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DEVELOPMENT OF WEBTOON APPLICATION-BASED MATH COMIC MEDIA (KOMIKA) IN LEARNING TO IMPROVE STUDENTS' NUMERACY LITERACY SKILLS

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Abstract:
This research was conducted in response to the problems that seventh-grade students face in learning mathematics in the classroom, such as boredom and low achievement grades compared to the school's Minimum Completeness (KKM). The research aims to describe mathematics comic media's development process, validity, practicality, and effectiveness. The study was conducted at MTsN 2 Surabaya class VII G. The data collection techniques used were field notes, validation, response questionnaires, and test techniques. Furthermore, the research data obtained were analyzed using data analysis of field notes, validity, and practicality. Based on the results of the study, it was found that: (1) The process of developing math comics by using the Plomp development method. (2) The math comic media was declared "valid" with an average validity score of 3.534. (3) The math comic media was declared "practical" in the criteria of getting a "positive" response with a score of 81.79%. (4) The math comic media is declared effective because the percentage of learning completeness is above 70%, and there is an increase in students' numeracy literacy skills with an N-Gain value of 0.657. As for the effectiveness of the learning media itself, it can be seen from the results of the N-Gain test calculation which shows that the average value of the N-Gain Score is 0.657, including the moderate category with a minimum N-Gain value of 0.13 and a maximum of 1.00. So, using math comic media has a moderate effectiveness category with a percentage value of 44% in improving students' numeracy literacy skills.

Keywords: Math Comic, Webtoon App, Numeracy Literacy Skills

PENGEMBANGAN MEDIA KOMIK MATEMATIKA BERBASIS APLIKASI WEBTOON (KOMIKA) DALAM PEMBELAJARAN UNTUK MENINGKATKAN KEMAMPUAN LITERASI NUMERASI SISWA

Abstrak:
Penelitian ini dilakukan sebagai respon terhadap permasalahan yang dihadapi oleh siswa kelas VII dalam pembelajaran matematika di kelas, seperti kebosanan dan rendahnya pencapaian nilai dibandingkan dengan Ketuntasan Minimal (KKM) yang ditetapkan oleh sekolah. Tujuan dari penelitian adalah mendeskripsikan proses

pengembangan, kevalidan, kepraktisan, dan keefektifan dari media komik matematika. Teknik pengumpulan data yang digunakan yaitu catatan lapangan, teknik validasi, teknik angket respon, dan teknik tes. Selanjutnya data penelitian yang diperoleh dianalisis menggunakan analisi data catatan lapangan, kevalidan, dan kepraktisan. Berdasarkan hasil penelitian, ditemukan bahwa: (1) Proses pengembangan komik matematika dengan dilakukan menggunakan metode pengembangan Plomp. (2) Media komik matematika dinyatakan "valid" dengan rata-rata skor kevalidan dalam sebesar 3,534. (3) Media komik matematika dinyatakan "praktis" dalam kriteria mendapat respon "positif" dengan skor sebesar 81,79%. (4) Media komik matematika dinyatakan efektif karena persentase ketuntasan hasil belajar di atas 70% dan terdapat peningkatan kemampuan literasi numerasi siswa dengan nilai N-Gain sebesar 0,657.

Kata Kunci: Komik Matematika, Webtoon, Kemampuan Literasi Numerasi

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INTRODUCTION

In this era of Industrial Revolution 4.0, education plays a vital role in the nation's progress, making the next generation superior and able to compete, especially in mathematics. Mathematics is one of the most important subjects to be taught at every level of education because it is the basis for developing other sciences. Mathematics lessons must be given to all students starting from elementary school to equip them with logical, systematic, critical, and creative thinking skills and the ability to work together (Kilpatrick, 2020). At the junior high school/MTs level, mathematics is a general subject included in Group A subjects, regulated by the Ministry of Education and Culture article 5, paragraph 6, concerning the education curriculum. That is why math is a subject that students need and must be taught by educators at all levels of education (Sheppard & Wieman, 2020). In addition, mathematics is the primary influence on the intelligence of students' thinking power and the revolution of modern science and technology today (Voskoglou & Salem, 2020). Learning math can build students' thought processes to find, process, and use existing information to get a conclusion used to solve daily problems (Nur, Waluya, Rochmad, & Wardono, 2020). It is also related to the Regulation of the Minister of National Education No. 22 of 2006 related to content standards in mathematics education; the content

standard regulations are also in line with the definition of numeracy literacy according to PISA, namely the ability to formulate, apply, and interpret mathematics in various situations that mathematics is a vital subject for all levels because it will have a significant effect on the thinking process. Mathematics is essential for all levels because it affects students' thinking processes (Goos & Kaya, 2020).

