

Learning in the 21st Century Education Era: Problems of Mathematics Teachers in the Use of Information and Communication Technology-Based Media

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Abstract:

Penelitian ini menggunakan pendekatan kualitatif deskriptif. Jenis penelitian yang digunakan dalam penelitian ini adalah studi kasus. Penelitian ini dilakukan pada tahun ajaran 2022/2023. Penelitian ini dilakukan di MAN 2 Malang. subyek penelitian sebanyak 7 oadalah guru matematika di sekolah yang mengajar kelas X sampai dengan XII. Pengumpulan data dalam penelitian ini menggunakan teknik observasi dan wawancara. Teknik analisis data yang digunakan dalam penelitian ini adalah teknik analisis data yang dikemukakan oleh Miles & Hubberman (Reduksi, Penyajian, Kesimpulan). Hasil problem yang ditemukan: 1) sebagian siswa belum memiliki pemahaman konsep matematika yang matang dan belum memiliki pengetahuan untuk mempelajari matematika dari kelas sebelumnya, dan 2) kurangnya motivasi belajar, 3) penggunaan media pembelajaran kurang efektif dalam merangsang motivasi belajar siswa, dan 4) penggunaan metode pembelajaran tidak disesuaikan dengan karakteristik siswa. 5) Guru dengan pengalaman mengajar 2 sampai 5 tahun di awal cenderung menggunakan media pembelajaran secara aktif, sedangkan guru yang sudah lama mengajar dengan pengalaman mengajar lebih dari 10 tahun cenderung menggunakan metode pembelajaran tradisional. 6) Kapasitas guru untuk menggunakan TIK masih kurang memadai, dan kapasitas guru untuk mengintegrasikan teknologi ke dalam praktik mengajar masih kurang. Dengan kata lain, guru tidak mahir menggunakan komputer dan kekurangan peralatan dan infrastruktur TIK. 7) sekolah dengan fasilitas yang ada seperti LCD, komputer, dan internet masih jarang digunakan dalam proses pembelajaran.

Kata Kunci : Pembelajaran Abad 21; Problematika Guru Matematika; Media Pembelajaran; TIK

Abstract:

This study uses a descriptive qualitative approach. The type of research used in this research is a case study. This research was conducted in the 2022/2023 academic year. This research was conducted at MAN 2 Malang. 7 research subjects were math teachers at schools who taught grades X to XII. Collecting data in this study using observation and interview techniques. The data analysis technique used in this study is the data analysis technique proposed by Miles & Hubberman (Reduction, Presentation, Conclusion). The results of the problems found: 1) some students do not yet have a mature understanding of mathematical concepts and do not have the knowledge to learn mathematics from previous classes, and 2) lack of motivation to learn, 3) the use of instructional media is less effective in stimulating student learning motivation, and 4) the use of learning methods is not adapted to the characteristics of students. 5) Teachers with 2 to 5 years of teaching experience at the beginning tend to use learning media actively, while teachers who have been teaching for a long time with more than 10 years of teaching experience tend to use traditional learning methods. 6) Teachers' capacity to use ICT is still lacking, and teachers' capacity to integrate technology into teaching practice is lacking. In other words, teachers are not proficient with computers and lack ICT equipment and infrastructure. 7) schools with existing facilities such as LCDs, computers, and the internet are rarely used in the learning process.

Keywords : 21st Century Learning; Mathematics Teacher Problems; Learning Media; ICT

Introduction

21st century learning is learning that prepares humans to remain stable with the desires of the modern century. In all efforts and quality, it is produced with institutional use

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resources that are managed professionally so as to produce maximum results (Kim et al., 2019). There are also several versions of the 21st century and the previous century, especially in the learning approach in the 20th century where the teacher in his learning used a lecture approach (Waite & McDonald, 2019). The teacher only explains, gives orders (assignments/homework) and students only listen without any discussion/feedback between the teacher and students so that it becomes more monotonous (van Laar et al., 2020). Moreover, both teachers and students in learning use less information and communication technology.

Information and communication technology or commonly referred to as ICT is technology used to process statistics, such as processing, obtaining, compiling, storing, manipulating statistics in various approaches to supply satisfactory facts, especially facts that are relevant, correct and timely (Hämäläinen et al., 2021; Inganah et al., 2023). Information creation has aspects, particularly aspects of hardware and software programs. While Communication Technology is a technological gadget including hardware, software programs, processes, and structures that are used to assist the way of conversation which aims to make the conversation successful (Rabiman et al., 2020). Furthermore, information and communication technology (ICT) is a tool for communicating information relating to the processing, management and transmission of information (Mailizar & Fan, 2020; Yim & Gomez, 2021). Information and Communication Technology covers standards especially fact creation and conversation creation.

