Quantifying the Impact of Visual Media on Mathematics Learning in Mirwais Minah Secondary School

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Abstract: Today, we live in an era often referred to as the age of communication and the Internet. Overall, information technology, including visual media, provides a suitable platform for learning and shifts the focus from teacher-centered to student-centered education. The present research aimed to determine the impact of visual media on mathematics learning in Mirwais Minah secondary school. The study involved a group of middle school students, comprising a total of 95 individuals from seventh, eighth, and ninth grades. These students were engaged in mathematics instruction, attending four sessions per week, each lasting a maximum of 40 minutes. The theoretical framework included reputable scientific articles to enrich the hypotheses, and field research was conducted to gather data. In the field research, the opinions and perspectives of a statistical population of 81 students were reflected through a questionnaire. Sampling was conducted using a non-random quota-based method according to Kerjes and Morgan's table. The research hypotheses, design, and independent and dependent variables were specified based on the research method. The independent variables included the accessibility of visual media to students and the broadcast of mathematics programs in Persian, a language most of them are proficient in. The dependent variable was the impact of watching mathematics classes through visual media on better mathematics learning in the classroom. These variables were distributed among the statistical population, consisting of students from Mirwais Minah secondary school, and the results were analyzed and interpreted using the SPSS computer program. The findings of this study indicate that there is a need for innovative teaching methods in response to the increasing advancements in science and technology. Considering the various resources examined in this research, it can be stated that educational media currently play a significant role in the educational process. Computer-based educational programs, in particular, play a vital role by providing clear, comprehensive, and realistic problem-solving environments that are

easily accessible. Through interactive representations, these programs directly enhance learning outcomes.

Keywords: learning, visual media, mathematics education, computer-based educational programs

INTRODUCTION

Mathematics is one of the most effective and efficient subjects in education. Richard Courant once said: "Mathematics is one of the highest forms of human thought, reflecting the will of humans and indicating the course of reasoning and evidence, as well as expressing the extent of human interest in perfection and beauty." Failure to achieve educational goals in mathematics can lead to weakness, disability, and failure to achieve goals related to the advancement of other sciences and technologies (Jamshidi Badrobani, Asgari, & Baqiri, 2020). The first step toward successful education is crucial, and this issue is of great importance in mathematical instructional videos. This is because of the one-sided nature of television's relationship with viewers. If an educational film fails to engage the audience and capture their attention, all subsequent efforts will be in vain (Nia, 2007). Using visual media for teaching mathematics can improve students' attitudes towards the subject. Researchers have always sought solutions to enhance students' learning outcomes in mathematics, and they have found various factors that influence academic progress in this subject. Numerous findings and studies have shown that academic progress in mathematics is influenced not only by cognitive structures but also by motivational factors such as beliefs, attitudes, and values. Since attitude is one of the crucial factors in learning mathematics, the goal of fostering interest and positive attitudes towards this subject has led to the conclusion that one of the methods for teaching and learning mathematics, which has become more prominent with the proliferation of new technologies, is learning with the help of visual media (Asareh & Zadishir, 2017). Information technology, especially visual media, has a significant impact on learning, including changes in the roles of learners and teachers, increased student participation with peers, increased use of resources outside textbooks, and growth and improvement in design and presentation skills. In general, the role of students in technology-based learning environments undergoes a transformation, where students become active participants in the learning process and engage in content creation. Additionally, information technology plays an effective role in creating motivation, depth, and breadth in learning, sustaining it, alleviating student fatigue and boredom, and fostering cognitive skills to respond to questions (Zamani & Kardan, 2010). The comprehensive use and new and diverse applications of information technology in mathematics education emphasize the role of technology as a support system in the growth of mathematical skills and concepts. It serves as an aid in problem-solving, fosters

mathematical reasoning, and facilitates mathematical communication. Amini-Far has highlighted various applications of technology that can assist in mathematics education, providing rapid feedback for students and tools for precise and quick visualization of mathematical shapes. It is presented as a facilitator for students to practice with mathematical shapes and an opportunity to demonstrate the effects of these shapes (Amini, Elaheh, Bahram, & Valinezhad Turkmani, 2010). Teaching and learning mathematics is not merely about transferring concepts and definitions to students; rather, the mathematics curriculum is also responsible for developing and generalizing mathematical concepts, fostering motivation, nurturing creativity, and establishing connections between students' learning outcomes. On the other hand, numerous studies have shown the significant impact of information technology on learning mathematics, reflecting the rapid and transformative changes in various aspects of human life.