Discussing numeracy literacy cannot be separated from PISA (Programme for International Mathematics and Science Study) and TIMMS (The Trends in International Mathematics and Science Study), two international programs that monitor student literacy in several countries (Kadijevich, Stephens, Solares-Rojas, & Guberman, 2023). The definition of numeracy literacy quoted from the 2018 PISA report is the ability of individuals to formulate, apply, and interpret mathematics in various contexts. Numeracy literacy can be construed as the ability of individuals to use their mathematical knowledge to solve problems from multiple life contexts (Rakhmawati & Mustadi, 2022). This says that numeracy literacy is not only about being able to carry out procedures in solving mathematical problems but also about utilizing mathematics in everyday life, which contains dimensions of critical thinking, creativity, and problem-solving (Ahdhianto, Marsigit, & Nurfauzi, 2020). Literacy skills serve to develop students' knowledge, skills, and confidence to develop their thoughts, perspectives, and perspectives on various things around them. This helps a person recognize the role of mathematics in life and make judgments and decisions rationally and logically (Smith, Maynard, Berry, Stephenson, Spiteri, Corrigan, & Smith, 2022). Matics learning supported by good numeracy literacy skills will improve students' ability to solve various daily problems (Sumarto, Junaedi, Ahmadi, Marwoto, & Sumarni, 2022).

Speaking of the importance of mathematics in learning at school, several problems occur. The problem in the teaching and learning activities sector is that math learning is to be unsuccessful (Mazana, Montero, & Casmir, 2020). The results of both national and international reviews in Indonesia show results that could be more optimal for learning mathematics (Juandi, Kusumah, & Tamur, 2022). Indonesia's ranking in mathematics achievement is at the 44th level out of 49 countries, as shown in research conducted by TIMSS (Trends in International Mathematics and Science Study) in 2015. The research shows that students' mathematics achievement in Indonesia could be improved. Facts in the field based on data obtained during PLP 2 Uin Sunan

Ampel Surabaya at MTsN 2 Surabaya City, the results of the achievement of the midterm exam scores of class VIII found that the average mathematics score of 4 classes was only 34.65 in mathematics. In this case, student scores are very far from the Minimum Completion Criteria (KKM) value set by the school, which is 76. In addition, from the results of observations and interviews with mathematics teachers in class VIII MTsN 2 Surabaya City, it can also be seen that during the learning process, students mostly tend to be passive, feel bored quickly, and only record the material presented without having to understand the meaning and benefits of the material learned in everyday life. Given the importance of numeracy literacy in learning mathematics in schools, there are also related problems. The 2018 PISA study released by The Organization for Economic Cooperation and Development (OECD) showed that Indonesian students' numeracy literacy skills received a 379 out of an average score of 487.9. This is similar to the results of the TIMSS study 2015, in which Indonesia received a score of 395 out of an average of 500. The following survey is still about the low interest in reading, based on a study of one of the research institutions entitled world's most literate nations ranked conducted by central connecticut state university in march 2016. Reading interest is still five years old, although Indonesia ranks above European countries regarding infrastructure assessment to support reading (Darmiyanti & Taufik, 2022). One of the influences of the need for more interest in reading is cell phone technology, where students prefer to play on their cell phones for hours rather than read books. Students' interest in literacy is still relatively low due to various factors, including the fact that students are more engrossed in playing on cell phones (Gezgin, Gurbuz, & Barburoglu, 2023).

Entering the 21st century, the wave of globalization is powerful and open; we cannot avoid the rapid advancement of technology. We must take advantage of these technological advances to create innovations related to all the problems in learning mathematics (Hernandez, Diaz, & Menendez, 2020). One of them is by making learning media for math comics. The simple nature of comics, with story elements that contain information and are poured into images, can be used as learning media, especially when combined with math lessons (Arafik, Putra, Putro, Nisa, & Wiarsih, 2021). Math comic media is one of the tools or objects in the form of a story that uses a series of images and is equipped with speech balloons and certain symbols to convey messages containing mathematical calculation problems (Akcanca, 2020). Comics used to be in the form of books, with technological advances, one of which developed

into online digital comics. Webtoon is among today's most popular online digital comic applications (Maity, 2022). Webtoon is part of social media because it includes elements of participation, openness, community, and interconnectedness. Webtoon is a digital comic application with 6 million active users in Indonesia and 35 million active users worldwide (Shim, Yecies, Ren, & Wang, 2020). Webtoon has many fans worldwide, and 60% of its readers are 15 or older (Jeong, 2020). Webtoon is a prevalent application among students and adults and is very appropriate if used to learn media. Based on this description, researchers are interested in using the webtoon application to develop math comic media to improve students' numeracy literacy. The webtoon application in this study is used to access the math comics that will be used to make it easier (Amalia, Sutarto, & Pranoto, 2022).

Numeracy literacy consists of three indicators, namely having the ability to understand related symbols and numbers in mathematics, analyze information that is displayed in various forms (graphs, tables, charts, etc.), interpret the results of the analysis to predict and make decisions in solving problems related to daily life with mathematical concepts (Zulfayani, Ariawan, Nufus, & Kafrina, 2023). Three aspects of numeracy literacy skills, researchers think math comics media is the most appropriate for improving students' numeracy literacy skills. Math comics will contain a lot of writing, pictures, graphs, tables, and so on, with stories of everyday life and contextual problems that can improve students' numeracy literacy skills.