In the current era of information and communication technology, the use of technology is a very important prerequisite for improving the quality and quality of education and expanding access to educational knowledge (Hafifah & Sulistyo, 2020; Hasanah et al., 2022). Mastery of information and communication technology is required, which is equivalent to high school skills he can use ICT. This affects the learning process in models, strategies, media, and learning assessment (Hikmah, 2020). Learning innovation during the 5.0 revolution through the use of information technology to improve the quality of learning and learning systems based on information and communication technology (Sabiri, 2020). Innovations used by teachers in the learning process consist of the use of computer devices, ICT-based learning media and LCD projectors.

This is in accordance with the 21st century learning, where the learning process cannot be separated from the role of technology. The hallmark of 21st century learning is that the world is inseparable from information and communication technology (ND Safitri et al., 2023; RWA Sah et al., 2022). Therefore, teachers also need to integrate ICT into their learning activities in order to improve the quality of teaching. With the development of the current era of globalization, teachers are required to be able to use information and communication technology. The use of information and communication technology (ICT) in learning can improve the quality of education and reduce technical stuttering of teacher competence (Quezada, 2020).

Teacher competencies used in coaching are in accordance with Article 10 Paragraph 1 of Law No. 14 of 2005 which reads:

" The ability of teachers who want to be empowered in using ICT in schools consists of the ability of teachers to apply ICT to implement learning innovations in every planning, implementation and evaluation of learning".

The method that must exist According to Wijayanti, the use of ICT has several functions: (a) Assisting teachers in administrative tasks, (b) assisting in perfecting coaching materials, increasing skills, (c) and assisting learning techniques, (d) making it easier to determine which media appropriate to be applied in the learning process according to students' difficulties and ICT characteristics, (e) helps teachers to create energetic and fun

learning, and (f) can increase learning prowess at school. Furthermore, in terms of their responsibilities and roles in education, teachers must be able to choose ICT learning strategies and layouts that students can follow. Provides many learning resources. Students can easily absorb facts and choose learning media that encourage them to study (Dell'Angela et al., 2020; Qomariyah et al., 2023). The very essential thing in learning is the use of learning media, especially in learning mathematics.

Mathematics is a subject that is used as a basic subject because mastering mathematics broadens the mind (Sugianto et al., 2022). But in reality students' love of mathematics is still very small. However, because many students' opinions assume that counting is a subject that is difficult to understand and difficult to understand, such an assumption makes many students tend not to be involved in counting (Chin & Fu, 2021; Rahmah et al., 2022; Simanjuntak & Imelda, 2019). Of course, this has a significant impact on student learning outcomes. Students continue to struggle to solve math problems in each bankruptcy and subchapter.

Mathematics plays an important role in improving all aspects of life, especially human magic (Ozen Unal & Urun, 2021; Rizki et al., 2022; Vidyastuti et al., 2022). Learning mathematics is an integral activity, especially methods that involve acquisition and education. This activity has developed into an interest that creates interaction between fellow students, students and teachers, teachers and teachers (Colomé, 2019; Siregar & Surya, 2017). Mathematics is technical knowledge that is very important in human life and students are trained to use it systematically, logically and critically through mathematics to solve problems they face in real life (Ruswanto et al., 2018; Sari & Cahyono, 2020).

The goals of mathematics in primary and secondary education approved by the Ministry of National Education in 2006 are (a) learning mathematical concepts, (b) using reasoning about style and function, and (c) arithmetic. formation, (d) talk about ideas, (e) have a way of thinking, and realize the use of mathematics in life. This shows that problem solving is one of the five most common computing processes in the department. Therefore, problem solving is one of the main concerns of numeracy training, an important part of mathematics interest, and its use in everyday life. Furthermore, because mathematics is a summary of teaching difficulties, teachers are expected to be innovative when learning in the classroom, using multiple media and strategies to make fabrics more easily understood by school children (Nasello et al., 2020; Suciati, 2018).