In the modern era, information and communication technology (ICT) has rapidly transformed the world, leading to an increasing reliance on ICT in all fields, most importantly in education and learning. The use of ICT for achieving high-quality learning outcomes for all has become inevitable, necessitating a reevaluation of traditional teaching methods and their replacement for learners. With the emergence of computers, the adoption of multimedia through educational software has had a significant impact, prompting attention to their effects on educational systems, especially in the teaching and learning process, and fundamentally changing traditional learning approaches (Zowarki & Gharibi, 2012). Research in the classroom setting indicates that traditional mathematics teaching, relying on predefined formulas, often leads to dissatisfaction among students. In this method, only a small number of learners achieve understanding, and for most students, mathematics education becomes illogical and incompatible with their interests and experiences. Advanced technology provides an opportunity to create a completely new learning environment in mathematics, enhancing the meaning and understanding of classroom activities. Access to technology provides teachers and students with a platform that, when used effectively, creates opportunities to enhance mathematics learning (Beijari & Ayyati, 2020). According to studies, European schools use computer games for teaching. The findings of Robertson and Howells (2018) indicate that computer games increase students' enthusiasm and motivation and lead to a positive attitude toward learning. Teaching through games and modeling is a potential factor in interacting with students (Hossein khanzada, Ibrahimi, Hosseini, & Khodakarami, 2019). Additionally, a group of researchers found that visual and display-based teaching of numbers and mathematical materials enhances visual cortex activity, and visual perception is successful in activities dependent on cortical surface activity. Information technology encompasses a combination of text, graphics, sound, animation, and video available to

students through computers and other electronic devices (Farhang Ranjbar, Dartaj, Sahdi por, & Dawar, 2019).

The aim of examining the impact of visual media on learning mathematics is to assess the effectiveness of information technology in mathematics education. On one hand, it serves as a means to rethink and reconstruct the curriculum and computer literacy. On the other hand, it revitalizes and enriches the learning environment and facilitates interaction for learners with the necessary learning resources.

One of the most common reasons cited for the use of information technology in the classroom is better preparing the current generation of students for adapting to new learning environments to meet educational needs and, consequently, future job market demands. The burden of traditional methods and their time-consuming nature, as well as the lack of up-to-date information, prevent teachers from adequately preparing students for an ideal working environment. Therefore, incorporating information technology into classroom teaching can serve as a fundamental basis and competitive advantage in a globalizing job market, enabling educated individuals to enter the global, political, and educational arenas with a broad perspective.

Research Methodology

One of the major contemporary challenges in education is that students lack motivation to learn mathematics. This has led us to conduct field research to assess the impact of visual media on learning mathematics in the secondary school of Mirkus Minah. From a pool of students in this program, consisting of 95 individuals from seventh, eighth, and ninth grades, those engaged in education receive four mathematics classes per week, each lasting a maximum of 40 minutes. In the theoretical section, reputable scientific articles have been utilized to enrich the hypotheses, and field research has been conducted to gather data. In the field research, the opinions and views of a statistical community of 81 students have been reflected through questionnaires, selected based on non-random quota sampling using Kerjesy and Morgan tables. Based on the hypothesis formulation method of research, the independent and dependent variables have been identified. The independent variables include accessibility of visual media to students and the broadcasting of specifically mathematical programs in Persian, which most of them have full command over, while the dependent variable is the impact of watching mathematics class sessions through visual media on better learning in mathematics class. These variables have been distributed among the statistical community consisting of students of Mirkus Minah secondary school, and their results have been analyzed and dissected using the SPSS computer program.

This research endeavors to investigate the impact of visual and illustrative instruction on the learning of mathematics in the secondary education setting. It aims to make mathematical concepts, numbers, figures, curves of functions, and mathematical terminologies more accessible to students by transitioning them from

traditional formats to interactive digital platforms and computer-based painting concepts in the curriculum.

Results and discussion

Based on the analysis and breakdown of closed-ended questions and comparison with findings from previous theoretical studies, the researcher's perspective regarding the expected outcomes of this research on the subject matter is as follows:

Hypothesis one, watching math classes via visual media: It seems that watching math class sessions through visual media leads to deeper and better learning of mathematics.

To validate the above hypothesis, findings from closed-ended questions with five options (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) will be considered from secondary school students, including the theoretical fundamentals section.

Table (1): Watching math lessons from visual media indicating by percentage.

With the consideration that 49.4% chose "completely agree," 43.2% chose "agree," 2.5% chose "no opinion," 1.2% chose "disagree," and 3.7% chose "completely disagree," it can be inferred that significant percentage of students selected the option "completely agree" because the broadcast of educational programs by the media, especially for math lessons, accompanied by the movement of curves, regular drawing of geometric shapes, and presentation of practical examples through computer programs, makes the teaching process interesting and visually appealing.

Table (1)

Watching math lessons from visual media leads to deeper and better understanding of the math subject

options	Frequency	Percent
Strongly Agree	40	49.4
Agree	35	43.2
No idea	2	2.5
Disagree	1	1.2
Strongly Disagree	3	3.7
Total	81	100.0

About 75% of student learning through the use of visual senses and 13% through auditory senses occurs during the viewing of math lessons via visual media. Therefore, using visual media for deeper learning of mathematical concepts is considered one of the best methods for teaching and learning. The application of this method in math classes leads to increased interest among students in the subject because learning is accompanied by beautiful images. Since information technology is a tool for engaging both visual and auditory senses, it deepens learning among students. Additionally, information technology serves as a tool for thinking and action, enhancing students'

reasoning and creativity (Rezaeian, Sadiqi, Rashid fard, Rezaeian, & Goorbandi, 2015).

