PAEDAGOGIA
Jurnal Penelitian Pendidikan
http://jurnal.uns.ac.id/paedagogia

DOI : 10.20961/paedagogia.v27i2.84504
Vol. 27, No. 2, 2024, pp. 252-264
p-ISSN 0126-4109
e-ISSN 2549-6670

Activity Contents Of Mathematical Communication In Merdeka Curriculum Textbooks Of Grade VII On Plane Geometry Materials

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Keywords:
Mathematical communication; plane geometry; mathematical textbooks; Merdeka curriculum

Article history
Received: 8 May 2024
Revised: 20 June 2024
Accepted: 23 June 2024
Published: 30 June 2024

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doi: 10.20961/paedagogia.v27i2.84504

Abstract: This research was conducted to analyze the availability of activity content in curriculum merdeka textbooks of grade VII on plane geometry materials published by the Ministry of Education and Culture of the Republic of Indonesia. The research method was carried out in a descriptive qualitative manner using textbook content analysis. Mathematical communication indicators are used as the aspect of analysis. The research results show that all activities in this book have supported the improvement of students' mathematical communication competence. However, there are no special labels or instructions related to mathematical communication indicators embedded in each activity, so the meaning is still implied or based on the opinion of researchers with adjusted theory used in relation to mathematical communication. From the data analysis that has been done, it can be concluded that the content material is good enough based on the percentage category table for the suitability of book activity, which is equal to 39%. Based on the research, these books can help students develop their mathematical communication ability with teacher guidance. However, basically this book provides sufficient activities as an effort to improve students' mathematical communication skills if teachers are able to use this book well as a resource and learning media in the classroom.

How to cite: Febrianti, T S., Dahlan, J A., Fatimah, S. (2024). Activity Contents of Mathematical Communication in Curriculum Merdeka Textbooks of Grade VII on Plane Geometry Materials. *PAEDAGOGIA*, *27*(2), 252-264. doi: 10.20961/paedagogia.v27i2.84504

INTRODUCTION

Starting from a study of curriculum analysis and mathematics learning problems, according to NCTM, there are five standards set for mathematics learning objectives, including problem-solving abilities, reasoning and proof, connections, communication, and representing or understanding mathematical concepts (NCTM, 2000). Furthermore, these five standards have inspired the Indonesian national curriculum in preparing content standards for school mathematics learning. This is in accordance with what is stated in the Subject Learning Outcomes handbook mathematics, it is stated that the process elements in mathematics subjects are related to views that mathematics as a conceptual tool for constructing and reconstructing mathematics learning material in the form of mental activities form a flow of thinking and a flow of understanding that can develop skills, these process elements include problem-solving abilities, reasoning and proof, connections, communication, and representing or understanding mathematical concepts (Kemdikbud, 2022). According to NCTM, communication is an essential part of mathematics and mathematics education because communication can be a way to share ideas and clarify understanding, through communication an idea can be reflected, improved, discussed and completed (NCTM, 2000). In line with NCTM, the Indonesia Ministry of Education and Culture defines mathematical communication as forming a flow of understanding mathematics learning material through methods of communicating mathematical thinking using precise mathematical language, analyzing and evaluating thoughts of other people's mathematics of plot formation understanding mathematics learning material through methods communicate mathematical thinking using precise mathematical language

(Kemdikbud, 2022). Mathematical communication skills here include students' ability to organize students' mathematical thinking abilities through communication; communicate mathematical thinking skills coherently and clearly to classmates, teachers, and others; analyze and evaluate mathematical and strategic thinking abilities to others; and be able to use mathematical language to express mathematical ideas accurately. The success of realizing teacher goals really depends on the effectiveness of the teacher communication process that takes place at school between teachers and students in learning activities. To create effective communication in the learning process, teachers must understand the basic concepts of communication science, the goals and functions of communication, and communication components (Mahadi, 2021).

