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The utilization of digital mathematics comics as an effort to enhance literacy and numeracy and to instill character in Students

Binti Anisaul Khasanah [a,1,*], Susilo Hartono [a,2], Astoni Nurdin [a,3]

[a] Universitas Muhammadiyah Pringsewu Lampung, Agung Timur, Pringsewu, 34174, Indonesia
[1] bintianisaul@umpri.ac.id; [2] susilohartono@umpri.ac.id; [3] astoninurdin@umpri.ac.id
* Corresponding Author

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ABSTRACT

In accordance with the main problem, namely a decline in assessment results on literacy, numeracy and character indicators of SD Muhammadiyah Waringinsari from 2022 to 2023. So it is necessary to carry out PKM activities with the aim of improving the ability of teachers in partner schools in creating digital media in the form of digital comics in an effort to improve literacy and numeracy as well as in an effort to instill character through the storyline in digital comics. SD Muhammadiyah Waringinsari already has technological support from both the government and the Muhammadiyah Association. Teachers also have personal technological facilities such as laptops and cellphones that are used in digital learning. Some of the points produced and achieved in this PKM include; teachers can produce digital comics well, and the level of understanding of partners at the beginning and end of the activity regarding the material presented during the workshop was measured using a pretest and posttest, the results increased. The next activity is in the form of mentoring and scaffolding in the creation of digital mathematics comic media for teachers of grades 3, 4, 5, and 6. Through this activity, it is hoped that teachers will be able to design digital mathematics comic media for use in learning activities so that students' literacy and numeracy increase and can instill character through the storyline in the digital comic.

KEYWORDS
Digital Math Comics
Literacy
Numeracy
Character

1. Introduction

SD Muhammadiyah Waringinsari, which is a partner in this Community Service (PkM) activity, is part of the Muhammadiyah organization's charitable efforts that actively contribute to the advancement of national education. The condition of the partner in terms of regional potential is that the partner's location is situated in Sukoharjo District, which is still in a rural environment. Along with the development of technology, education in Indonesia must be able to prepare future leaders who are responsive and have character in facing the changes of the times, including partner schools with characteristics of Islamic-based learning. In facing the digital world, digital literacy has become a crucial skill that students must master as part of the generation of leaders in the future [1]–[3]. The use of digital technology in education can enhance the quality of learning through the utilization of technology-based learning resources and media [4].

Although it has a B Accreditation status, SD Muhammadiyah Waringinsari already has technological support from both the government and the Muhammadiyah Organization as the managing charitable institution. Teachers also have personal technology facilities such as laptops and mobile phones that can be used as tools for utilizing technology in learning. However, the reality is that the issue of utilizing this technology remains one of the main problems faced by partners, even though the teachers, in terms of potential, are still young and capable of learning and adapting to technology well. Another issue related to the

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professional development of teachers is that many teachers, including school principals, are honorary teachers. As a result, they do not have many opportunities to develop themselves through various intensive and in-person technology training sessions. This results in teachers making less use of the digital tools available around them for learning, and they still rely on textbooks as the main source of learning. However, based on the results of previous interviews with the principal, the students of SD Muhammadiyah Waringinsari are already capable of using smartphones, and almost all parents of the students own Android phones. This is evident from all the parents who joined the class WhatsApp group. This indicates that all students/guardians have Android phones that can be utilized by students as a learning resource.In addition, it is known that SD Muhammadiyah Waringinsari also has a set of LCD projectors that teachers can use for classroom learning. This shows the potential that every school has to utilize technology in learning activities, and it is a pity if it is not used optimally. The use of technology in learning can prevent students from feeling bored and make them more enthusiastic about studying [5], [6]. In addition, the independent curriculum that has been implemented at SD Muhammadiyah Waringinsari must also be supported by the use of technology in learning. According to [7], [8] the implementation of the independent curriculum in elementary schools requires teachers to possess a competent level of digital skills in accordance with the established standards.

