Mathematics Teachers' Perceptions of Ethno-STEAM Learning Using Digital Application

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ABSTRACT
The study aims to determine the perceptions of junior high school Mathematics teachers regarding Ethno-STEAM based learning using digital applications. This study was a quantitative descriptive. A questionnaire as an instrument in collecting research data was distributed to 33 Mathematics teachers as respondents. 93.9% of teachers stated that they had used technology in learning, and 69.7% of teachers had used the Ethno-STEAM concept in the learning process. According to teachers, the use of digital applications in Mathematics learning process provided several advantages as well as disadvantages.100% of teachers stated that it is important to use digital applications in Mathematics learning process in the future.

Keywords: Digital Application, Ethno-STEAM, Perception

1. BACKGROUND

Education has always been an important concern for the Indonesian government. One of the indicators of education is students' numeracy literacy skills. Numeracy literacy is the knowledge and skills to obtain, interpret, use, and communicate various numbers and mathematical symbols to solve practical problems in various contexts of everyday life; then analyze the information displayed in various forms (graphs, tables, charts, etc.) to make decisions [1]. Numeracy can form rational reasoning and reasoning techniques in daily activities [2], [3]. Indonesia periodically conducts assessment activities to determine students' numeracy skills both internationally and nationally. The Program for International Student Assessment (PISA) is an international survey to map students' numeracy skills. The results of PISA in 2022 showed that students' numeracy skills were still far below average. Compared to the previous PISA test results, the average PISA score in 2022 also decreased [4]. Meanwhile, nationally, students' numeracy skills are known through the Minimum Competency Assessment (AKM). AKM measures competency in depth, not just content mastery [5]. The results of the AKM in 2022 showed that 57% of

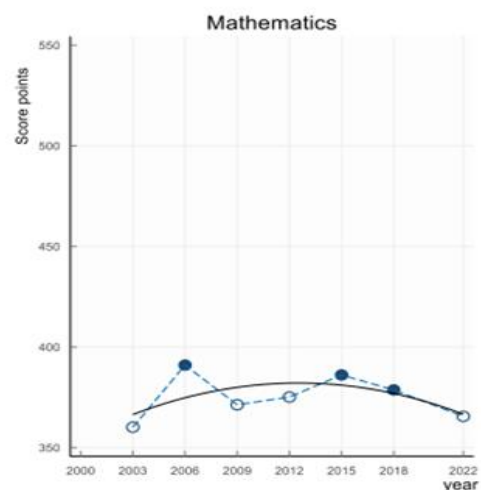students from various levels of education had not achieved the minimum numeracy competency [6].

Figure 1 PISA Mathematics Results 2022

This condition certainly needs to be addressed wisely by all parties, especially for academics in Indonesia. The government has issued various policies to improve students' numeracy skills. One of them is the

school digitalization program that has been carried out since 2019. School digitization is the implementation of new student-centered learning, using multimedia, prioritizing collaborative work, information exchange, and encouraging critical thinking and problem solving [7]. Many digital applications are offered in the world of education to help teachers in the learning process, ranging from unpaid and paid digital applications. The government itself also provides digital platforms to help teachers develop themselves as a means of learning.

Researchers have also conducted several studies related to the development of students' numeracy skills. Various strategies have been carried out, for example learning with an ethnomathematics approach [8], [9], [10], numeracy-oriented questions [11], and there are also online games [12]. Several studies also show a significant impact of Science, Technology, Engineering, Art, Mathematics (STEAM)-based learning[13].

Most of the research were conducted by researchers have a significant positive impact on the use of various learning methods involving digital applications, ethnomathematics, STEAM. However, what is the perception of teachers as implementers of the learning process in schools? According to Law No. 14 of 2005, teachers are professional educators who have the main task of educating, teaching, guiding, directing, training, assessing, and evaluating early childhood through formal education and secondary education [14]. The role of teachers is very important in the world of education starting from being a facilitator, motivator, model, assessor, counselor, class manager and planner of the learning process in the classroom so that the learning potential of students is optimal [15]. Therefore, teachers are the spearhead in the learning process. It is also necessary to know the perception of Mathematics teachers themselves regarding the implementation of Ethno-STEAM learning with digital applications.