"Mathematical communication skills are abilities in mathematics which include the use of reading, writing, listening, analyzing, interpreting and evaluating ideas, symbols, terms, and mathematical information" (Maulyda, 2020). Basically, mathematical communication is the same as communication in general, but the domain that is communicated is conceptions related to mathematics (Annisa & Siswanto in Yunita & Siswanto, 2023). This is because mathematics is a scientific discipline that is related to other scientific disciplines. It is used as a symbolic language because it provides a means for exchanging mathematical concepts or ideas. A mathematical concept can be communicated vocally or in writing while incorporating illustrations, algebra, or schematics as part of the mathematical communication (Cahyani & Abadi, 2023). Mathematical communication indicators are the main core of this analysis research. As a first step in the analysis process, indicators of mathematical communication skills were prepared. The preparation of mathematical communication indicators was carried out by considering the following research. Based on Firdausa (2023), students' mathematical communication profiles are obtained by choosing an indicator to measure the extent to which students are able to communicate their mathematical ideas. The definition of indicators is variables that can show or indicate to users about specific conditions so that they can be used to measure changes that occur (Green in Firdausa (2023). "The basic word indicator means a marker of competency achievement as shown by measurable changes in behavior which include attitudes, knowledge and skills" (Hartini, 2013). According to NCTM, mathematical communication indicators can be seen from: (1) Ability to express mathematical ideas verbally, in writing, and demonstrate and illustrate them visually; (2) The ability to understand, interpret, and evaluate mathematical ideas both verbally, in writing and in other visual forms; (3) Ability to use terms, mathematical notation, and structures to present ideas, describe relationships with these models (NCTM, 2000). Yang, Chang, Cheng, and Chan state that mathematical communication skills are as follows: (1) Understand the meaning of mathematical problems; (2) Use mathematical symbols by listing equations, algebraic expressions, and arguments to solve mathematical problems; (3) Using mathematical language and presenting again to explain mathematical concepts in solving the problems used. It is known that there are two types of communication, namely written and oral communication, and previously, we discussed the five aspects of mathematical communication (Fariha & Indahwati, 2020). Furthermore, Ansari examines mathematical communication skills from two aspects, namely oral communication (talking) and written communication (writing) (Laksananti, P M, n.d.). Oral communication can be seen from the intensity of student involvement in small groups during the learning process. Meanwhile, what is meant by written mathematical communication (writing) is the ability and skills of students to use vocabulary, notation, and mathematical structures to express relationships and ideas and understand them in solving a problem. This ability is expressed through mathematical representation.

One branch of mathematics that requires students' mathematical communication skills is geometry. "Geometry is a branch of mathematics that studies the relationship between points, lines, angles, planes, as well as plane figures and geometric figures" (Ulum, 2018). Most of the items we frequently see and use in our environment consist of geometric shapes and objects. Making efficient use of these objects and shapes depends on understanding the relationships between them. We also use geometric thinking in solving problems (such as painting, covering walls, etc.), defining spaces, and carrying out our profession. Geometric shapes and objects are part of our work and creations. For this reason, it is not surprising that geometry material is always present at every grade level in mathematics subjects. Each level has its own reference competency standard. Based on NCTM, students who will study geometry in Grades VI-VIII must already have informal knowledge about points, lines, planes, and various

two- and three-dimensional shapes, with experience, including visualizing and drawing lines, angles, triangles, and other polygons as well as intuitive ideas about forms built from everyday life. In the middle grades geometry program, students are recommended to investigate relationships with drawing; measure, visualize, compare, transform, and classify geometric objects; development of mathematical reasoning (inductive and deductive); create and validate conjectures; classify and define geometric objects; solve problems related to geometric objects that exist in everyday life (NCTM, 2000). In the teaching and learning process, it is also impossible if the teachers do not use any teaching materials to support it (Masturah et al., 2021).

Facts on the ground show that almost all state schools in Indonesia use textbooks published by the Ministry of Education and Culture as the main learning materials, this is in accordance with what was stated by the Center for Books, which concluded that textbooks are books that are used by students at a certain level as learning media (instructional), relating to certain fields of study. Based on this, to form students who have good mathematical communication skills, learning resources are needed that are able to support activities for developing mathematical communication skills (Mukhlis in Wiyono, 2013). In 2022, the government launched a new curriculum, the Merdeka curriculum. In line with the statement (Septiani et al., 2022) the Merdeka curriculum is the latest curriculum that has begun to be implemented by several schools in Indonesia. The implementation of the Merdeka curriculum aims to "learning loss recovery" due to the Covid-19 pandemic. In the era of the newest curriculum in 2022, the Merdeka curriculum, Learning resources have also undergone updates in line with curriculum reference standards. Of course, because of this update, there is limited research analyzing textbook content adapted to activities to support students' mathematical communication competence in geometry material. Therefore, an analysis of the content of mathematical communication in textbooks released by the Ministry of Culture of the Republic of Indonesia needs to be carried out as a first step in developing students' mathematical communication skills.