Based on the presentation and the conditions in the field above, it can be concluded that the utilization of technology in learning at SD Muhammadiyah Waringinsari needs to be improved so that the progressive ideals of Muhammadiyah can be realized through learning activities. In addition, although it has been accredited with a B status, it is also known that the literacy and numeracy skills at SD Muhammadiyah Waringinsari have declined over the past two years. According to [9], numeracy literacy and digital literacy are closely related and both aim to help students understand and use information in the modern world. On the other hand, as a Muhammadiyah school that embodies Islamic values, it is certainly necessary to integrate character-building in every learning activity. However, in the last 2 years, the character indicators of SD Muhammadiyah Waringinsari have also experienced a decline. This is based on data obtained from the national assessment AKM Kemdikbudristek report on the education report of SD Muhammadiyah Waringinsari for the year 2022-2023. Based on this data, it is known that there is a decrease in the three aspects measured, namely literacy, numeracy, and character from 2022 to 2023. Literacy skills decreased from 55.17 in 2022 to 52.38 in 2023, with a difference of 2.79 points. A more significant decline occurred in numeracy, from 34.48 in 2022 to 28.57 in 2023, a decrease of 5.91 points. The character aspect also declined, from 53.58 in 2022 to 50.1 in 2023, with a difference of 3.48 points. This decline indicates the need for special attention to improving these three aspects again so that better results can be achieved in the future.

Thus, it is necessary to carry out community service activities aimed at enhancing the skills of teachers in partner schools in creating digital media in the form of digital comics in an effort to improve literacy and numeracy, and it can also be utilized in character building through the storyline present in the digital comics. It is consistent with [10]–[12] that digital comics can be used as a medium for student literacy and numeration in learning. Considering that mathematics is still regarded as a difficult subject by students, in order to attract their interest in mathematics, the proposed product is a mathematics comic. By using comic media, students will be motivated to learn mathematics, and the perception that mathematics is difficult and unenjoyable can transform into a fun subject, ultimately leading to improved student learning outcomes [13]–[15].

Based on the issues mentioned, the priorities for the partner's problems to be resolved are:

- The limited ability of teachers to produce digital media that makes learning more engaging and enjoyable, in line with the technological advancements experienced by students. This issue will be addressed through socialization activities and workshops on the use of digital math comics in learning activities.

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- The absence of digital math comic media that teachers can utilize to enhance literacy, numeracy, and character development in students, thereby creating a more effective and meaningful learning experience. This issue will be resolved through intensive mentoring activities related to the creation of digital math comics to be used in learning activities.

Digital math comics can be used as a solution to the problems occurring at SD Muhammadiyah Waringinsari with the aim of:

- Increasing Students' Reading Interest With an appealing visual format and simplified narration, students are more interested in reading and understanding the material presented.
- Strengthening Numeracy Understanding Comics can present mathematical concepts in everyday contexts that are easy to understand, helping students grasp the application of mathematical concepts in real life.
- Instilling Character Comics can also contain moral messages and character values that can be woven into the story, thus not only conveying academic material but also shaping students' personalities.

Thus, SD Muhammadiyah Waringinsari has great potential to develop more engaging and effective learning by utilizing digital math comics. However, support in the form of socialization and workshops for teachers, as well as the provision of digital math comic media through mentoring activities, is needed

2. Method

PKM is carried out through several stages of activities, namely the preparation stage, the implementation stage, and the evaluation stage. The stages of activity are systematic steps used for the implementation of the PkM carried out as shown in the Fig. 1.

