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DEVELOPMENT OF COMIC-BASED TEACHING MATERIALS TO IMPROVE THE MATHEMATICAL CRITICAL THINKING ABILITY OF FIFTH-GRADE ELEMENTARY SCHOOL STUDENTS

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Abstract

This research changed students' low critical mathematical thinking abilities. To overcome this problem, researchers developed comic-based teaching materials to enhance college students' critical mathematical thinking skills. This study aims to supply comic-based coaching materials that are legitimate and practical. This research uses the R&D method with a 4D development model. This research design uses data collection techniques, validation sheets, and practicality questionnaire sheets. The subjects in this research were 20 students in class V. From the research results, it was found that the media expert's score was 96.66%, which was categorized as very appropriate. The linguist scored 88% in the very appropriate category, the material expert was 80% in the proper category, and the teacher practitioner was 92% in the very appropriate category. For the practicality of comic-based teaching materials, the teacher's practicality score was 96%, and the students' practicality score was 87.7%, categorized as very practical. Therefore, comic-based teaching materials can be used as a solution for educators to improve critical mathematical thinking.

Keywords: teaching materials, comics, mathematical critical thinking.

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INTRODUCTION

Mathematics learning is something that exists from elementary school to college (Alfina, 2022; Meliana & Sopiany, 2022; Sitepu, 2022; Agustina, 2023; Priyanti & Nurhayati, 2023; Biskara & Dewi, 2023). Learning mathematics in education can equip students to think critically, logically, creatively, and systematically. This is in line with the mathematics learning objectives of the Ministry of Education and Culture in 2013, namely improving intellectual abilities, ability to solve problems, high learning outcomes, practicing communication, and developing students' character siswa (Susriyati & Yurida, 2019; Davita & Pujiastuti, 2020; Yayuk et al., 2020; Anderha & Maskar, 2021; Alfina, 2022; Lantakay, 2023; Maula et al., 2023).

The importance of learning mathematics in elementary schools also aims to help students calculate, discover, and use their analytical skills and imagination in social life (Erninda, 2023). Learning mathematics can create quality human resources because mathematics is a science related to human reasoning and thought patterns (Indasari, 2021). In line with this, mathematics is an essential skill in the 21st century. Certainly, one of those is the capability to assume significantly (Arifuddin, 2019). One of the skills needed to gain knowledge of math is the ability to think critically. This critical thinking ability is an ability that students need to solve story problems or those related to everyday life (Prajono, 2022).

Several research outcomes state that elementary school students' mathematical critical thinking abilities are still low, namely, based on the results of research conducted by Nizammudin et al. (2022), found that the mathematical reasoning ability of students IV at SD Negeri Bantengmati 02 Demak based on the results of students' test answers obtained an average test result of 47.7% in the low category. The results of further research by Rudianto et al. (2022) found that out of 60 samples, 13 students could think critically by critical thinking criteria, 17 with less critical thinking criteria, and 30 with less essential criteria of thinking. Meanwhile, the results of the third research conducted by Wibowo et al. (2022) found that students critical thinking abilities in solving story problems in mathematics subjects in the VA class of SD Negeri 09 Sintang were 49.73%, which was included in the low category.

Based on the results of interviews in 2022 with class V elementary school teachers in Cirebon Regency, it was stated that the lesson that was difficult and did not meet the KKM for class V students was mathematics. Based on the test results of class V students, only 17 out of 39 passed above the minimum standard score for completion. Primarily based on the outcomes of interviews with fifth-grade elementary school students, they stated that learning mathematics was difficult, especially regarding fractions. This was because mathematics involved many calculations and learning, and only textbooks and worksheets were used.

This is reinforced by the results of the distributed needs analysis questionnaire, which resulted in 100% of children claiming that mathematics is a difficult lesson and 93% of children stating that

learning mathematics is difficult to understand. Also, this mathematics learning only uses textbooks and worksheets, never using other media apart from the books provided; because of this, students cannot work on questions that can improve their mathematical critical thinking skills. Because of the language package, the students don't understand. Then, based on the data obtained, it was found that as many as 68% of children stated that the fraction material was difficult to understand. Therefore, efforts are needed to improve students' mathematical critical thinking ability. One of the efforts that can be made is developing teaching materials.