Previously, there had been several studies related to students' mathematical communication skills in geometry material conducted by Nurlaila et al., (2018); Hafifah & Bharata (2018); Astuti & Leonard, (2015); Murdaningsih & Murtiyasa (2016). From the five existing studies, it can be concluded that students' mathematical communication skills are an important competency to improve. However, until now, there has been no research related to content analysis of book activities to support mathematical communication competence, so with the existing learning resources provided by the government in the form of Merdeka curriculum mathematics textbooks, researchers want to see whether this book provides facilities in the form of activity content that can support increasing students' mathematical communication skills. This research was carried out to analyze the availability of activity content in the Merdeka curriculum mathematics textbooks on plane geometry material in class VII published by the Ministry of Education and Culture of the Republic of Indonesia. So, the research question of this research is, “Do the Merdeka curriculum mathematics textbooks provide activities to cover students’ mathematical communication?”.

METHOD

This research uses an empirical research paradigm with a descriptive qualitative research approach of the content analysis type. The research method was carried out in a descriptive qualitative manner, according to (Rusandi, 2014) qualitative descriptive research is one type of research which is included in the type of qualitative research. The characteristic of descriptive research is that the data obtained is in the form of words, images, and not numbers, like quantitative research. The type of research used is content analysis. (Rukminingsih et al., 2020) explain that content analysis is in-depth research into the content of written or printed information in mass media. Furthermore, content analysis is defined as a method for studying and analyzing communication systemically, objectively, and quantitatively regarding the visible message (Berelson in Kerlinger in Rukminingsih et al., 2020). Content analysis is a type of qualitative research. Content analysis requires what specific aspects should be analyzed. This is also associated with indicators of communication skills. In this research, the materials used were Merdeka curriculum mathematics textbooks for class VII,

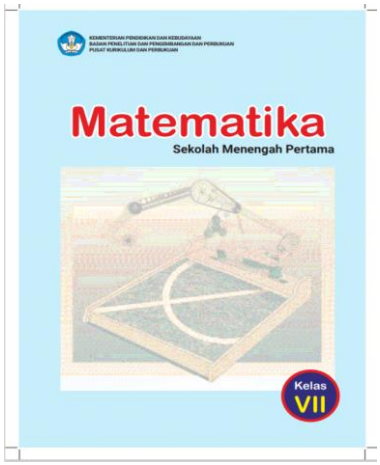


Figure 1. Mathematics Textbook
(source: Gakko Tosho, 2021)

This research was carried out in two processes: (1) Developing a content analysis framework as a reference in the textbook content analysis process. The content framework developed by researchers refers to the analytical framework of several relevant previous studies, such as the research of Pramesti, (2017); Moneta et al., (2020); Mawarni (2020); Murdaningsih & Murtiyasa (2016); (2) Carrying out content analysis, where the analysis process consists of four steps, which are explained in Table 1 below.

Table 1. Textbook Content Analysis Steps

Steps Used	Information
Step 1. Determination of the topic of analysis	One of the chapters in the Independent Curriculum Class VII Mathematics Book is Chapter 5, Plane Figures.
Step 2. Categorization of the parts to be analyzed	The content that will be analyzed is all material activities in the book, which includes three sub-chapters, including properties of plane shapes, paint lines, angles, and shapes, and plane shape transformation.
Step 3. Description of the analyzed content	There are a total of 30 activity pages whose content analysis is adjusted to the table of indicators of achievement of mathematical communication competence with the following details: 1) Sub-Chapter 1 Properties of Plane Shapes, pages 163-171 2) Sub-Chapter 2 Painting Lines, Angles, and Plane Shapes, pages 172-184 3) Sub-Chapter 3 Transformation of Geometry, pages 185-193
Step 4. Data Compilation	After the analysis data is obtained, the data is then compiled in a frequency table to see the distribution of material content.