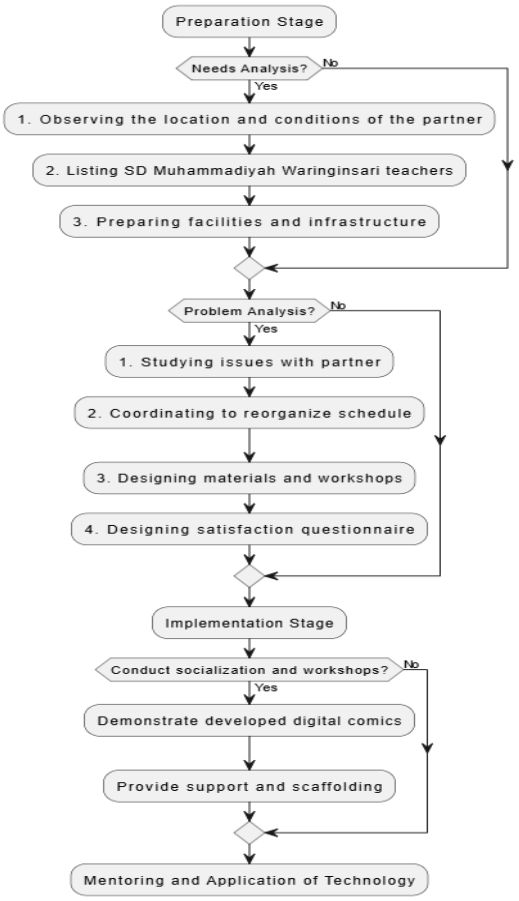

Fig. 1. Flow of PkM implementation

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Based Fig. 1, the explanation of each stage in the implementation of the PKM activities is as follows:

- Preparation

  In the preparation stage, there are three activities carried out by the PKM team:

  - Needs Analysis

    This PKM activity begins with the issues raised by the partner to the proposing team regarding the lack of utilization of digital media in learning and the absence of digital media that can be used to enhance literacy, numeracy, and character building in students, particularly in mathematics learning through digital comics. Based on this, the proposing team, together with the partner, identifies the needs that will be addressed in the implementation of the PKM activities. The needs analysis activities conducted include:

    - Observing the location and conditions of the partner, including initial observations related to the teachers' ability to create media in the form of digital mathematics comics.
    - Listing the teachers of SD Muhammadiyah Waringinsari who will participate in the PKM activities.
    - Preparing the facilities and infrastructure needed to support the smooth implementation of the PKM.

  - Problem Analysis

    - In the problem analysis activity, the proposing team collaborates with the partner to study the issues faced by teachers in their efforts to improve literacy and numeracy as well as character building in students.
    - Coordinating with the partner to reorganize the schedule for the implementation of the PKM activities.
    - Designing materials for socialization and workshops/training.
    - Designing a questionnaire to assess the partner's satisfaction with the implementation of the PKM

- Implementation

  The activities in the implementation stage are:

  - Conducting socialization and workshops related to the creation of digital media in the form of digital mathematics comics that can be utilized as learning media to enhance literacy, numeracy, and character building for students.
  - Demonstrating the digital media product in the form of digital mathematics comics that have been developed by the proposing team.
  - Providing support and scaffolding to teachers to directly create digital mathematics comics both online and intensively at the partner's location.
  - The application of technology in the form of utilizing the digital mathematics comics created by the proposing team together with partners through a mentoring program in classroom learning activities

The digital comic media that has been previously developed by the proposing team serves as an illustration of the science and technology implemented in this PKM activity, as shown in Fig. 2 and Fig. 3.

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Fig. 2. Excerpt from the story in E-Colate (E-comic Lampung Matematika)

Fig. 3. Excerpt from the story in the E-Comic Mathematics Folklore of Lampung, "Buaya Perompak"

3. Results and Discussion

3.1. Preparation Stage

In the preparation stage, three activities will be carried out by the PKM Team.

3.1.1. Needs Analysis

This activity is conducted in collaboration with the PKM partner to analyze what is needed by the partner, namely SD Muhammadiyah Waringinsari, regarding using digital media in learning to enhance literacy, numeracy, and the instillation of character in students, particularly in mathematics education. This activity began with observing the location and the condition of the partner. Based on the results of observations and interviews, it was found that SD Muhammadiyah Waringinsari has a set of LCD projectors that teachers can utilize in classroom learning. This can be seen in the following Fig. 4. The next activity is to list the teachers from SD Muhammadiyah Waringinsari who will participate in the PKM activities, which include socialization and workshops, totaling 11 teachers, as well as the mentoring for the creation of digital math comics involving 4 class teachers.