Media is a conversational method that connects a reassessment of facts and recipients. AECT (Association of Educational and Communication Technologies) translates media as all the bureaucracy and channels that humans use to convey information and facts (Rajkovic et al., 2019). Learning media is a key element in enhancing learning competencies and great scholars (Cábyová et al., 2020; Güner & Gökçe, 2021). This increases the motivation to learn in addition to the standard competencies related to learning outcomes (Aikina & Bolsunovskaya, 2020). Learning media is an academic device that is used as a facilitator of learning techniques to increase effectiveness and performance in achieving academic goals (Chen, 2019; Porras & Naukkarinen, 2021; Zamani & Nurcahyo, 2016). For this reason, all teachers must have good skills and knowledge of learning media. The learning media that we use can take advantage of technological advances at that time to form media. Teachers must be able to integrate learning media and technology according to the abilities and characteristics of students. The more creative and innovative the learning media the teacher uses, the more students are stimulated to learn.

Based on the results of observations at school, especially at Madrasah Aliyah Negeri (MAN) 2 Malang City, where the researcher here is one of the mathematics teachers at the school, it can be seen that MAN 2 Malang City already has ICT (computer system and LCD projector as an aid to acquire knowledge). The results of interviews conducted with other

mathematics teachers showed that some teachers already used ICT devices such as laptops/computers and LCD projectors. However, in learning the teacher has difficulty in utilizing ICT as a medium. Thus, there are still many teachers who do not use revolutionary learning media. The use of technology-based media in learning goes hand in hand with the problems faced by teachers. Therefore, it is very important to analyze what problems teachers face when using technology-based learning media.

Research methods

This study uses a descriptive qualitative approach. The type of research used in this research is a case study. This research was conducted in the 2022/2023 academic year. This research was conducted at MAN 2 Malang. Subjects are determined by several criteria: 1) Teachers at MAN 2 Malang, 2) Teach mathematics, 3) Age 25-45 years, 4) Have teaching experience of more than 5 years, 5) Have ICT (Computer, HP, or other electronic media). So that it was found that 7 o research subjects were mathematics teachers in schools who taught grades X to XII both teaching MIPS, MIPA and teaching in other majors (Acceleration Class) totaling 7 teachers (not including researchers).

Collecting data in this study using observation and interview techniques . Detailed observations were made to obtain information about the mathematics teacher's problems when using ICT. While the interview will be conducted if the observation is not answered. Interviews were conducted to learn more about the problems teachers face in using their ICT. The data analysis technique used in this study is the data analysis technique proposed by Miles & Hubberman, which can be seen in Figure 1.

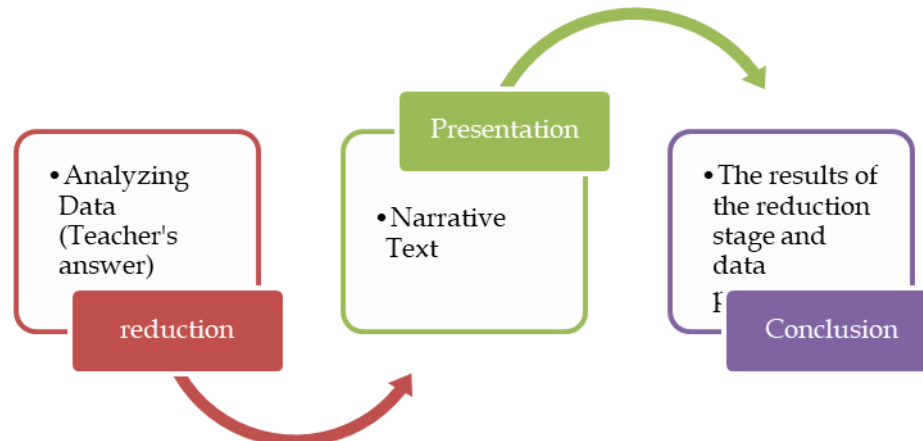


Figure 1. Stages in analyzing the observation data

In Figure 1 it can be explained the flow stages in the analysis technique carried out by the researcher, namely first by reducing data from observations (teacher's answers), this stage is carried out by analyzing the teacher's answers. Next is the presentation stage . This presentation is how the researcher can decipher (which was previously done by studying the teacher's answers) which later results of the data obtained are presented in the form of narrative sentences . The final stage is the conclusion. This stage is the result of the two previous stages (reduction and presentation of data) which means the conclusion of why this research was conducted .

To make it easier to analyze the data, the teacher's initials were coded (teacher data). Coding can be seen in table 1.

Table 1. Mathematics Teacher Coding Data at MAN 2 Malang

teacher to-	Code
Teacher 1	G1
Teacher 2	G2
Teacher 3	G3
Teacher 4	G4
Teacher 5	G5
Teacher 6	G6
Teacher 7	G7

Results and Discussion

Problems in learning mathematics

The first difficulty in learning mathematics is an underdeveloped knowledge of mathematical principles (concepts) . This affects the technique of learning mathematics in the school room.