The integration of digital technology in education has become a prominent trend, driven by the need to make learning more engaging and accessible. The development of webtoon application-based math comic media (Komika) reflects this trend by leveraging visual and narrative elements of webtoons' to enhance students' numeracy literacy skills. Numeracy literacy, a critical component of 21st-century skills, involves applying mathematical reasoning in real-world contexts. Komika aims to present visually appealing and contextually relevant mathematical concepts, addressing the challenge of low engagement and comprehension in traditional mathematics learning. Research by McCloud (2000) on using comics as an educational medium highlights their potential to simplify complex ideas through visual storytelling. Comics allow learners to interact with content more engagingly and memorably. Studies by Mikulecky (2017); Yang (2012) reveal that digital comics can support literacy development, including comprehension and critical thinking, making them suitable for teaching abstract subjects like

mathematics. Kwon, Park, and Park (2019) explored the use of webtoons in education, emphasizing their appeal to younger audiences and their potential to foster motivation and engagement. Chung, Kim, and Lee (2020) found that webtoon-based learning applications improve learning outcomes by providing relatable, real-world contexts for applying theoretical knowledge. Research by Geiger, Goos, and Dole (2015) identifies numeracy literacy as a vital skill for modern learners, highlighting the need for innovative pedagogical approaches. Sinclair, Pimm, and Higginson (2016) studied the role of interactive digital media in mathematics education and reported significant improvements in student engagement and achievement. Recent studies, such as those by Anastasia and Reni (2022), show that incorporating comics into mathematics learning increases conceptual understanding and fosters a positive attitude toward the subject. Wijaya, Doorman, and Keijer (2023) tested webtoon-based media for mathematics and found improvements in numeracy literacy, especially for complex problem-solving tasks.

The development of Komika aligns with the broader consensus in educational research that technology-enhanced learning environments, particularly those employing narrative and visual elements, improve learner outcomes. Noetel, Griffith, Delaney, Harris, Sanders, Parker, and Lonsdale (2022) multimedia learning theory supports the idea that combining visuals and narratives enhances cognitive engagement and retention. Komika, by presenting math concepts in story-based formats, resonates with this principle. Rosedi (2024) argues that student engagement is a critical factor for success, and multimedia tools like Komika have proven effective in boosting this engagement. Abella, Kilag, Andrin, Taniza, Groenewald, and Cordova (2024) identify numeracy literacy as foundational for navigating contemporary challenges. Innovative educational tools like Komika directly address the gap in numeracy literacy by making math accessible and enjoyable. Researchers such as Walker (2023) argue for the role of visual learning in education, asserting that comics and similar media blend visual and textual learning, catering to diverse learner profiles. The state of the art for webtoon application-based math comics is well-grounded in existing literature and supported by empirical evidence. It fills a gap in engaging educational media and aligns with broader educational objectives of enhancing numeracy literacy. By integrating insights from previous research and expert opinions, Komika emerges as a promising innovation in mathematics education, offering a scalable and effective solution to improve students' numeracy literacy skills.

The research gap from this research is that while digital tools and comics have been explored individually, there needs to be more research on integrating webtoon-style comics with mathematical concepts to address numeracy literacy. Most existing studies focus on general literacy improvement using comics or web-based tools. Few studies specifically address how these media can enhance numeracy literacy, particularly for abstract mathematical concepts. Current methods for improving numeracy literacy often need more student engagement. There is a need for media that aligns with younger generations' preferences and digital habits. Research on the effectiveness of webtoon-based learning tools in improving numeracy skills still needs to be completed, particularly in measuring cognitive understanding and practical application.

The research aims to design and develop a webtoon application-based math comic (Komika) that combines mathematical concepts with engaging storytelling and visual elements. The comic will enhance students' numeracy literacy skills by presenting mathematical problems and solutions in contextual, story-based scenarios. To enhance students' numeracy literacy skills by presenting mathematical problems and solutions in contextual, story-based scenarios. To enhance students' numeracy literacy skills by presenting mathematical problems and solutions in contextual, story-based scenarios. Enhance students' numeracy literacy skills by presenting mathematical problems and solutions in contextual, story-based scenarios.

The research aims to enhance students' numeracy literacy skills by presenting mathematical problems and solutions in contextual, story-based scenarios. The research confines itself to developing and testing a single platform (Komika) without exploring compatibility or integration with other educational tools or systems. The research confines itself to developing and testing a single platform (Komika) without exploring compatibility or integration with other educational tools or systems. The research confines itself to developing and testing a single platform (Komika) without exploring compatibility or integration with other educational tools or systems. The research confines itself to developing and testing a single platform (Komika) without exploring compatibility or integration with other educational tools or systems. These gaps, objectives, and boundaries provide a clear framework for examining how webtoon-based math comics can improve numeracy literacy while highlighting the research's limitations and focus areas.