In connection with data compilation, the percentage of the data is measured using calculations presented in the following equation.

$$P = \frac{frecuency}{sum\ of\ the\ analysis\ pages} \times 100\%$$

The total number of pages analyzed is 30 pages. The percentage of book suitability is shown in

Table 1 below.

Table 2. Book Suitability Categories

Conformity Percentage	Category
$60\% \leq P < 100\%$	Good
$30\% \leq P < 60\%$	Pretty good
$P < 30\%$	Not good

Modification from source: Asih in (Beni et al., 2013).

After analyzing the data based on the quantity results, the quality analysis was then carried out descriptive qualitatively. This process produces qualitative data that represents the results of the research carried out; according to the opinion of Miles & Huberman (1994), in qualitative research, data analysis is carried out by reducing the data, presenting it, and making conclusions.

Based on the indicators of mathematical communication that have been declared by NCTM and used in the research of Pramesti, (2017); Moneta et al., (2020); Mawarni (2020); Murdaningsih & Murtiyasa (2016), the general mathematical communication indicators used in this research are explained as follows: (1) Thinking about problems; (2) Proving a guess or conjecture; (3) Formulate an explanation; (4) Experiment with forms of argumentation; (5) Uses mathematical language and symbols appropriately; (6) Try new vocabulary or notation; (7) Reflect on their understanding and the ideas of others; (8) Criticize the evidence. Next, these indicators are represented in the work table as follows.

Table 3. Content Analysis Indicators for Mathematical Communication Activities

Component	**Sub Component**
Organizing and Strengthening Mathematical Thinking Abilities with Communication	Thinking about problems Formulate an explanation Try new vocabulary or notation
Communicate mathematical thinking coherently and clearly to peers, teachers, and others.	Experiment with forms of argumentation Proving allegations/conjectures
Analyze and evaluate the mathematical thinking and strategies of others	Criticize the evidence Reflect on their understanding and the ideas of others
Use mathematical language to express mathematical ideas precisely	Use mathematical language and symbols appropriately

RESULT AND DISCUSSION

Results

The process of analyzing mathematical communication content in textbooks is carried out first by creating an analytical framework in the form of components and sub-components, which will be analyzed for the availability of activity content in the book. Researchers determine indicator components and sub-components based on mathematical communication competency standards that have been described in the NCTM book. Next, the researcher carried out an analysis by recording the availability of activity content for each book page according to the analysis indicators. After that, the researcher processed the data by calculating the frequency and percentage of achievement of the activity content in the book (Table 4).

Table 4. Results of Frequentative Analysis

Component	**Sub Component**	**Frequency**	**Percentage**
Organizing and Strengthening Mathematical Thinking Abilities with Communication	Thinking about problems	18	60%
	Formulate an explanation	15	50%
	Try new vocabulary or notation	10	33.3%

Communicate mathematical thinking coherently and clearly to peers, teachers, and others.	Experiment with forms of argumentation	24	80%
	Proving allegations/conjectures	4	13.3%
Analyze and evaluate the mathematical thinking and strategies of others	Criticize the evidence	3	10%
	Reflect on their own understanding and the ideas of others	7	23.3%
Use mathematical language to express mathematical ideas precisely	Use mathematical language and symbols appropriately	13	43.3%
Average percentage			39%

Based on this table, the achievement of mathematical communication activity content is in the quite good category with an average of 39%. Indicators of mathematical communication that appear frequently in books are experimenting with forms of argumentation well. There is conditioning or introduction to activities and behavior that students must carry out to experiment in solving the discussed problems. The following are examples of activities related to indicators of experimenting with forms of argumentation found in book page 177.