Coaching substances are critical in the studying procedure because they are beneficial for making it less complicated for teachers to supply fabric and help students in the learning process (Wirawan, 2022). Teaching materials can be used as an intermediary between teachers and students, so teachers must recognize students' characteristics, intelligence, and abilities (Rosyidah, 2022). One of the teaching materials that can be used is comic teaching material. Comics have charm, which can motivate students to learn because they contain elements of humor and entertainment and are useful (Guntur et al., 2023). Comic-based teaching materials can help students understand the material, increase students' interest in reading, improve learning outcomes, and improve students' critical thinking skills because there are pictures and material that have been arranged systematically so that students can understand them easily (Ngazizah 2022; Safira & Sukmawarti, 2022; Marlina, 2023). In this research, the comic product developed focuses on addition and subtraction of fractions to improve students' critical mathematical thinking skills using the IbisPaint application and combined with the Canva application as a supporting application in perfecting this comic-based teaching material.

Several relevant studies examine comic teaching materials to overcome multiplication misconceptions in SD Plus Sunan Pandanaran Blitar class II students. This research describes the process of developing mathematics teaching materials in the form of multiplication comics (KOPER) to reduce misconceptions about multiplication in lower grades. The results of his research show that the development of KOPER can reduce misconceptions about multiplication well (Wulandari, 2019). The next research on Islamic values is "Comic Teaching Materials Based on Islamic Values." This research produces comic teaching materials containing Islamic values using the IbisPaint application. The results show that comic teaching materials are suitable for learning (Novita, 2021). Furthermore, regarding the concept of multiplication and division, namely "Development of e-comic-based mathematics teaching materials with the topic of multiplication and division using the RME approach." This research produces teaching materials suitable for use with the concepts of multiplication and division that are suitable for use in learning.

This research is different from previous research. In this research, researchers developed comic-based teaching substances to enhance mathematical critical wondering capabilities. Apart from that, in the comic, there are worksheets that students can do after they have read and understood the contents of the comic. Therefore, researchers aim to 1) describe the validity of comic-based teaching materials and 2) describe the practicality of comic-based teaching materials.

METHODS

The research design used is to use research and development methods. Research and development are used to produce application products and test their effectiveness (Chairudin & Dewi, 2021). This research uses a 4-D model designed by Thiagarajan, which consists of 4 stages: define, design, develop, and disseminate (Agustini, 2021). At the level of definition is the initial stage in this research, which aims to obtain information related to school problems. The stage design is the initial stage in product creation or development regarding the product's appearance, material, or language. Meanwhile, stage development is the stage that produces a product validated by several experts, such as media experts, language experts, and material experts, who will later undergo several revisions to make a suitable product. Then, at the dissemination stage, this is the final stage of developing the 4-D model. The activity carried out at this disseminating stage is to disseminate products that are suitable for use.

The subjects of this research were 20 fifth-grade elementary school students in Cirebon Regency. The object of this research is comic-based teaching materials. The instruments used are validation sheets and practicality questionnaire sheets. The validation sheet determines the suitability of teaching materials developed and assessed by media, language, material experts, and practitioners (teachers). Meanwhile, a practicality questionnaire sheet was used to determine the practicality of the advanced teaching substances assessed using class V teachers and students. The data analysis used was qualitative and quantitative descriptive analysis. Qualitative descriptive data analysis is used to process validator comments and suggestions through validation. Meanwhile, quantitative descriptive data analysis analyzes data resulting from expert validation assessments. The validation criteria are 81 % - 100% (very feasible), 61% - 80% (feasible), 41% - 60% (quite feasible), 21% - 40% (not feasible), and 0% - 20% (very unfeasible) (Lestari et al., 2023). Meanwhile, the practicality criteria for comic-based teaching materials are 81% - 100% (very practical), 61% - 80% (practical), 41% - 60% (less practical), 21% - 40% (not practical), 0 % - 20 % (very impractical) (Konjin & Wiratama, 2023).

RESULTS AND DISCUSSION

Validity of Comic-Based Teaching Materials

The results of expert validation of comic-based teaching materials are shown in Table 1 below.

Table 1. Results of Expert Validation Sheet

Member	Results	Criteria
Media Expert	96,66%	Very Worth It
Language Expert	88%	Very Worth It
Materials Expert	80%	Worth it
Expert Practitioner (Teacher)	92%	Very Worth It

Advice from media experts is to add a math sheet to the comic and add an author profile. Meanwhile, advice from linguists is to pay more attention to grammar. Material experts suggest making the story more realistic and adding student worksheets. Suggestions from practitioners (teachers) are that the dialogue sequence should be rearranged to make it easier for students to recognize the content material of the comic.

Based on the results of feasibility tests carried out by experts on comic-based teaching materials, they produce valid teaching materials. The resulting teaching materials have passed the validation stage by experts. Based on the results of obtaining validation sheets and input from comic-based teaching material media experts, a feasibility result of 96.66% was categorized as very feasible with slight improvements. Meanwhile, the feasibility test by linguists obtained a feasibility result of 88%, which was categorized as very feasible with slight improvements. Feasibility tests by material experts obtained feasibility results of 80%, classified as possible with subtle enhancements. The results of the feasibility test by practitioners (teachers) were 92%, categorized as very feasible with slight modifications. Based totally on the consequences of the feasibility check that has been completed, it may be stated that comic-based teaching materials are comic-primarily based teaching materials are legitimate or may be used within the gaining knowledge of the process with mild upgrades. The results before and after repair are shown in the image below.