2. RESEARCH METHODOLOGY

This study is a quantitative descriptive research. Quantitative descriptive research is a research that describes, examines, explains, summarizes and analyzes quantitative data as it is without the intention of testing a hypothesis [16], [17]. The research instrument was a questionnaire distributed online to 31 junior high school Mathematics teachers from schools in Yogyakarta and Central Java Province.

3. RESULT AND DISCUSSION

3.1. Demographics of Research Participants

The participants in this study were 33 Mathematics teachers with different backgrounds in terms of school location, gender, employment status, teaching experience, and teacher certification status.

3.1.1. Gender of Participants

There were 9 male teachers (27.3%) and 24 female teachers (72.7%). So, there are more female teachers than male teachers.
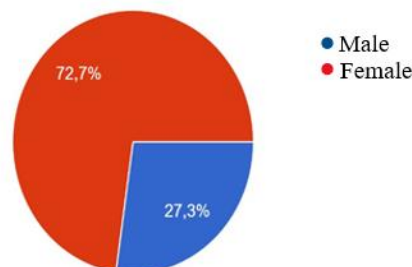

Figure 2 Teachers Gender Distribution

3.1.2. Location of the School

The teachers who filled out the questionnaire were Mathematics teachers from schools located in the provinces of Yogyakarta and Central Java. There were 26 teachers from schools in Yogyakarta (78.8%) and 7 teachers from Central Java (21.2%).
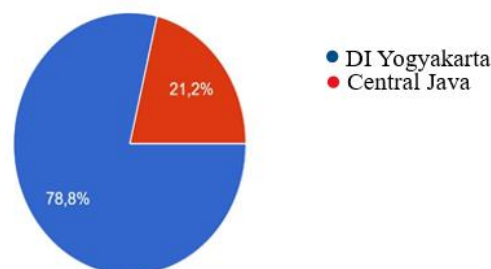

Figure 3 Province of Origin of School

3.1.3. Employee Status

Based on their employment status, there are 18 teachers who have government employee status (54.5%), and 15 teachers who do not have government employee status (45.5%).
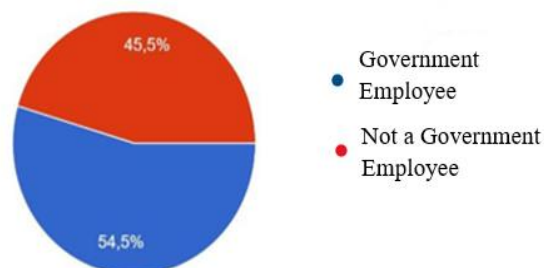

Figure 4 Employee Status of Teacher

3.1.4. Teaching Experience

As many as 14 teachers have less than 10 years of teaching experience (42.4%), 11 teachers have 10 to 20 years of teaching experience (33.3%), and 8 teachers have more than 20 years of teaching experience (24.2%).
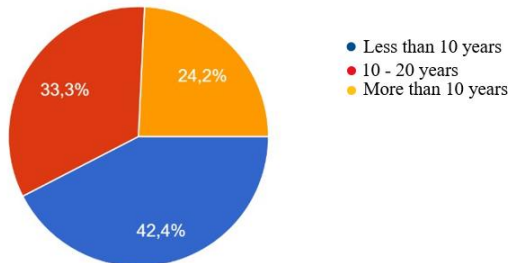

Figure 5 Teaching Experience

Thus, teachers with less than 10 years of teaching experience were more likely to be respondents, followed by teachers with teaching experience of between 10 and 20 years, and teachers with more than 20 years of teaching experience.

3.1.5. Teacher Professional Certificate Status

Based on the teacher certification status, 20 teachers have been certified (60.6%) and 13 teachers have not been certified (39.4%).
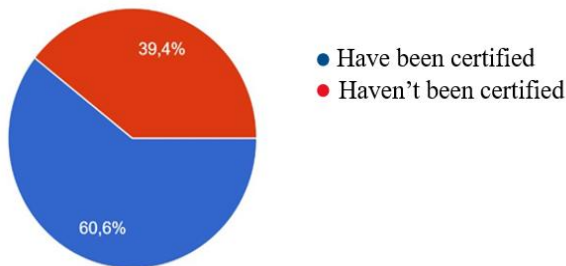

Figure 6 Teacher Professional Certificate Status

This means that there are more teachers who have been certified than teachers who have not been certified.