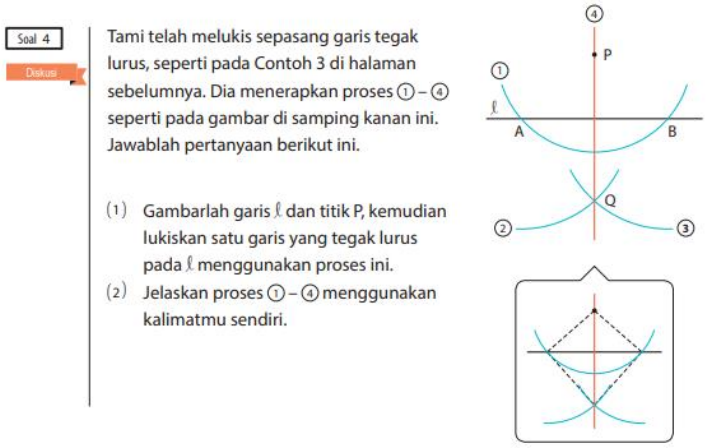


Figure 2. Book Content Page 177

Then, in second place as, an indicator that appears frequently in books is the indicator of thinking about problems with good quality activities that stimulate students to think about a solution plan. The following is an activity thinking about problems as an introduction to material related to distance on page 167.

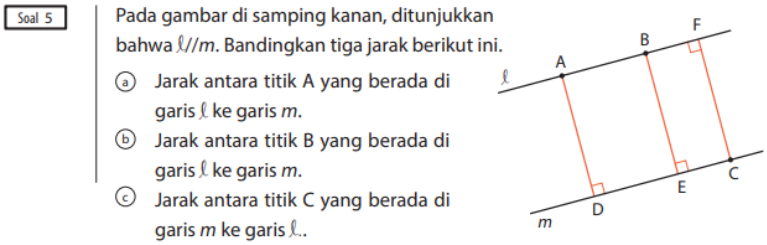


Figure 3. Book Content Page 167

Rank three is occupied by the indicator of formulating an explanation. Usually, the explanation is given in the book, but in this book, students are invited to formulate their explanations, of course, this is a good activity because it is able to validate the results of students' work and encourage students to improve their mathematical communication skills, here is an example activities related to indicators

formulate explanations contained in the book page 167

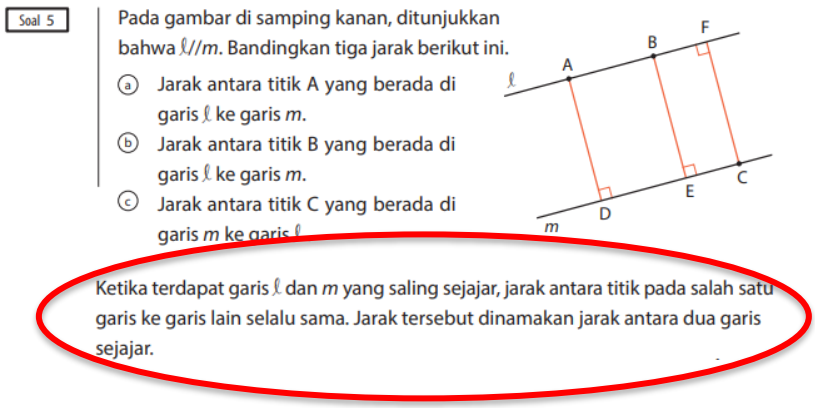


Figure 4. Continued Content Page 167

Activities related to indicators using mathematical language and symbols correctly also appear a lot in this book. These activities are of good quality because there are activities that explain directly the language and mathematical symbols that students will use in the material, for example the activity on page 164 is the following: "When we say line, what is meant is a straight line that extends infinitely in both directions. For line AB, the part of the line from A to B is called line segment AB. A straight line extended in the direction B starting from point A is called ray AB."

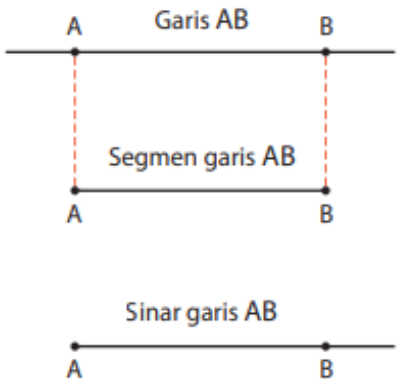


Figure 5. Book Content Page 164

Some activities ask students to solve problems using mathematical language and symbols correctly, as on page 188 below.