Fig. 4. Learning activities using an LCD projector

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3.1.2. Problem Analysis

Based on the results of interviews with the principal of SD Muhammadiyah Waringinsari, it was found that there has been a decline in assessment results in the areas of literacy, numeracy, and character at SD Muhammadiyah Waringinsari from 2022 to 2023. Therefore, it is necessary to conduct community service activities aimed at enhancing the skills of teachers in partner schools by creating digital media in the form of digital comics to improve literacy and numeracy, which can also be utilized in character-building through the storylines present in the digital comics. The next activity involves preparing the facilities and infrastructure needed to support the smooth implementation of community service activities, including designing training/workshop materials such as digital learning media, digital comics, and mathematics learning media to enhance literacy and numeracy, digital mathematics comics as learning media, mathematics learning media for instilling character in students, and character building through stories in digital comics. Subsequently, the community service team will prepare a questionnaire to assess the partners' understanding at the beginning and end of the activities using the pretest and the posttest.

3.2. Implementation Stage

The activities carried out during the implementation phase consist of socialization and workshops on the use of digital math comics. The documentation of the workshop activities can be seen in the Fig. 5.

Fig. 5. Activities During the Implementation of Socialization and Workshop

The level of understanding of the partners before and after the activities regarding the material presented during the workshop was measured using pretests and posttests that were administered. The results of the pretest and posttest can be seen in the Fig. 6.

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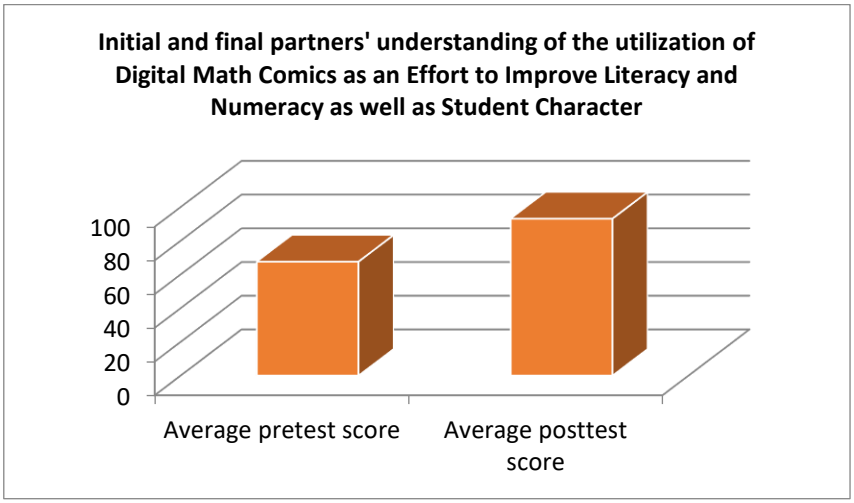

Fig. 6. Results of the pretest and posttest of partners' understanding at the beginning and end regarding the use of digital math comics to enhance literacy, numeracy, and the instillation of character in students

Fig. 6 shows a comparison of the average pretest and posttest scores of partners' understanding of the utilization of digital mathematics comics which shows an increase. This improvement can also be seen in teacher competence, namely the teacher's ability to utilize digital comics to support learning. Teachers become more confident in integrating digital technology into mathematics learning. By using digital comics, students understand abstract mathematical concepts more easily, which has a positive impact on their literacy [16] and numeracy skills. This is in line with findings showing that using digital comics can increase students' interest and motivation to learn [17]–[20]. In addition, digital comics contain moral and character values that students can learn while building character values in everyday life. These results also reinforce that the use of educational technology innovations, especially digital comics, has a real impact on literacy, numeracy, and character education-based learning at SD Muhammadiyah Waringinsari.

The next activity involves support and scaffolding in the creation of digital math comic media for teachers of grades 3, 4, 5, and 6. Through this activity, it is hoped that teachers will be able to design digital math comic media for use in learning activities. This activity is conducted both online and offline, allowing for more frequent and intensive support activities. Here is the documentation of the activities conducted through WhatsApp Group, Google Meet, and direct visits to the school, which can be seen in Fig. 7.