METHODS

The type of research used by researchers is Research and Development (R&D) development research. Because researchers want to develop math comic media (Komika) to improve students' numeracy literacy skills. The development model used in this study is an adaptation of the Plomp development model. The phases of the Plomp model development are: (1) the preliminary research phase, (2) the prototyping research phase, and (3) the assessment phase.

The preliminary research phase involves identifying the needs and challenges in teaching numeracy literacy through a literature review and surveys or interviews with teachers and students. This phase explores existing studies on digital learning tools, webtoon media, and numeracy literacy, providing insights into user preferences, difficulties, and expectations. It establishes the theoretical framework and guides the design of Komika by determining its target audience, content scope, and key features. In the prototyping research phase, the Komika application is developed based on the findings from the preliminary phase. The prototype integrates mathematical concepts into webtoon-style comics and undergoes iterative testing with experts, teachers, and small groups of students. Feedback from these tests is used to refine the storyline, visuals, and technical functionality to ensure alignment with educational objectives and user needs. The assessment phase evaluates Komika's validity, practicality, and effectiveness through implementation in actual classroom settings. Pre- tests and post-tests measure improvements in students' numeracy literacy skills, while questionnaires, interviews, and observations provide qualitative and quantitative feedback on usability, engagement, and overall performance. This phase determines whether Komika effectively enhances numeracy literacy and meets its educational goals.

The data analysis for this research involves assessing the validity, practicality, and effectiveness of the Komika application. Validity is determined through expert validation using rubrics that evaluate content alignment, pedagogical quality, and technical design. Data from these validations are analyzed on a likert scale, and a media is considered valid if it meets a high threshold. Practicality is assessed by collecting feedback from teachers and students through questionnaires that measure usability, engagement, and clarity of instructions. Descriptive statistical analysis is applied to determine the average practicality score. Effectiveness is evaluated

by comparing pre-and post-test results of students' numeracy literacy skills using paired t-tests or gain score analysis to identify significant improvements. Qualitative data from observations and interviews also support these findings.

The research instruments include expert validation rubrics, teacher and student response questionnaires, pre-and post-test questions focused on numeracy literacy, observational checklists, and semi-structured interview guidelines. The study is conducted in selected schools, including both urban and rural settings, to ensure diversity and representativeness. The research subjects consist of junior high school students at MTsN 2 Surabaya class VII G, who are within the targeted grade levels, emphasizing numeracy literacy, and mathematics teachers who integrate Komika into their classrooms. Experts such as media developers, mathematicians, and educators validate the content to ensure its quality and alignment with educational objectives. Criteria for the Validity of Mathematics Comic Materials if Score Interval $3 \leq VR \leq 4$ Valid.

Mathematics comic media is practical using a questionnaire of student response results. Student response data is obtained from a questionnaire sheet given to students, which contains statements to assess the learning that has been given. This analysis was carried out by calculating the percentage score of each statement provided on the questionnaire sheet. If the overall percentage score reaches specific criteria ($70\% \leq NR < 85\%$ and $85\% \leq NR$), then the math comic media is considered practical and can be used in learning. Furthermore, the data from the questionnaire can also be used to evaluate specific aspects, such as ease of use, content comprehensibility, visual appeal, and contribution to material understanding. Thus, the results of this analysis not only show the level of practicality and provide input for further media development.

The effectiveness of math comic media is measured through the percentage of students' completeness and proven by increased numeracy literacy. There will be two things analyzed. First, Analysis of Student Learning Outcomes. This learning outcome data is quantitative data that describes the numeracy literacy skills of students after learning (post-test). After that, this data is calculated using individual and classical techniques. Individual techniques calculate that students meet the criteria for completion if they get a score ≥ KKM set at the school where the research will be conducted. Meanwhile, in the calculation with the classical technique, completeness is assessed by the number of students who achieve scores above the KKM, with a percentage of student success in one class reaching 70%. Second, the results of improving numeracy literacy skills should be analyzed. The analysis technique

used in this stage is calculating the data from the pretest and posttest results to assess the improvement of students' numeracy literacy skills. The data was grouped using Microsoft Excel 2010 and analyzed using SPSS software version 25. The analysis steps taken to determine the results of numeracy literacy improvement are as follows: (1) Calculating the results of pretest and posttest scores of numeracy literacy based on a predetermined assessment rubric, (2) Conducting a normality test on the pretest and posttest data, (3) Conducting a paired t-test to determine the difference between pretest and posttest data and to determine the existence of an increase in students' numeracy literacy skills, (4) As for measuring the increase in posttest-pretest results, the authors used the N-Gain test to see how far the improvement obtained in the use of related media, the N-Gain value serves to see the difference between pretest and posttest. Math Comic Media meets the effective criteria if it shows high or medium interval results (0.3 > N-Gain > 0.7 and N-Gain > 0.7).