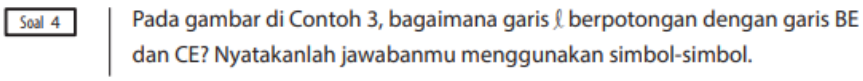


Figure 6. Book Content Page 188

In relation to the previous indicator, namely using mathematical language and symbols correctly, the indicator of trying new notation is also a good quality activity because students are invited to recognize new notations that appear in the material using the context, for example, the activity on page 167 below.

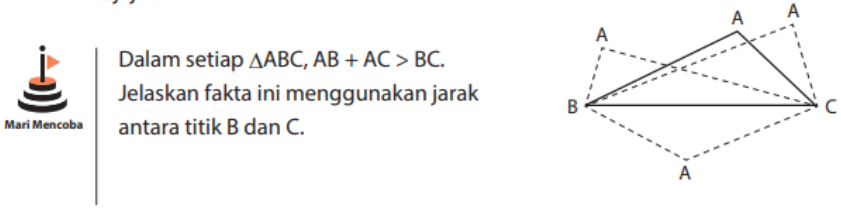


Figure 7. Activity Content Page 167

Before this activity, there were activities related to indicators using appropriate mathematical language and symbols found on page 163 below.

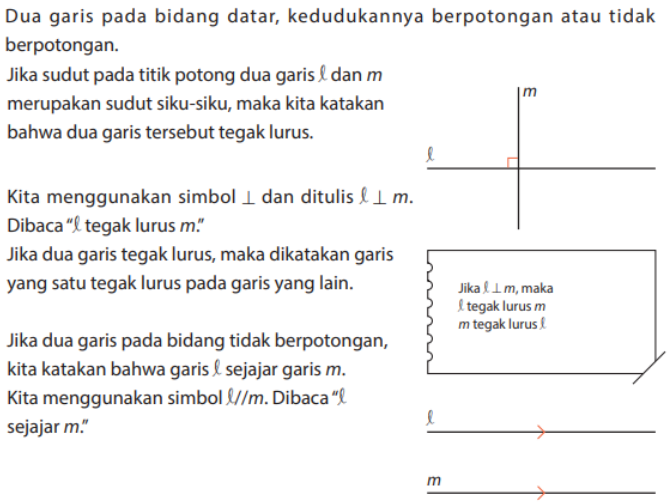
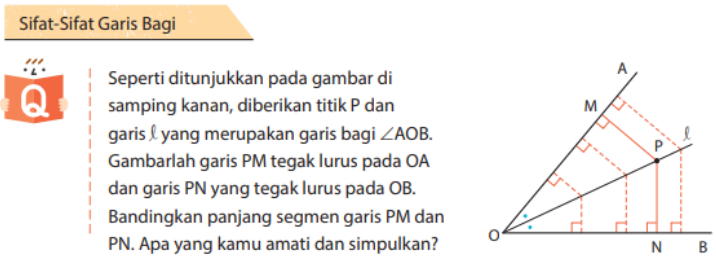

Dua garis pada bidang datar, kedudukannya berpotongan atau tidak berpotongan.
Jika sudut pada titik potong dua garis ℓ dan m merupakan sudut siku-siku, maka kita katakan bahwa dua garis tersebut tegak lurus.
Kita menggunakan simbol $\perp$ dan ditulis $\ell \perp m$. Dibaca "ℓ tegak lurus m."
Jika dua garis tegak lurus, maka dikatakan garis yang satu tegak lurus pada garis yang lain.
Jika dua garis pada bidang tidak berpotongan, kita katakan bahwa garis ℓ sejajar garis m. Kita menggunakan simbol $\ell // m$. Dibaca "ℓ sejajar m."

Figure 8. Book Content Page 163

In this book, there are not only activities to introduce mathematical language and symbols, but there are also activities that ask students to directly apply the knowledge they have just gained through activities related to trying out new vocabulary or notation, as found on page 164. Furthermore, activities related to indicators reflect their own and other people's understanding does not appear much in the book, this is, of course, a concern for researchers because this book does not provide direct activities with instructions in the form of "discussing with a friend or teacher" which previously often appeared in printed books or Student Worksheets revised edition of the 2013 curriculum. The activities found by researchers relating to indicators reflect their own understanding, and other people's ideas are implicit with the assumption that later, the teacher will facilitate learning by asking students to explain the results of their opinions on the questions raised in the book, as found on page 179 below.