G1 said: " The student's lack of mathematical concepts was due to being carried over from the previous grade level " .

Furthermore, G3 also added :

G3: "Yes, that's true, the student's lack of concept is also because most students have a tendency to ignore situations that have been taught at the previous grade level . "

The low mastery of students' mathematical principles at the previous level means that the teacher usually has to repeat the material and this can spend a significant amount of learning time that is wasted and cannot be used to provide explanations of new material in accordance with the RPP they already have (which was previously designed). The same thing was said by (Windari & Winarti, 2019)those who stated that students' low mastery of concepts was due to: (1) students' intelligence was not always correct, (2) abilities were lost or not in accordance with the lesson material provided by the teacher , c) learning in the classroom was lost and many more lazy to learn math.

Teacher 1 also chimed in: "Oh yes, there's more. Poor study habits, especially learning with mastery of comprehension at the rote level . Now the way they master the concept is as if we know they are learning it so a habit arises so they memorize it, but it turns out they don't do it. Even their knowledge is obtained from them , no longer with knowledge that they are able to recognize without rote learning. "

The second obstacle in the process of learning mathematics is the low motivation of students which is not true due to *online games* . The *online video game* lifestyle around the neighborhood, at school has resulted in many students flocking to it during breaks so that they often forget the time. It is compatible with G7 :

"Sometimes a lot of students skip classes, there are more when I enter class, there are students who are still playing games . "

This is consistent with the statement (Alwi, 2017) that students do not properly use their *smartphones* (which should be used to help study via the internet on their cellphones when the teacher provides *video/* material links) because of other activities such as games, scrolling through social media such as tiktok, Instagram, etc.

Teacher 3: "Students are caught when they are engrossed in playing HP, their reason is that they are studying material from the teacher. Even though they use it to play games. They only use this reason to trick parents and teachers. The second obstacle in the process of learning mathematics is the low motivation of students which is not true due to online games .

Problems in using media in learning mathematics

Difficulty The third problem in learning mathematics is the use of media. Teachers do not always use learning media, they do not use different media. Because not all mathematical content can be illustrated in concrete media, and the media used does not always support the learning material being taught.

G5: " I don't use learning media all the time because I can't explain it with any media , especially with current media. I am more comfortable with teaching like I used to do."

There are also teachers who use the media when teaching mathematics.

G7: "I have used learning media, but there are students who are confused and don't understand how the media is used , so I have to teach the media first, then I repeat the material in the lecture. "

G1 also added: "I am used to using media, but I don't understand the material taught well, and I feel the need to use it repeatedly." Mathematics students only waste time when using media while studying "

This result is supported by a statement from (Husna et al., 2021), which states that the teacher prefers to teach with lectures , because according to him using instructional media is just a waste of time. When students cannot adjust to one learning method at the same class level at the same time. The use of this learning is not uniform This method results in the achievement of learning objectives that are not evenly distributed for each class at the same level .

Problems in using media in ICT-Based mathematics learning

The teacher's problem in using conversational technology-based learning media in learning mathematics can be defined as follows:

First, the length of teaching experience. Based on the evaluation results of the 7 teachers, most of them had teaching experience of more than 5 years and some even had more than 10 years.

Second, the obstacles in studying mathematics a. According to the results of the evaluation of unusual problems in learning mathematics found : (a) to students , among others: students are less active in participating in learning, low student interest in learning, loss of basic math skills, slow level of student knowledge of the concepts given so that the teacher has to repeat cloth often. (b) Problems originating from the teacher include: the

teacher lacks mastery of the material to be taught, students with extraordinary backgrounds so that the teacher experiences difficulty with student knowledge, the teacher loses the ability to make learning media, especially technology-based media.

Third, the learning techniques used . The use of interesting and innovative learning strategies is also important to increase students' hobbies and activeness in learning. According to the evaluation results of various strategies used by several teachers, especially cooperative, discovery learning, expository, problem solving, TGT (Team Game Tournament), PBL (Problem Based Learning). But there are still some teachers who still use the lecture technique. Of the 7 teachers , almost all of them used lecture techniques more frequently in learning mathematics .

Fourth, the use of ICT as a learning medium . Learning media is very important in improving the quality of learning and students' abilities. In the latest technological revolution, it is expected that teachers can use technology-based learning media. However, from the evaluation of the effects received from 7 teachers , there are still five teachers who no longer use ICT. This is because currently MAN 2 does not require its teaching staff to apply ICT in learning.