RESULTS AND DISCUSSION

Several activities are carried out at the preliminary research stage, including curriculum analysis, student analysis, material analysis, and analysis of comic making needs analysis; each of these analysis activities provides different results, curriculum analysis, knowing the curriculum used in daily learning at MTsN 2 Surabaya. The curriculum used as a research site is MTsN 2 Surabaya City, and in-class VII is the independent curriculum. So, making stories on Komika refers to the merdeka curriculum. In student analysis, an initial description of the initial condition of students. How are students' abilities when working on math problems? This information is obtained from the results of discussions with the math subject teacher and the results of observations and research with the students themselves. With the students themselves. According to the results of a brief discussion with the mathematics teacher at MTsN 2 Surabaya City, the average seventh-grade student finds it challenging to understand and work on math problems, as can be seen from the students' scores. Math problems can all be seen from the scores of students with an average score below the KKM set by the school. By the school. In addition, based on interviews with seventh-grade math teachers that researchers have conducted, the teacher felt that students were often bored and eventually ignored the teacher when explaining the material. In the material analysis, a description of the material that will be used as research in class VII MTsN 2 Surabaya City will be described. Material analysis reviews the selection and

determination of relevant material to be used as the primary material in Komika. Based on the independent curriculum, the teacher has determined the learning outcomes used in the school.

Tools and software are needed to prepare math comics in the analysis of comic making needs. The author has discussed this with an expert who is a student of UIN, Sunan Ampel Surabaya, who has visualized his writing in math comics. Who visualized his writing through digital images and got some information to analyze the needs in making math comics. The author has determined that some of the equipment and software used in making Komika are as follows: Webtoon is the leading media, and later, the comics will be uploaded to this platform. This platform makes it easy for readers to access or read Komika. Adobe Photoshop 2018 is used as the main application in making Komika. This application serves to unify all Komika elements that have been created by supporting software. Easypose is used to help the author sketch characters in Komika so that the author does not need to draw characters from scratch. This software can be used on Android and iOS. Planner 5D was used to help set up the room. This software can help to set the characters and rooms used in this comic to be seen from the left side, the right side, and the right side in this comic to be seen from the left side, right, up, or down. IbisPaint X is used to draw characters that Easypose Software has created to add colors or character variations as desired. Character variations as desired.

Several activities are carried out in the prototyping research phase, namely islamic nuanced mathematics comic design, validation, and revision, from which each of these activities provides different results. The scenario creation stage begins with developing stories from ordinary story problems adapted to the learning outcomes used at MTsN 2 Surabaya City. After creating a story based on ordinary story problems obtained from several research studies, the next step is determining the main character, his character, and nature and then designing the conversation for each panel and designing the conversation for each panel.

Besides the attractive image side, one of the crucial things in making comics is the form of conversation in comics. The conversation must be simple, not too many sentences, not have many meanings (ambiguous), and can reach readers, especially junior high school/MTs students. The problem based on these difficulties was discussed with the supervisor. Then, the information was obtained so that additional illustrations, especially on the core or main problem in the story, were provided in the conversation. In preparing the story, the

scenario used is related to everyday life. This is intended to make it easier to digest the problems presented. The author uses the title "Mr. Rice Field Rental" in this comic. Mr. Udin is the main character in the comic. He is directed as a character who always has daily problems, and solutions appear to help Mr. Udin solve his problems. In preparing the scenario, there is a character description and characterization of the central and companion characters. The characters of the leading and companion characters' characters are arranged so that the story displayed is alive and real.

After the scenario creation has been finalized, the next step is to create a storyboard. The storyboard is a tool to channel story ideas into visual form. The form is illustrated panels containing visualizations of scenes from the scenario. Making storyboards using Adobe Photoshop 2018 and assisted with IbisPaint X as the drawing media. as the drawing media. The ink used to make the storyboard is gray, and there are still many strokes of the image, which is the form of the initial design of the comic image. Besides that, on the storyboard, there is a step to determine the number of panels on one sheet of paper and the size of each panel.

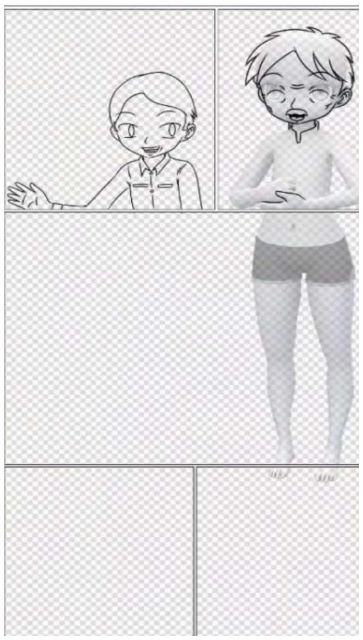

Figure 1. Storyboard Overview and Rough Sketches

The sketch stage details the image on the storyboard, meaning that the image is thickened using black ink. Sketches on Islamic math comics are made using Adobe Photoshop 2018 and are assisted by IbisPaint X. This process

makes the images on the comic already visible. The following is the appearance of Islamic math comics that have gone through the sketching process.