Sifat-Sifat Garis Bagi

Seperti ditunjukkan pada gambar di samping kanan, diberikan titik P dan garis ℓ yang merupakan garis bagi $\angle AOB$. Gambarlah garis PM tegak lurus pada OA dan garis PN yang tegak lurus pada OB. Bandingkan panjang segmen garis PM dan PN. Apa yang kamu amati dan simpulkan?

Figure 9. Book Content Page 179

Activities related to indicators proving conjectures/conjectures are also not often found in this book, considering the nature of the activity content which emphasizes context-based procedural experimentation activities presented by the material, not experimentation proving mathematical conjectures/conjectures, there are only four activities that are felt to be able to bring out competence proving allegations/conjectures, one of which is the activity on page 165 below.

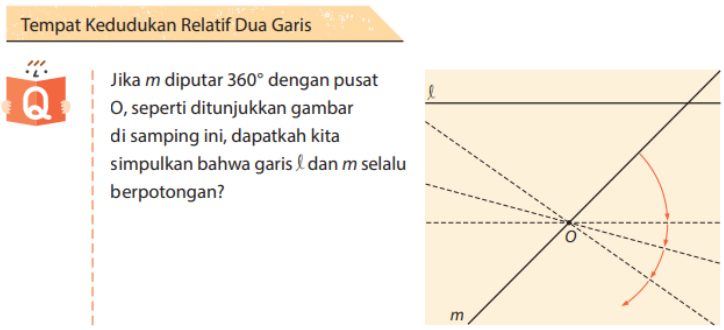


Figure 10. Book Content Page 165

The indicator that appears the least in the activities of this book is the indicator of criticizing proofs, for the same reason as before, researchers were only able to find three activities that were able to support the development of mathematical communication competence related to indicators of criticizing proofs, one of the activities is the one on page 170 below.

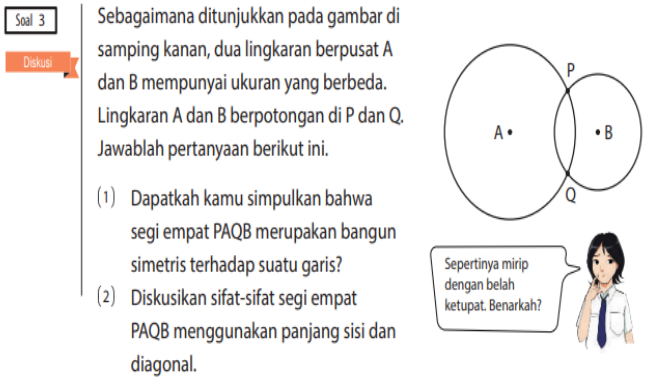


Figure 11. Book Content Page 170

In this activity, the problems posed are able to stimulate critical thinking, even though the activity does not directly ask students to criticize evidence (evidence regarding the properties of quadrilaterals), this activity is felt to be able to support the achievement of indicators of criticizing evidence with the assumption that the teacher directs students to explain the results. Their thoughts in responding to these problems.

From the data displayed, it can be concluded that the content in the independent curriculum textbook for plane geometry material is good enough to present activities to develop students' mathematical communication skills. The data displayed both in frequency tables and descriptively can be summarized as a conclusion through the analysis conclusion table with data that has been sorted from the indicators that appear the most to the ones that appear the least in Table 5 below.