Results of Media Expert Improvements

Before improvement

Information:

I have not added how the bread is cut.

After improvement

Information:

Information:

There are no math sheets yet

Information:

I Added math sheet

Before improvement

After improvement

Information:

There are no fragments of the Bima and Caca ribbons yet.

Information:

Added the shape of the Bima And Caca ribbon fragments

Information:
There is no author bio yet

Information:
Add author biodata

Results of Language Expert Improvement

Before improvement **After improvement**

Information:
There are no names of the father and mother

Information:
Add the names of the father and mother.

Information:
Use a foreign language

Information:
Change into Indonesian

Before improvement

Information:
The speech balloon that speaks first positioned high and is not placed high.

After improvement

Information:
The speech balloon that speaks first is

Results of material expert improvement

Information:

Add student worksheets

Result of practitioner (teacher) improvement

Before improvement

Information:

The Speech Balloon That Speaks First is not positioned high

After improvement

Information:

The speech balloon that speaks first is positioned high

Practicality of Comic-Based Teaching Materials

Products that experts have validated are then tested to determine the practicality of the comic-based teaching materials that have been developed. This product was tested at Battembat 2 State Primary School. After trying comic-based teaching materials in learning, the teacher and class V students filled out a practicality questionnaire containing aspects of the usefulness and convenience of comic-based teaching materials. The effects of the practicality questionnaire are proven in Table 2.

Table 2. Practicality Questionnaire Results

Respondent	Results	Criteria
Teacher	96%	Very Practical
Class V students	87,7%	Very Practical

The results of practicality questionnaire for teachers and students obtained as many results as 96% and 87%, using very practical criteria. So, this comic-based teaching material is easy to learn.

The findings in this research indicate that comic-based teaching materials meet the criteria of being valid and practical. The product developed has been declared legitimate primarily based on experts' assessment, namely media, language, material, and practitioners (teachers). This is consistent with the opinion of Rismawati et al. (2022) that these comics are not boring because they not only contain pictures and Entertainment but also contain interesting plots and can be used as an alternative use of teaching materials in learning. This is in keeping with the results of studies conducted by Safa'ah and Ishari (2021), stating that comic media can be integrated into the learning process as teaching materials that can motivate students in terms of reading literacy, learning outcomes, or motivation in learning. Also, based on the results of research conducted by Rachman et al. (2023), this comic media can help with problems in mathematics subjects, especially when combined with pictures, symbols, language, material, stories, and interesting plots according to the age of elementary school children. It can make learning more meaningful. And add new knowledge to students. The results of research conducted by Sipayung et al. (2020) show that learning using comics influences students' learning motivation, with an average in the experimental class of 1.17, better than the average in the control class of 1.09. This comic teaching material can be used as one of the media used in mathematics learning because it is still rare for schools to use it for learning. In this case, comics can be used as an alternative that can be used by teachers during learning so that students are happy and make it easier for students to understand abstract lessons to become more concrete (Febriyandani & Kowiyah, 2021). Comic-based teaching materials are practical to use in learning. This is consistent with the effects of studies performed by Sari & Ratu (2021) that show that comic media is very practical

to use in learning to increase student motivation, with a practicality percentage of 96%. Moreover, Faizah states, " elementary school students have a high interest in visual images and stories." So, apart from creating innovative learning, this comic can also provide messages to students regarding material that is difficult for them to understand. So, comic teaching materials are very appropriate for use inside the classroom. And learning the comics can develop primary students' interest in learning. Once students' interest in learning increases, thinking more critically about the existing material will be easier. So, in this case, comics must also contain characters, plots, and appropriate material for the elementary school level (Wulandari & Anugraheni, 2020).

CONCLUSION

The development of comic-based teaching materials on adding and subtracting fractions has met the indicators of critical mathematical thinking skills, namely formulating problems, determining facts, using correct evidence, drawing conclusions according to the facts, providing further explanations, and decision-making abilities based on feasibility test results. Media experts, linguists, material experts, and practitioners (teachers) and the results of teacher and student practicality questionnaires show very feasible and practical results. This suggests that comic-primarily based teaching substances are very doable and practiced to get knowledge. For that reason, this comic-based teaching material is an opportunity teaching material to enhance primary school students' mathematical critical thinking skills, especially in addition and subtraction of fractions.

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