Figure 2. Math Comic Sketch

The next step is coloring. Coloring is a reasonably important phase because it determines the proper color gradation to make the comic look more attractive. The media used in the coloring process is IbisPaint X. The following is the appearance of the math comic that has passed the coloring process.

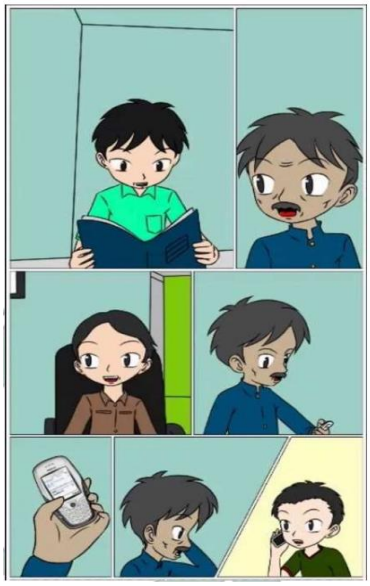

Figure 3. Coloring Process of Math Comic

After the coloring process, the next step is to create word and thought balloons and captions and then insert text. The compiled math comics were uploaded to the Webtoon app. Before uploading, the comic must be cut into pieces (image slices) using the size specified by webtoon. The next step is uploading comics on the Webtoon App. The process includes uploading a square thumbnail, determining the genre, writing a series title, explaining, and uploading comic content.

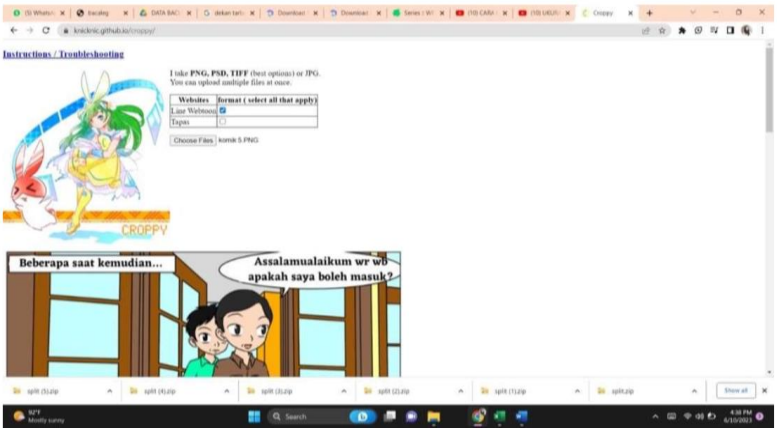

Figure 4. Image Slice

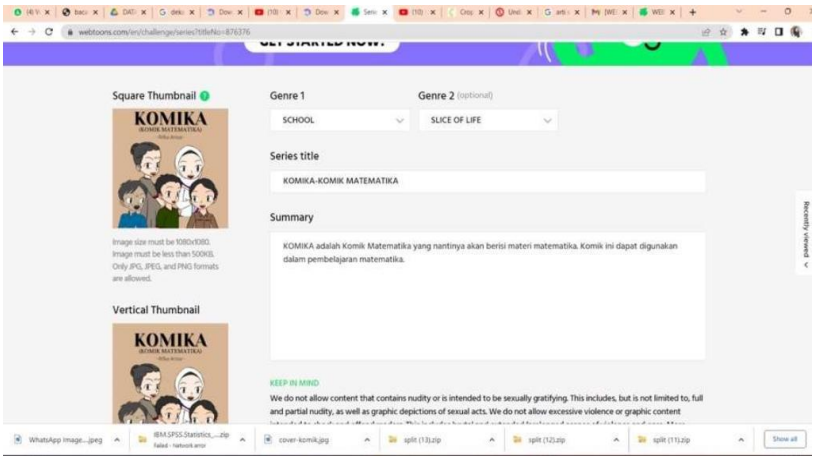

Figure 5. Comic Upload

The assessment phase aims to assess the quality of the developed math comic, and the validator provides suggestions and solutions. Then, further decisions are made. Based on the results of consideration and evaluation,

further revisions are made until the resulting prototype can be used in research. The main activities in the research phase are validating math comics and conducting trials.

The math comics that are developed and then will be used by students should have a valid status. To determine this, a developer needs to double-check with experts regarding material and media. This activity aims to obtain "valid" status from media and material experts. If the status obtained is "moderately valid" or "invalid," the developer needs to revise and revalidate until they get a valid status. This series of validation processes was carried out in approximately one week. It is conducted with competent validators who are in their fields. Suggestions from validators are then used as a basis and reference to revise the math comics to make them more perfect for producing prototype 1. Three validators were chosen for this study. Two validators were UIN Sunan Ampel Surabaya, a mathematics education study program lecturer, and an STAI Al-Azhar mathematics education lecturer. Then, one validator was a Mathematics Teacher at MTsn 2 Surabaya.