3.2. Teachers' Experiences Using Digital Applications in Learning

93.9% of Mathematics teachers stated that they had carried out Mathematics learning with digital technology, such as photo math, ChatGPT, and the like, while the rest (6.1%) of teachers had never used digital technology.

Have you ever carried out mathematics learning using digital applications on smartphones/ internet?
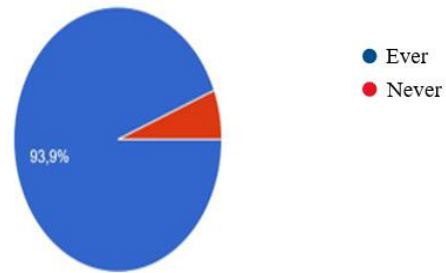

Figure 7 Questions and teacher's answers about implementation of mathematics learning with digital technology

The data above clearly shows that almost all mathematics teachers have used digital applications in learning, although the teachers who were respondents in this study were mostly women. A study [18] related to gender differences in the use and skills of technology in most of North America and East Asia revealed that there were no gender differences in technology skills with samples mostly in the world of education.

Currently, there are various digital applications available for learning. Likewise in the mathematical calculations themselves, many applications can be used [19]. By using a smartphone, various digital applications can be easily accessed. Many studies have been conducted related to the use of digital applications in Mathematics learning, both applications that are already available and ready to use and applications developed by researchers or teachers themselves. The Quizizz application was used by students using computers or cellphones [20], [21], [22]. The games feature in this application makes students feel happy and provides meaningful learning. Quizizz combined with learning videos were used by [23]. Photo math was also used in algebra learning [24]. Meanwhile, interactive E-Books was developed to facilitate students' digital literacy [25]. An interactive learning media using android assisted by google site was also developed [26]. Moreover, there are many other developments that have been carried out by experts.

3.3. Teachers' Experiences Using Ethno-STEAM in Learning

69.7% of teachers have used the Ethno-STEAM context in the learning process. The remaining 30.3% have never used Ethno-STEAM in the learning process. This means that most teachers have experience in managing the mathematics learning process with the Ethno-STEAM approach.

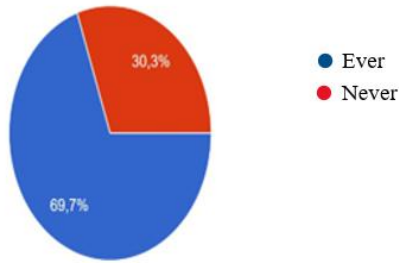Have you ever conducted mathematics learning using the STEAM context?

Figure 8 Questions and teacher's answers about implementation of Ethno-STEAM in mathematics learning

This is in line with several studies conducted by researchers to develop students' numeracy skills. Various efforts and strategies have been made, such as starting learning by presenting mathematical problems with an ethnomathematics approach[27], [28]. Ethnomathematics can be developed in various mathematics learning [29]. Likewise with STEAM-based mathematics learning. Research relevant to STEAM in learning has increased significantly in the period from 2012 to 2021. The use of STEAM in learning has spread to the continents of Asia, America, and Europe [30].

3.4. Teachers' Responses Regarding the Use of Ethno-STEAM Using Digital Applications

All mathematics teachers who were respondents stated that it is important to implement Ethno-STEAM with digital applications on certain mathematical topics. Integration of digital technology in mathematics learning with the Ethno-STEAM approach can be done to optimize learning outcomes.

To optimize learning outcomes, do you think it is important to use Ethno-STEAM with digital applications in studying certain topics?
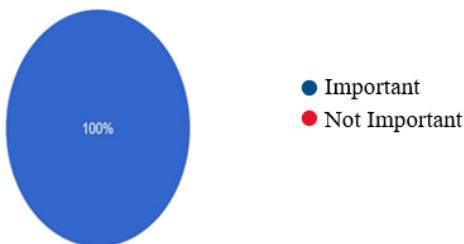

Figure 9 Questions and teacher's answers about implementation of digital technology and Ethno-STEAM in mathematics learning

In line with the statement[31] that technology must be integrated into learning in schools through appropriate learning methods because the current generation is a generation that has been able to access technology easily since an early age. In STEAM-based learning, technology is a very important part, which is able to provide new learning experiences and learning techniques [32]. The existence of new technology allows for changes and pedagogical approaches that provide opportunities for students to be more active and can learn according to their own abilities and speed [33], [34]. According to[35], [36] STEAM-based learning has a significant impact on developing students' numeracy skills. Furthermore, STEAM supports the quality of learning through collaboration and multimodality, flexibility, reflection, experimentation and curiosity [37]. STEAM is able to build an open mindset, develop critical, creative and communicative competencies.

