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Study Literature of ICT toward Mathematics Anxiety for Students

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Abstract

Mathematical anxiety is the emergence of feelings of panic, helplessness, inability to act, and unable to control the mentality that occurs when someone is asked to solve mathematical problems. Mathematical anxiety has an influence on student learning outcomes. Researchers conducted an analysis of the studies that have been done related to the use of ICT-based learning media and students' mathematical anxiety. The purpose of this study was to examine in depth the use of ICT-based mathematics learning media to reduce students' math anxiety in learning mathematics. The method used in this research is literature study. The results of this study are students who use ICT as a medium in learning mathematics have lower levels of anxiety than students who do not use ICT as a medium in learning. Therefore, it can be concluded that the use of ICT-based learning media can help reduce math anxiety experienced by students when learning mathematics so as to increase interest, motivation, and student learning outcomes. The suggestion from this research is that further studies can be carried out regarding the maximum use of ICT-based learning media to overcome students' mathematical anxiety.

Keywords:
ICT, Learning Media, Mathematics Anxiety

1. Introduction

Mathematics is a subject that must be given to students from elementary school to high school level (Santoso, 2017, 32). Mathematics has a very important role in life, so it is not surprising that this subject must be given to students at every level of education. In order to be applied optimally and effectively in everyday life, mastery of mathematics is needed (Fadilah & Munandar, 2019, 459).

Based on (NCTM, 2000), there are five standards of mathematical ability that must be mastered by students, namely Problem Solving, Reasoning and Proof, Communication, Connections, and Representations. However, in reality there are still many students who have not mastered the standard of mathematical ability. This can be seen from the Program for International Student Assessment (PISA) data in 2018. In mathematical ability, Indonesia is ranked 75th out of 81 countries in the world with a score of 379. This score has decreased compared to 2015 with a score of 385. In level 5 or level 6 student achievement in at least one subject, Indonesia only has a percentage of 0.6%. While at level 2 student achievement in three subjects, Indonesia has a percentage of 51.7%. This percentage is of course very low when compared to neighboring countries such as Malaysia, Singapore, and Brunei Darussalam (OECD, 2018).

There are several factors that affect students' mathematical abilities, these factors cause low mathematical abilities in students which also affect students' mathematics learning outcomes. One of these factors is mathematical anxiety. (Santoso, 2021) explains that anxiety in a normal stage is normal and it is a response to a situation or environment that makes him feel anxious. However, if anxiety is in an

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excessive stage, of course this will interfere with our focus on something. Mathematical anxiety is the emergence of feelings of panic, helplessness, inability to act, and unable to control the mentality that occurs when someone is asked to solve mathematical problems (Tobias, 1990).

(Saputra, 2014, 78) states that feelings such as tension, anxiety, or fear in dealing with math problems are a condition of someone experiencing mathematical anxiety. A person with this condition tends to have negative thoughts about mathematics and perceives mathematics as something difficult and uncomfortable. Factors that cause mathematical anxiety to appear can come from internal personal and external experiences such as the influence of other people's responses to us in solving mathematical problems. (Riski et al., 2019, 13) stated that learning activities that do not emphasize problem solving and monotonous learning will have an impact on students' frustration when faced with math problems that lead to anxiety.

Mathematical anxiety makes students unfocused and difficult to understand the subject matter presented by the teacher. Of course, this resulted in a decrease in students' mathematics learning outcomes (Fadilah & Munandar, 2019, 460). Research that has been conducted (Ikhsan, 2019, 5) reveals that there is an influence between students' mathematical anxiety and students' mathematics learning outcomes. Students who have higher levels of anxiety have lower mathematics learning outcomes. In contrast, students who have lower levels of anxiety have higher learning outcomes in mathematics. Students' mathematical anxiety can be reduced by applying appropriate models, methods, approaches, and learning media that can make students feel conducive and can make it easier to understand the subject matter given. One way that can be done by teachers is to use ICT as a medium in learning mathematics.

The rapid development of technology makes it easier for humans in many ways, including education. Various innovations in education have emerged to facilitate and improve the quality of learning. The use of ICT (Information, Communication, and Technology) as a learning medium is one of them. (Minarti et al., 2014) defines ICT as a technology for distributing and processing data using hardware (hardware), software (software), computers, communication media, digital electronics, audio, data, networks, satellites, and other communication technologies, including application development tools and multimedia. The use of ICT as a learning medium is very widespread and diverse. In addition to being more effective, students can also develop and keep abreast of increasingly sophisticated technological developments. ICT as a learning medium is expected to reduce anxiety or feelings of tension towards math problems so as to maximize student learning outcomes.