The results of the analysis by the material validator. In the content quality aspect, the score obtained is 3.39. The score is included in the valid category. This shows that math comics have met the learning outcomes determined by the school. Even so, suggestions were obtained from validators regarding the numbers used in math comics to be adjusted to the level. The linguistic aspect received a score of 3.55, where the score was included in the very valid category. This shows that in terms of language, math comics are good enough. Even so, there were suggestions from the validators regarding the language used, including using sound and correct language and writing. The aspect of feedback and adaptation received the highest score of 3.66. The score is included in the valid category if categorized in the existing criteria. This shows that this media can make learning easier for teachers and reduce student boredom. The motivation aspect also received the highest score of 3.66. The score is included in the valid category if categorized in the existing criteria. This shows that this media can increase students' motivation to learn math. The average Total Validity (VR) is 3.53.

The results of the analysis by the media validator. In the aspect of comic anatomy, it gets the highest average score of 3.66, where the score is included in the valid category. This shows that math comics have a clear and precise structure in terms of clarity of reading panels and suitability of word balloons, alleys, illustrations, and sound letters. Regarding image quality, the score

obtained is 3.42, where the score is included in the valid category. This average score shows that mathematics comics have met the requirements in terms of the accuracy of the presentation of illustrations, color composition, and the suitability of comic characters with reality. The average Total Validity (VR) obtained is 3.54. Based on the data on the validity of the math comic media, the average total validity of the material and media validation is 3.53 and 3.54, respectively. So, the average of both material validation and media validation is 3.535. This value is included in the "Valid" criteria.

Based on the mathematics comic practicality data analysis results, student responses to statement 1 obtained a response of 82.14% with details of 12 students answering SS, 13 students answering S, two students answering TS, and one student answering STS. Statement 2 obtained a response of 83.92% with details of 12 students answering SS, 14 students answering S, two students answering TS, and no students answering STS. Statement 3 obtained a response of 80.53% with details of 10 students answering SS, 15 students answering S, two students answering TS, and one student answering STS. Statement 4 received a response of 83.03% with details of 10 students answering SS, 17 students answering S, one student answering TS, and no students answering TS. Statement 5 received a response of 83.92%, with details of 10 students answering SS, 18 students answering S, and no students answering TS and STS. Statement 6 received a response of 77.67%, with details of 9 students answering SS, 13 students answering S, 6 students answering TS, and no students answering STS. Statement 7 received a response of 71.42%, with details of 7 students answering SS, 20 students answering S, one student answering TS, and no students answering STS. Statement 8 received a response of 79.46%, with details of 11 students answering SS, 12 students answering S, four students answering TS, and one student answering TS. Statement 9 received a response of 84.82%, with details of 12 students answering SS, 14 students answering S, no students answering TS, and one student answering STS. Statement 10 obtained a response of 91.07% with details of 20 students answering SS, six students answering S, two students answering TS, and no students answering STS. The student response value obtained is 81.79%. Students respond well to the learning carried out by the teacher in the classroom and the math comic media provided. Based on Chapter III, it is said that students respond positively to learning if the average student response score is 70% to below 85%. So it can be concluded that the

webtoon application-based math comic media (Romika) in learning mathematics to improve students' numeracy literacy is "practical".

Data Analysis of the Effectiveness of Math Comic Media includes analysis of student learning outcomes and Data Analysis of Improvement of Numeracy Literacy Skills. Based on the minimum completeness criteria set by MTs Negeri 2 Surabaya City, the number of students who are complete or incomplete can be seen in the following table.

Table 1. Analysis of Student Learning Outcomes

Description	Number	Score
Student Completion	24	85,71%
Students who have not Completed	4	14,29%

Table 1 shows that 24 people were declared complete, meaning that students have achieved the competencies that have been set. At the same time, four students still need to complete it and have yet to achieve the competencies set. Based on the data above, the percentage of students who are complete is 85.71%, which means that the percentage of students who are complete has exceeded 70%. It can be concluded that the math comic media (Komika) has fulfilled one of the requirements to be a webtoon application-based math comic media (Komika) in mathematics learning to improve students' numeracy literacy skills, which is "effective."

From the results of the student pretest, seven students scored with complete criteria, and 21 students scored with incomplete criteria. Meanwhile, the students' posttest scores showed that 24 students scored with complete criteria and 4 with incomplete criteria. This proves that the learning outcome criteria obtained by students during the posttest are better than those obtained during the pretest. Furthermore, the normality test of student value data obtained is normally distributed or not. The test results are as follows.

Table 2. Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.119	28	.200	.972	28	.633
Posttest	.183	28	.170	.883	28	.005

Based on the picture of the normality test through the SPSS program with the Kolmogororv-Smirnov type above, the data on the pretest scores of

student learning outcomes are generally distributed as indicated by the value obtained of 0.200. Thus, the pretest data is classified as generally distributed because it applies 0.200 > 0.05. While the data on the posttest scores of student learning outcomes are generally distributed as indicated by the value of 0.17. Thus, the pretest results are classified as generally distributed because they apply 0.17 > 0.05. After the data was normally distributed, then the T-test was conducted to determine the increase in students' pretest-posttest scores with the following results.