Fifth, problems in using ICT-based learning media . The use of ICT-based learning media is certainly inseparable from the various problems faced by teachers. Based on an evaluation of some of the problems encountered through teacher facilities, namely: (a) The infrastructure and guidelines provided through school facilities are not sufficient to use technology in learning together with computers, the internet and LCD, the level of teacher ability in using technology in learning mathematics is still low , teachers lack self-confidence and self-confidence while coaching the use of technological equipment and studying mathematical concepts that are not in accordance with the technology used.

Sixth, increasing skills in ICT learning . More courses/schools are needed to improve teachers' expertise in technology as it is very important to improve Indonesian teachers' expertise in this aspect. However, in fact there is no special education related to technology that can improve the pedagogical abilities of Information and Communication Technology through teacher means. Based on the results of the evaluation, several topics were obtained by schools in using technology when studying at school, but became limited so that these topics were no longer fully understood.

Information and Communication Technology includes many technologies that enable us to receive information and communicate or exchange information with others, with devices and functions to capture, interpret, store, transmit information. ICT is a term used to describe exciting and innovative ways to provide lifelong learning with global access to information, learning and support. In the teaching and learning process, of course, there are subjects and objects that play an active, dynamic and interactive role in the learning space, both inside and outside the classroom.

Based on the results of the analysis of observations and interviews with the subject, namely the teacher, it was obtained data that the length of teaching experience also influences the use of technology-based media in learning. Teachers with teaching experience of more than 10 years teach more using lecture or conventional methods and do not use learning media , whereas teachers with previous teaching experience of 2 to 5 years are more active in using learning media and various learning methods such as cooperative learning, discovery learning , expository, problem solving, TGT (Team Game Tournament), PBL (Problem Based Learning).

So far, teachers still lack skills in using ICT, as well as the ICT facilities and infrastructure they have. On the other hand, schools that already have facilities such as LCDs, computers and the internet are rarely used in the learning process. Also, schools do not require teachers to use their ICT for learning. The most important thing is that the

material is conveyed well, the teacher is also comfortable in teaching, can make good use of time. but in reality Another thing that can limit is time. The teacher's comfort in using traditional learning methods which are considered easier and not too difficult. The inability of teachers to integrate technology into teaching practice. They lack computer knowledge and skills and are not enthusiastic about change and integration with computer-based learning in the classroom. Teachers lose confidence and lack confidence when teaching using technological tools and mathematics learning materials that are not in accordance with the use of technology.

Procurement of ICT devices is also very important for the successful implementation of learning using ICT media. Without the right media , implementing learning in technology-based media is very difficult. Along with the development of the times, the development of technology is also very rapid. There are many electronic media that can help you get the most out of your studies. The lack of specific training that can improve teachers' technology teaching skills is also a contributing factor to the slow adoption of technology by teachers. Some teachers only receive training while studying , but are limited and never fully mastered.

To provide teachers with hands-on training in technologies that facilitate learning and engage students in learning. Training must be regular or continuous, so one time is not enough. A consistent training program is more likely to maximize results. Training materials must also be adapted to educational needs. The training material must recognize the benefits of what is being trained

Conclusion

The problems of learning mathematics at MAN 2 Malang are 1) some students do not have a mature understanding of mathematical concepts and do not have the knowledge to learn mathematics from previous classes, and 2) lack of motivation to learn. There are many students who do not want to study . Motivation to learn mathematics is low, 3) the use of learning media is less effective in stimulating student learning motivation, and 4) the use of learning methods is not adapted to student characteristics. 5) Teachers with 2 to 5 years of teaching experience tend to use learning media actively, while teachers who have been teaching for more than 10 years tend to use traditional learning methods. 6) Teachers' capacity to use ICT is still lacking, and teachers' capacity to integrate technology into teaching practice is lacking. In other words, teachers are not proficient with computers and lack ICT equipment and infrastructure. 7) On the other hand, schools with existing facilities such as LCDs, computers and the internet are rarely used in the learning process.

Suggestion is for the teacher to pay attention to the various types of problems that arise in class and find solutions. The teacher must be able to provide a framework if the problem is related to mastery of the concept. If the problem is related to motivation, the teacher should offer psychological guidance and approaches. If the problem is related to learning media, the teacher should use media that is appropriate to the subject. If the problem is related to the characteristics of the students, the teacher should use learning methods that suit the characteristics of the students in the class. Each class is always treated differently because it adjusts the conditions of the class. Participating in teacher training, the lack of special training to improve teacher skills in teaching technology is also one of the reasons teachers don't use technology-based media for learning. Some teachers only received training in college, but it was limited and never fully mastered.

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