Based on the explanation described above, the assumption is that the use of ICT in mathematics learning can reduce students' mathematical anxiety, so as to maximize students' mathematics learning outcomes. This article will discuss the use of ICT in mathematics learning on mathematics anxiety. The purpose of this study was to examine in depth the use of ICT-based mathematics learning media to reduce students' mathematics anxiety in learning mathematics.

2. Discussion

2.1 Information and Communication Technologies (ICT)

In teaching and learning activities, teachers use learning media to increase the efficiency and effectiveness of learning mathematics. Learning media is a tool used to assist teachers in delivering material to students and plays an important role in the world of education (Widodo, 2018). There are two types of learning media, one of which is learning media that is integrated with Information and Communication Technologies or ICT. UNESCO states that the notion of information technology is a discipline of science, engineering, technology, and management that is used to convey information which is an application and association with economic, cultural and social problems (Das, 2019). ICT is also defined as a tool used to store, process, and disseminate information to achieve certain goals (Ramadhani, 2020). So it can be concluded that ICT-based learning media is a tool for teachers to convey their subject matter in the form of information and communication technology that can be used to process, display, store, and convey information.

The use of ICT as a learning medium in the learning process has various benefits including: (1) helping students understand the material being studied, (2) representing and visualizing abstract ideas, (3) increasing student interest in learning materials, (4) improving quality in the learning process, (5) there is an interaction between the material being studied and the learning process, and (6) expanding access to learning (Wangge, 2020). In addition, ICT-based learning media can also (1) reach many students, (2) increase student learning independence, (3) make learning oriented to students, and (4) its use can be done anywhere (Rista, 2019). It is stated that teachers who are able to use ICT-based learning media

effectively can improve students' abilities in mathematics and are able to provide meaningful learning experiences for students (Ramadhani, 2020). Therefore, ICT-based learning media is very necessary in the mathematics learning process.

ICT-based learning media consists of several forms including: (1) computer technology, this technology consists of supporting hardware and software which includes processors, data storage media, recording devices, input devices, and output devices; (2) multimedia technology, multimedia is defined as a combination of two or more media such as speakers, CD players, video cameras, digital cameras, and others; (3) network technology, this technology consists of software such as e-mail, java, php, html and hardware such as internet, wifi, LAN, and others; (4) telecommunications technology, this technology is not only in the form of cellular telephones or facsimiles but can also be in the form of cellphones, facebook, twitter, tiktok, and so on (Rusman, 2012). There are various ICT-based learning media that can be used in the mathematics learning process, including math software, augmented reality, Microsoft Office, computer graphics, graphing calculators, and so on. With this technology students can construct and communicate their mathematical ideas.

2.2 Math Anxiety

Psychologically, anxiety is a feeling of fear, tension, low self-confidence, feeling threatened and failing to achieve the desired expectations. While physically, anxiety is characterized by palpitations, sweaty hands, nausea, and difficulty breathing so that it interferes with solving mathematical problems (Santoso, 2017). This opinion is reinforced by Nawangsari that mathematics anxiety is an uncomfortable condition which includes fear, worry, tension, confusion, feelings of insecurity in imminent danger, and dislike of subjective things (Riski et al., 2019). Mathematical anxiety is also defined as a state of panic which is then followed by a helpless condition when faced with mathematical problems (Santoso, 2017).

Mathematical anxiety can be triggered by three factors, namely: (1) emotional factors, this factor comes from one's own feelings that can be shown to others such as the lack of ability to solve mathematical problems; (2) environmental factors, this factor comes from outside oneself which is usually in the form of concerns over mathematical abilities that are not comparable to the abilities of others who are much better; (3) assessment factor, this factor is caused by students' concerns about failure when carrying out math tests (Nabilah & Umam, 2021). Peker classifies the factors that cause math anxiety into three categories, namely; (1) personality factors that arise from students such as lack of confidence and shyness in asking questions that affect students' low expectations; (2) environmental factors such as the demands of parents who want their children to be good at math, learning in class is not fun, teachers are less interactive in using models, methods, and learning media so that students feel that mathematics only memorizes long formulas and calculations; (3) intellectual factors, these factors come from students' cognitive such as not feeling the benefits of the material being taught, feeling a learning style that is not suitable for themselves, lack of enthusiasm in learning mathematics, and lack of confidence in their abilities (Artama et al., 2020). In line with this, Oktariawan argues that factors that can trigger students' math anxiety are the lack of understanding of students in mathematics learning materials, concerns about the material to be studied next, obstacles in learning such as unstable internet connections, and difficulty completing tasks within a certain period of time (Munggaran et al., 2022).