Table 5. Summary of Content Quality of Mathematical Communication Activities

Indicator	Superiority	Lack
Experiment with forms of argumentation	Activities contain aspects of conditioning and behavior so that instructions regarding experiments that students must carry out are clear	There are not many specific instructions that ask students to experiment, many activities only label them as Q (Question) or questions that students need to answer, which actually require experimentation to answer these questions, few activities directly give the instruction "Let's Try"
Thinking about problems	The activities always appear at the beginning of	There are no special instructions or labels, for example, “Let's Think”

	the material as conditioning and the context is appropriate to the material to be discussed or studied	
Formulate an explanation	Related to the indicator of thinking about problems, this activity can validate the answers to problems that students have solved in the previous indicator	Not all questions asked in the book have answers provided
Use mathematical language and symbols appropriately	There are two types of activities displayed, namely activities in the form of explanations related to the language and mathematical symbols used in the material and activities that ask students to apply this knowledge to solve problems related to the material. Apart from that, the explanation presented is very complete, accompanied by the necessary illustrations.	It is necessary to add basic theory in the form of definitions or theorems related to explanations regarding the language and mathematical symbols that have been provided. This can also support the indicator's achievement of proving conjectures/conjectures as well as criticizing the proof if proof of the theorem is also shown.
Try new vocabulary or notation	In connection with the previous indicator, students are asked to explain answers that ask students to use new vocabulary or notation that is introduced to them for each material.	Not accompanied by discussion activities as a means of validating student answers
Reflect on their own understanding and the ideas of others	Many of the problems presented are worthy of discussion because they are open discussions	There are no special instructions or labels, for example "Let's Discuss"
Proving a guess or conjecture	Activities are presented according to the context of the material	The book does not present a theoretical basis related to mathematical concepts (definitions or theorems), so activities that support this indicator are not fulfilled, and activities related to this indicator are implicit.
Criticize the evidence	Activities are presented according to the context of the material	There are no special instructions or labels, for example, "Let's Think Critically," and activities related to this indicator are implied.

Discussion

This book needs improved clear instructions regarding activities, such as those in the following 2013 junior high school mathematics curriculum book.

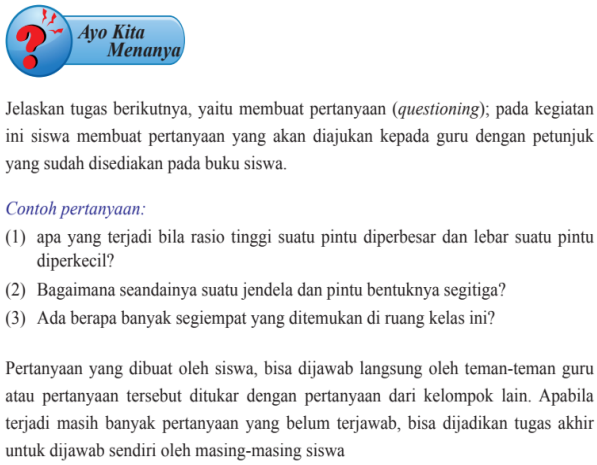


Figure 12. K-13 Book Activities

However, basically, this book provides sufficient activities as an effort to improve students' mathematical communication skills if teachers are able to use this book well as a resource and learning media in the classroom, this is in accordance with the statement "the meaning of building communication skills for teachers is as" teaching how to learn mathematics", while for students it means "learning how to learn mathematics" (Jacob in Siregar & Edy, 2020).

CONCLUSION

Content analysis of mathematical communication activities in Merdeka curriculum mathematics textbooks was carried out using descriptive qualitative research methods with the type of content analysis. The research results obtained are that the indicator of experimenting with the form of argumentation is an indicator that often appears in activities in books with a percentage of 80%, while the indicator of criticizing evidence is the one that appears the least with a percentage of 10% with an average percentage of conformity of book content with communication competence. Mathematically is 39% in the quite good category. Basically, the Merdeka curriculum mathematics textbook for plane geometry material provides activities that can support the improvement of students' mathematical communication skills. All indicators related to mathematical communication competence have been fulfilled in this book. However, there are no labels or special instructions related to these indicators. Hence, there are still many activities whose meanings related to these indicators are still implied or based on the researcher's opinion with adjustments to the theory used regarding mathematical communication. This is in accordance with what was conveyed by Tinungki even though there are no labels or special instructions related to these indicators, there are still many activities where the meaning related to these indicators is still implicit or based on the researcher's opinion adjusted to the theory used regarding mathematical communication (Nayazik & Wahyuni, 2017). Thus, to support the achievement of increasing students' mathematical communication competence, teachers need to understand well the meaning of the activities provided in the book and invite students to complete all the activities in the book using learning methods that allow discussion between students and other students as well as between teachers and students.

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