Table 3. T-test Result

		Mean	N	Std. Deviation	Std. Error Mean	Correlation	Sig.
Pair 1	Pretest	69.64	28	11.701	2.211		
	Posttest	87.68	28	11.701	2.144		
	Pretest and Posttest					.754	.000

The results of the T-test through the SPSS program with the Paired Sample Test type above show that the increase in the average pretest-posttest score above shows that the sig. (2-tailed) = 0.00 < 0.05 which means that H_0 is rejected and H_1 is accepted. Narratively, there is a significant increase between the pretest and posttest results. After the data is known to have a significant increase, the next step is to calculate the N-Gain value. This test is used to measure how far the effectiveness of using math comic media on increasing students' numeracy literacy. The following is the calculation of N-Gain.

Table 4. N-Gain Result

	N	Minimum	Maximum	Mean	Std.Deviation
N-Gain_Score	28	.13	1.00	.6570	.29226
Valid N (listwise)	28				

The results of the N-Gain test calculation above show that the average N-Gain Score is 0.657, including the medium category, with a minimum N-Gain value of 0.13 and a maximum of 1.00. So, using math comic media has a moderate effectiveness category with a percentage value of 44% in improving students' numeracy literacy skills.

This research is a type of research and development in which this research carries out various processes to develop and validate educational

products in the form of mathematical comics (Komika). The math comics (Komika) developed in this study are included in the type of media because they are a means of channeling communication that has a specific purpose by the theory, according to Mahfudoh and Sunarso (2024) Komika, according to its form, is included in online comics (Web Comic). This is because Komika is accessed using the webtoon application, a digital comic industry. Meanwhile, according to its type, this comic is included in educational comics, where this comic contains mathematics material, namely class VII data presentation material. This comic is expected to interest students in math and improve numeracy literacy skills. The stories presented are everyday stories so that students better understand the material taught and can implement it.

After the various stages of development research were conducted, several findings were made in developing comic development based on webtoon applications in learning mathematics. The first finding is validity in math comics, which is assessed from the feasibility of math comics assessed by material and media experts. Validators give scores on each aspect of assessing the feasibility of math comics. The average score obtained from each validator is 3.53 from the material validator and 3.54 from the media validator. According to what Ulviah, Subroto, and Satifah (2021) have explained, math comic media is re-examined by material expert validators regarding content quality, language, feedback, adaptation, and motivation before being used in learning. In addition to material expert validators, media validators also re-examined the comic anatomy and image quality until it was in the "valid" category, then the math comic could be used. The second finding is practicality. Practicality in research is practical in practice, meaning that the data to determine practicality is the student response questionnaire. The results of students' responses to math comics, students assessed that the language used in the math comics was good and the students were able to use them. The results of student responses to math comics, students assess that the language used in math comics is good and that students have an interest in math comics media. The number of student response results indicates the good response of students is 81.79%.

According to what has been explained by Aprilia, Nabila, Karomah, Irmawati, Permadani, and Nursyahidah (2023), a student response assessment is carried out after learning to use the media. The media is in the "practical" category if the media has fulfilled the aspect of getting a "positive response" from student assessments through the results of a student questionnaire so

that the math comic media can be used. The third finding is effectiveness. The effectiveness of this study is based on two aspects, namely: (1) the percentage of students' learning completeness is 85.71%, and (2) there is an increase in students' numeracy literacy skills as evidenced by the calculation of the pretest and posttest N-Gain value of 0.675 which is in the "medium" category. The math comic media meets the effective criteria if the learning outcomes after using the media have been completed with a percentage above 70%5. In addition, according to Irmaya, Syahputra, and Lubis (2024), the math comic media meets the effective criteria if there is an increase in numeracy literacy skills as evidenced by the N-Gain value being in the "medium" or "low" category. Math comic media has met these two criteria, so math comic media is considered "effective" and can be used.

CONCLUSION

Based on the results of the research that has been done, the conclusions obtained are as follows in the development process using the Plomp development method, namely: (1) Preliminary research phase; (2) Prototyping research phase, making math comics, there are four stages, namely: scenario creation, storyboard creation, sketching process, color process, and uploading; (3) Assessment phase, webtoon application-based mathematics comic media (Komika) in mathematics learning to improve students' numeracy literacy skills was declared "valid" by material and media expert validators, with an average validity score of 3.535, webtoon application-based mathematics comic media (Komika) in mathematics learning to improve students' numeracy literacy skills. Students' numeracy is declared "practical" in practice. The students' response showed a positive reaction because the percentage obtained was 81.79%; the webtoon application-based math comic media (Komika) in mathematics learning to improve students' numeracy literacy skills was declared "effective." This can be seen from: (1) The percentage of student learning outcomes completeness is 85.71%, which means that the percentage of students who are complete has exceeded 70%. (2) Based on the results of the analysis using statistics, the N-Gain value is 0.657, which means that there is an increase in students' numeracy literacy skills in the moderate category.

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