Mathematics anxiety has various levels, it was stated by Peplu that there are four levels of anxiety that can be experienced by students, namely: (1) mild anxiety, namely feelings of anxiety but accompanied by positive thoughts in order to support themselves in dealing with the problem well; (2) moderate anxiety, which is a feeling of being alert to things that will happen in the future, this is characterized by difficulty in thinking but still being able to accept other people's instructions; (3) severe anxiety, which is characterized by difficulty in thinking and only focuses on the current problem so that guidance is needed to reduce anxiety from others; (4) panic, which is characterized by difficulty communicating with others, unable to accept or carry out other people's instructions, unable to control oneself, and increased motor activity (Munggaran et al., 2022). It is different with Suharyadi (Riski et al., 2019) dividing mathematics anxiety into three aspects, namely as follows:

Tabel 1. Aspects and Indicators of Mathematics Anxiety

Aspect	Indicator
Affective (Attitude)	Restless, nervous, and not happy
Cognitive (Thinking)	Difficulty concentrating, self-confidence, fear of failure, and self-ability
Physiological (Reaction to physical conditions)	Headache, palpitations, feeling nauseous, and cold sweats

2.3 ICT-based mathematics learning media on students' mathematics anxiety

The use of ICT-based learning media can be a solution to reduce students' mathematical anxiety. Teachers can be creative and innovate to provide interesting and fun learning. This is because the use of ICT students not only learn by using cognitive aspects but also aspects of attitudes and psychomotor to the fullest (Dwirahayu et al., 2017).

In a study conducted by (Santoso, 2017) with the title *"Mengurangi Kecemasan Matematika dengan Bermain Game Logika"* it was concluded that the *Game Logika* learning media created using the Macromedia Flash 8 application was considered very interesting and could reduce students' mathematical anxiety levels. Before students are given learning using the *Game Logika* learning media, they are first given an anxiety questionnaire to determine the level of mathematics anxiety experienced by students. And after learning by using the *Game Logika* learning media, students were given a questionnaire again to find out whether there was a reduction in the level of math anxiety. From the test results, it is known that the physical aspect decreased from 76.17% to 45.38%. Likewise, the psychological aspect decreased from 75.79% to 44.65%. This is because when learning using Logic Games students become comfortable and not tense when studying mathematics.

Another study conducted by (Hidayat & Asmalah, 2022) aims to determine the differences in learning motivation and mathematics anxiety in students who use Augmented Reality and students who do not use Augmented Reality during the learning process. This study resulted in students who learn to use augmented reality have lower math anxiety and can increase learning motivation than students who do not learn to use augmented reality. The study also stated that the use of augmented reality can increase student satisfaction and self-confidence in learning mathematics.

(Irmawati & Sholihah, 2021) In her research, he developed an android application as a learning medium on opportunity material for vocational students. After the application development and assessment of the results of the development by experts. Android applications are implemented directly to students for the learning process in the classroom, showing a positive response from students that Android applications can make learning fun and eliminate the scary impression of learning mathematics. So that the use of android applications can reduce students' math anxiety and make students more confident, brave, and easy to understand the material.

Learning videos in the form of animations made with the Powtoon application can also be a solution to reduce students' math anxiety. By using this media students are more motivated in learning and learning is not monotonous so as to create a pleasant learning atmosphere. This is indicated by the average score of math anxiety on the cognitive aspect reaching 3.03, on the affective aspect it reached 2.71 and on the physiological aspect it reached 2.66. So that this learning video has a positive impact and is well interpreted on students' math anxiety (Sholihatunnisa et al., 2020).

From the results of the four articles, it can be concluded that students who use ICT as a medium in learning mathematics have lower levels of anxiety than students who do not use ICT as a medium in learning.

3. Conclusion

This research discusses the use of ICT in the mathematics learning process on mathematics anxiety with the aim of examining the use of ICT-based mathematics learning media to reduce students' mathematics anxiety in the mathematics learning process. The results of the study indicate that students who use learning media such as "*Game Logika*" made with the "Macromedia Flash 8" application, use Augmented Reality, use Android application, and learning video media in the form of animations made with the "Powtoon" application have a lower level of mathematical anxiety than those who do not use ICT-based learning media. Therefore, it can be concluded that the use of ICT-based learning media can help reduce math anxiety experienced by students when learning mathematics so as to increase interest, motivation, and student learning outcomes.

The suggestion from this research is that further studies can be carried out regarding the maximum use of ICT-based learning media to overcome students' mathematical anxiety.

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