According to the researcher, the use of visual media for learning mathematics increases students' interest and encourages them to realize that mathematical concepts and content have numerous practical applications in solving computational problems in real life. Conducting math lessons through visual media influences how the pricing of independent variables in functions, which are the independent variables, changes, and consequently how their curves are drawn. In general, writing mathematical concepts and drawing function curves, along with other important topics that require graphing equations, are facilitated by the movements of slides.

Therefore, considering the findings of the research, we can conclude that the majority of respondents believe that watching math lessons through visual media leads to better and deeper learning of mathematical concepts.

Hypothesis 2: Teaching math step by step through visual media seems to lead to students' learning.

Table (2) illustrates the sequential connection of mathematical topics to each other, which cannot be shared in subsequent sessions without watching a lesson because learning new mathematical topics requires knowledge of the rules and formulas related to the previously taught subject. Therefore, teaching math step by step through visual media is broadcasted repeatedly at different times, or recording the lessons can help fill in gaps or resolve mathematical misunderstandings.

In this study, teaching math step by step through visual media, categorized into five different categories, namely: "Completely Agree," "Agree," "No Opinion," "Disagree," and "Completely Disagree." Concerning these categories, each representing 100% of respondents, 56.6% completely agreed, 30.9% agreed, 3.7% had no opinion, 7.4% disagreed, and 1.2% completely disagreed. Table (2) indicates that mathematical topics are extensive and interconnected; therefore, visual media can play a crucial role in learning mathematical concepts. Recorded math lessons provide students with the opportunity to follow all the course topics from start to finish, enhancing the learning process.

Table (2)

Educational programs from visual media, particularly on step-by-step teaching of mathematical subjects, are implemented

Options	Frequency	Percent
Strongly Agree	46	56.8
Agree	25	30.9
No idea	3	3.7
Disagree	6	7.4
Strongly Disagree	1	1.2
Total	81	100.0

Mathematics is a fundamental skill, and learning it can be challenging for most students. To acquire this skill, students need to understand mathematical concepts and be able to solve problems based on their understanding. This difficulty is addressed by using high-quality educational films, especially in math classes, which are accessible to the majority of students through media or computer-recorded films. Misunderstandings in lessons, which occur due to students' inconsistent attendance in the classroom for various reasons, are filled by visual media like this (Motazavi zadah & Azizi Mohmoudabad, 2022).

One of the effective factors in enhancing the quality of teaching mathematics is the method of lesson presentation. Presenting mathematics lessons in a structured and organized manner, engaging learners actively in the teaching process, and connecting new content with learners' previous knowledge and background are essential. It should be noted that mathematical topics should be presented sequentially and step by step because mathematical concepts are interconnected, and knowing the fundamentals and rules of mathematics helps students learn new mathematical topics. For example, a student cannot solve a fractional exponent equation without understanding the rules and principles of exponentiation. To solve such a problem, the student must first have a complete understanding of the rules and principles of exponentiation and then proceed to solve the problem.

To ensure that students consistently watch all math class sessions broadcasted by visual media, there needs to be an interest and positive attitude towards mathematics. Since attitude is one of the important factors in learning mathematics, researchers in mathematics have always been seeking solutions to increase and create a positive attitude towards this subject. They have evaluated various teaching methods to generate interest and a positive attitude towards mathematics and have concluded that one of the teaching-learning methods in mathematics, which has become more prominent with the increasing use of new technologies, especially computer-assisted instructional programs, is learning through computer programs. Given that students, especially those in the post-elementary school ages, have developed a significant interest in using information technology today, computer-assisted learning can create a positive attitude toward learning this subject.

CONCLUSION

The findings of this research indicate that watching mathematics class sessions through visual media provides students with the opportunity to address any misconceptions encountered during class and learn the course topics from start to finish without any mistakes. Additionally, all the instructional tasks assigned by teachers for better learning outcomes can be accomplished with the help of visual media. Visual media, which broadcast specially designed educational programs for mathematics subjects, first select approved educational content from the Ministry of Education and,

most importantly, hire qualified and expert teachers in the field of mathematics, which is a crucial factor in the education sector. These teachers then record the instructional programs, further enhancing the effectiveness of teaching mathematics through visual media. In general, the findings of the research lead to the following conclusions:

✓ There is indeed a need for innovative teaching methods in light of the continuous advancements in science and technology. Teachers should explore teaching approaches that can move students away from rote memorization towards genuine learning.

✓ Given the various sources examined in this research, it can be stated that educational media plays a crucial role in the educational process. The use of educational media stimulates motivation and interest in students, facilitating their learning. Since media programs enhance students' learning, their application in mathematics education is essential.

✓ Computer-based educational programs create clear, comprehensive, and realistic problem-solving environments that are easily accessible. Through interactive representations, these programs directly enhance learning outcomes.

✓ Educational films continuously broadcasted through visual media not only include lectures but also various images related to mathematical subjects, such as movements of function curves, digital drawings of different geometric shapes, deformation of function curves concerning changes in their parameters, and systematic equation pricing. All of these elements strengthen the teaching process and generate special interest among students.

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