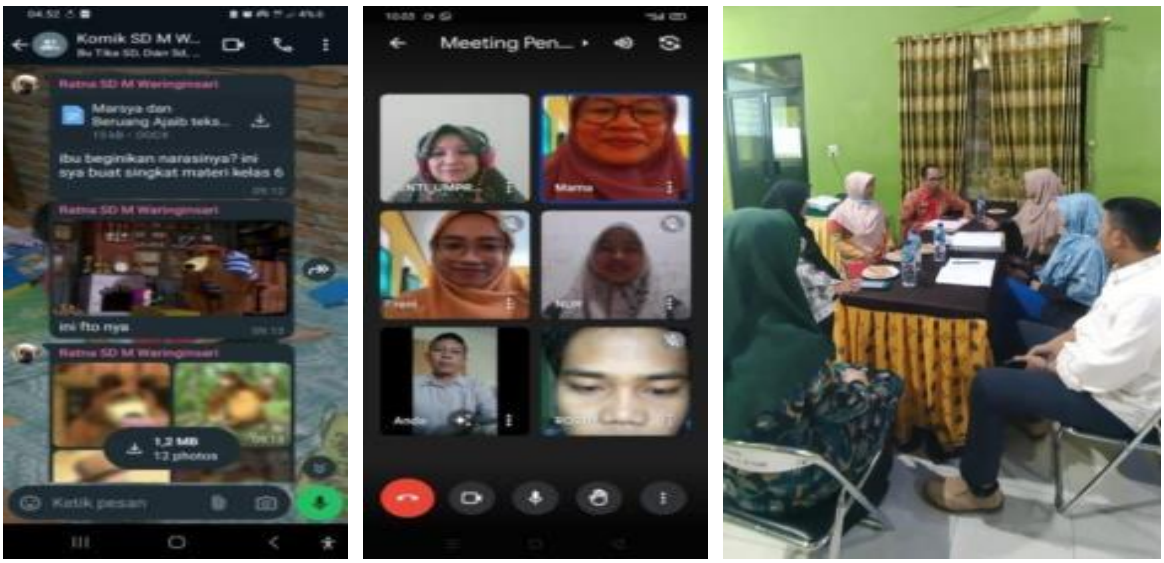

Fig. 7. Activities of mentoring and scaffolding in the creation of digital math comic media

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This mentoring activity produced 8 IPR-certified digital math comics that are ready to be used by teachers in learning activities. The eight digital math comics cover curriculum-compliant material and are designed to improve students' numeracy literacy. The comics are also designed to instill character values, such as honesty, discipline, and cooperation. Previous research shows that math comics are effective in improving students' numeracy literacy [21]. The advantages of using digital comics as learning media. Comic displays provide visualization of abstract mathematical concepts and make it easier for students to understand the material. In addition, digital comics that are made can also be used without having to be connected to the internet, making it easier for students to learn independently [20], [22], [23]. Comics can increase students' interest in reading through simple language with interesting illustrations which can have an impact on their literacy skills [11]. In addition, stories in comics can be inserted with moral messages that help in the formation of students' characters [24]–[26]. The implementation of digital comics in mathematics learning at SD Muhammadiyah Waringinsari is expected to improve students' literacy and numeracy, as well as instill positive character values.

4. Conclusion

The main issue, there has been a decline in assessment results on the indicators of literacy, numeracy, and character at SD Muhammadiyah Waringinsari from 2022 to 2023. Therefore, it is necessary to conduct community service activities aimed at enhancing the skills of teachers in partner schools in creating digital media in the form of digital comics, to improve literacy and numeracy, as well as to be utilized in character-building through the storylines present in the digital comics. Several points produced and achieved in this Community Service Program (PKM) include: teachers can create digital comics effectively, and the understanding level of partners before and after the activities regarding the material presented during the workshop, measured using pretests and posttests, has improved. The next activity involves support and scaffolding in the creation of digital math comic media for teachers of grades 3, 4, 5, and 6. Through this activity, it is hoped that teachers will be able to design digital math comic media to be used in learning activities, thereby enhancing students' literacy and numeracy, as well as instilling character through the storyline present in the digital comics.

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Declarations

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