the city of [Baghdad-First Karkh], as they represent the target age group for studying the impact of smartphone use on learning mathematics. The number of students in the research community is estimated at 32125

Third: Research sample

The sample was selected by deliberate selection method.(Purposive Sampling), where two classes of students (experimental group and control group) were selected to ensure similar educational levels between them.

Table 1. Shows the research sample

The group	Number of students	Class	Selection method
empiricism	30	Fourth	Deliberate
The officer	30	Fourth	Deliberate
the total	60	-	-

Fourth: Search tool

Survey questionnaire

The researcher relied on the survey questionnaire as the main tool for collecting data on the level of students’ motivation towards learning mathematics, after using interactive educational applications.

Preparing the questionnaire in its initial form

The questionnaire was prepared according to educational literature and previous models related to motivation and interactive learning, so that it covers the following topics::

1. Student self-motivation.
2. Participate and interact with educational content.
3. Interest in mathematical concepts.

Honesty

The validity of the questionnaire was verified by presenting it to a group of experts and specialists in education and educational technology, to evaluate the suitability, clarity, and relevance of the items to the research objectives [10][11][12][13][14][15].

Correcting the questionnaire

After expert review, some items were modified to ensure clarity of language and match the students' educational level.

Stability

The reliability of the questionnaire was tested using the test-retest method.(Test-Retest), where the questionnaire was re-administered to a small sample (10 students) after a week, and the reliability coefficient was calculated using Cronbach's alpha coefficient, and it reached [the reliability coefficient value], indicating that the tool has a high degree of stability and reliability.

Fifth: Applying the tool

The questionnaire was applied to the research sample after the end of the educational experiment which lasted for [3 weeks], where the experimental group used interactive smartphone applications to learn mathematics, while the control group relied on traditional methods. After the experiment ended, questionnaires were collected and the results analyzed.

Sixth: Statistical methods

The researcher used the following statistical methods to analyze the data::

1. Descriptive analysis:Mean, standard deviation, and percentages.
2. deductive analysis:Independent samples t-test to compare the experimental and control groups, and analyze the differences before and after applying the experiment.
3. Use the programSPSSTo conduct statistical analyses and draw accurate conclusions.

Chapter Four: Presentation, Interpretation and Discussion of the Results

The research aims to study the effect of using interactive technologies via smartphones on stimulating mathematics learning among middle school students, by assessing the level of self-motivation, active participation in educational activities, and understanding of mathematical concepts.

Show results

The questionnaire was applied to the research sample after experimenting with using interactive applications on smartphones. The results came according to the weighted mean, percentage weight, and classification of each paragraph as follows:

Table 2. Students' Perceptions of Using Smartphone-Based Interactive Applications in Learning Mathematics

Paragraph number	Paragraph text	Weighted mean	Weight percent(%)	Paragraph classification
1	I have a clear understanding of the math concepts I am learning through interactive applications.	3.10	62	Positive
2	I follow the interactive exercises and challenges provided by the applications.	3.35	67	Positive
3	I feel that educational apps help me understand math concepts.	2.80	56	Positive

4	I actively participate in educational activities via smartphone.	2.75	55	Positive
5	I have the technical skills necessary to use educational applications effectively.	2.90	58	Positive
6	I have received sufficient training in using interactive applications in the classroom.	2.75	55	Positive
7	I need more support and courses to develop my skills in using the applications	3.95	79	Positive
8	I am having difficulty using some features of the educational apps.	2.60	52	negative
9	The school or teacher provides the necessary support to use the applications effectively.	3.00	60	Positive
10	I feel that apps make learning math more fun and motivating.	3.40	68	Positive
11	I find that using apps improves my participation and interaction in class.	3.85	77	Positive
12	I have difficulty applying what I've learned through apps to real-world math problems.	2.85	57	Negative
13	I feel confident using interactive apps to exercise.	2.90	58	Positive
14	I find that educational apps can enhance my understanding of complex mathematical concepts.	3.55	71	Positive

The survey results indicate that the use of interactive technologies via smartphones has a clear positive impact on motivating students to learn mathematics. Items related to understanding mathematical concepts (1, 3, 14) showed good averages ranging between 2.80 and 3.55, with a percentage weight between 56% and 71%, reflecting the applications' ability to enhance comprehension of complex mathematical concepts. Items related to participation and interaction in educational activities (2, 4, 10, 11) also showed positive levels ranging between 2.75 and 3.85, with a percentage weight between 55% and 77%, indicating that interactive applications encourage students to actively engage in class and increase interaction with educational content. Regarding technical skills and support provided (5, 6, 7, 9, 13), the results showed that students possess an acceptable level of skills, with a clear need for further training and support to improve their proficiency in using the applications effectively. On the other hand, negative paragraphs (8, 12) revealed some difficulties faced by students, such as using some application features or applying what they have learned to real mathematical problems. This highlights the need to design applications more practically and link them to the academic reality. Overall, the results confirm that interactive technologies via smartphones contribute to raising the level of motivation, understanding, and engagement among students, while emphasizing the need to provide additional training and ongoing support to maximize the benefit of these educational tools.

The study results showed that the use of interactive technologies via smartphones has a positive and tangible impact on motivating middle school students to learn mathematics. The data showed that students demonstrated a good level of understanding and comprehension of mathematical concepts, indicating that interactive applications help them grasp complex concepts more easily. The results also revealed increased participation and active interaction in educational activities, with students' confidence boosted when using applications to conduct mathematical exercises. Regarding technical skills, the results showed that students possessed an average level of ability to use applications, with the need for additional training and support from teachers and schools. Some practical difficulties were also observed, such as using certain application features or applying concepts to real-world problems, indicating the need to improve application design and connect them to the academic context.

4. Conclusion

1. The study confirms that interactive technologies via smartphones contribute effectively to motivating students to learn mathematics, and increasing their interest and participation in educational activities.
2. These applications help students understand and comprehend complex mathematical concepts in a clearer and smoother way compared to traditional methods.
3. Although interactive technologies are educationally beneficial, students need additional support and ongoing training to enhance their technical skills and ensure effective use of applications.
4. There are some practical challenges in applying what they have learned through applications to real-world problems, which calls for a more appropriate design of educational applications that focus on the applied and interactive aspect.

Recommendations

1. Providing training programs and periodic workshops for students to develop their technical skills and use educational applications effectively in learning mathematics.
2. Encourage teachers to integrate interactive technologies into the educational process on a regular basis, while providing ongoing support and feedback to enhance motivation and engagement.
3. Improve the design of educational applications so that they are easy to use and linked to practical activities and real-life situations to enhance applied learning.
4. Supporting the technological infrastructure in schools, allowing students to access educational applications smoothly and securely.

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