3.5. Advantages and Disadvantages of Integrating Digital Technology in Learning.

Teachers state the advantages and disadvantages felt when using digital technology in learning. There are several advantages of using digital technology in mathematics learning, namely (1) makes the material more interesting and interactive; (2) facilitates access to various learning resources; (3) allows for varied practice questions and automatic evaluation; (4) fosters student interest in mathematics lessons; (5) enables students to understand and visualize abstract mathematical concepts; (6) attracts student involvement and is able to motivate students in learning; (7) encourages more enjoyable learning; (8) helps teachers in creating questions that are appropriate to student abilities (differentiation); (9) gives chance for students to learn anytime and anywhere according to their own speed.

The advantages conveyed by the teacher above are directly proportional to the advantages conveyed by previous teachers and researchers. Technology gives students the freedom to access digital knowledge according to their learning style. The use of technology helps students achieve their potential academic[38]. The use of digital technology in learning must be accompanied by teaching students to use technology responsibly and with self-discipline [39]. Teachers need to follow technology that is able to provide learning that is not limited by time through virtual learning. Teachers are expected to be able to overcome the traditional learning paradigm and support the new learning paradigm which requires policy support in Education[40].

Meanwhile, the disadvantages of learning using digital technology conveyed by teachers are as follows: (1) Smartphones and the internet can be a source of distraction because students can be tempted to open other applications that are not relevant to learning; (2) Learning through applications can reduce direct interaction between teachers and students, which is important in understanding students' personal learning needs. (3) The quality of learning is highly dependent on a stable internet connection, which can be an obstacle in certain areas. (4) Teachers need more time to prepare learning needs; (5) Learning is too instant so that students think less critically because they rely on applications on smartphones; (6) Teachers who lack the

skills get difficulties to create learning media with the help of digital media/applications on smartphones/the internet; (7) There are limitations in the capacity of smartphones owned by students.

Along with teacher complaints about the lack of teacher ability in preparing learning with digital applications, [41] revealed his findings that there is a gap in available skills and the need for technology use in Education. Teachers are less interested and do not want to learn new learning methods using technology, while students are positive about the use of technology in Education. Teacher preparation is still very limited in the use of technology in the field of Education[42][43] There are still few experts who are able to prepare technology in Education. However, this is in contrast to the findings[43] that the enthusiasm and ability of teachers in using technology to facilitate learning has increased not only in using existing technology but also in creating their own content according to needs.

Related to the tendency of students who are tempted to use technology not only for learning is a problem in almost all parts of the world. Addiction to the use of technology has become a global problem, especially in children who cannot be separated from games[44]. Intervention and recovery are needed, policies and prevention efforts to control the use of technology and improve the quality of life. Thus, our role as teachers is to control and facilitate students so that they can use technology not only for playing but also to achieve learning goals in the classroom. Government support is also needed in this regard. Not only support to improve teacher competence in carrying out learning that is integrated with Education, but also support in the form of facilities and infrastructure such as internet coverage to schools, availability of computers in schools, and other things related to digital learning. This government support is expected to be able to reduce the shortcomings felt by teachers in learning.

4. CONCLUSION

Numeracy literacy is one of the education indicators that is of special concern to the Indonesian government. Based on the results of assessments conducted on a national and international scale, students' numeracy skills continue to decline. Consequently, various efforts for improvement have been made by the government and teachers. Various learning strategies have been developed by researchers, including the ethnomathematics approach and Science, Technology, Engineering, Art, Mathematics (STEAM)-based learning. Many digital applications have been developed to be used in the learning process.

All mathematics teachers have the perception that implementing ethnomathematics, science, technology, engineering, art, mathematics (Ethno-STEAM) with digital applications in mathematics learning in junior high schools is important to do. Although the integration of digital technology in learning has disadvantages,

there are also advantages that can help optimize learning outcomes.

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