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COMMUNICATIVE CHILD FRIENDLY MATHEMATICS LEARNING MANAGEMENT: COLLABORATIVE SKILLS IN PROBLEM SOLVING

Meggy Novitasari[1]*, Erni Suharini[1], Mintarsih Arbarini[1] & Bambang Sumardjoko[2]

[1]
Universitas Negeri Semarang

[2]
Universitas Muhammadiyah Surakarta

Corresponding Author:
Universitas Negeri Semarang
E-mail:
meggy151013@students.unnes.ac.id

ABSTRACT

The purpose of the study is to describe the management of communicative child-friendly mathematics learning for collaborating skills in problem solving which has three aspects namely 1) interpretation of problems, 2) discussion to solve problems and 3) communicating ideas. The type of study utilised is qualitative ethnography and incorporated data collection techniques of participatory observation, in-depth interviews, and document analysis. Data validation is carried out by triangulation of sources and time. The data analysis technique was done inductively. As for the results of the study, communicative child-friendly mathematics learning management for collaboration skills in problem solving can be categorized into three aspects: 1) Aspects of collaborating skills in problem solving related to aspects of problem interpretation are carried out by measuring students' abilities to analyse, understand, and give meaning to data or information that exists in problems or questions; 2) Aspects of collaborating skills in solving problems related to discussing aspects are carried out by thinking mathematically to learn to solve problems together; 3) Aspects of collaboration skills in solving problems related to aspects of communicating ideas are carried out by students being able to present the results of discussions both orally and in writing in the form of pictures, diagrams, or real objects into language, symbols, ideas, or mathematical models.

Keywords: **Management; Communicative; Collaboration; Mathematics; Child Friendly**

INTRODUCTION

In today's era of globalization, education, particularly in the sphere of science and technology, is evolving quickly, increasing in sophistication and play a bigger role in society. Globalization provides many new challenges, especially in the world of education (Atta Quainoo et al., 2022). Due to this, there is a need for educators who can control classes and help students learn. As for the new competencies needed in education, educators must regulate the learning process, choose the right information and how to organize an effective learning process (Banasiak & Karczmarzyk, 2018). This is because teachers are managers in the learning process who need to have competence, transparency, efficiency and high quality. In order to enhance the quality of learning, teachers must encourage students' eagerness to increase their knowledge and abilities (De Klerk & Pauline Smith, 2022; Kim et al., 2019).

Education must be developed in order to improve social conditions, skills, and knowledge. In this regard, education needs to pay attention to human resources that are ready to face competition and increasingly strong demands (Hermino, 2016). Schools, as educational institutions, must have 21st century abilities that include the 4C: *creative thinking, critical thinking and problem solving, communication, and collaboration*. Students need 21st century abilities to help them solve difficulties that arise in the context of core learning. One of them is studying math (Zubaidah, 2016).

Mathematical learning is still dominated by the verbal introduction of formulas and ideas, with little emphasis paid to student grasp of material notions. Mathematics as a science that requires reasoning in the thought process (Ahmad et al., 2018; Kadarisma et al., 2019). Learning mathematics is said to focus entirely on the cognitive side. To satisfy the needs of the 21st century, mathematics learning must be transformed from mechanical to humanistic learning with character. Therefore, learning needs to be integrated into the skills needed by students humanely (Talib, 2019). In addition, to create integrated humanist (child-friendly) mathematics learning by developing problems with a collaborative approach (Botha & Nel, 2022). Learning that was formerly centered on cognitive characteristics has declined in all dimensions, including personality, social skills, and learning styles (Sheromova et al., 2020). Mathematics education fosters 21st century abilities such as communication and collaboration. Collaborative mathematics learning requires students to take part, be more communicative, and think more critically to develop a holistic learning dimension (Sotto, 2021). Skill-based mathematics learning for the 21st century is not a new concept, but it leads to learning that allows students to study actively, critically, creatively, innovatively, collaboratively, and communicatively (Ismail et al., 2019).

The findings of observations and preliminary interviews with teacher and students indicate that learning management in SD Muhammadiyah 1 Surakarta is still suboptimal. Management of learning in SD Muhammadiyah 1 Surakarta, consist of three stages of activity including planning, implementation and closing. Teacher planning activities prepare everything used for the learning process, for example making a Learning Implementation Plan (RPP). Implementation activities in the teaching and learning process tend to use only conventional lecture methods, without any creativity and innovation from the teacher. Closing activities are carried out monotonously. The teaching and learning process is dominated by traditional lecture methods, with little room for the teacher's originality and invention. As a result, "communicative child-friendly mathematics learning innovation" is an alternate method that can be implemented. This learning innovation allows for the development of problem-solving cooperation abilities. Because students will collaborate with one another in the learning process, the presence of communicative child-friendly mathematics learning innovation is predicted to help children understand the topic. This innovation will very probably be linked to features of 21st century abilities.

Child-friendly mathematics learning tries to use learning approaches that include children and present real-world examples that students are familiar with. Child-friendly mathematics learning provides familiar contextual problems (Setyaningsih et al., 2019). As children cannot learn mathematics by memorizing concepts, they must be trained in mathematical thinking and be able to solve mathematical problems. Mathematics education must also be relevant

to students' real-world experiences (Ulhusna et al., 2020). The communicative learning process must create a welcoming environment in which students can feel at ease and develop their full potential through collaboration. A healthy, comfortable and safe environment propels students to be more communicative in learning together. Students with persuasive communication skills are more flexible in a pleasant and favorable environment (Heng, 2014). Teachers can create a favorable environment by considering a variety of elements, including: 1) appropriate learning topics, 2) a supportive school climate, and 3) acceptable facilities.

Any lesson topic can be used to design learning with the ultimate goal of developing students' collaborative abilities. Mathematics is one of the learning skills associated with collaboration. Collaborative mathematics learning will be more effective and superior than conventional learning methods. Anyone can use mathematics to tackle everyday difficulties (Esra, 2018). A personal understanding of mathematical concepts is required for the development of mathematical competence and learning outcomes (Suciati et al., 2019). Students in collaborative learning must also tackle mathematical challenges. In order to develop mathematical problem-solving skills based on critical thinking, instructors must be sharper, more innovative, and broad-minded (Sutama et al., 2022).

Collaboration in mathematics learning demands ideas and dedication from both teachers and principals. Professional development to support the quality of teaching in improving student achievement (Salleh & Zulkifli, 2020; Hassan, R., 2022). Feedback and evaluation during the learning process enhance collaboration and make learning more meaningful (Huah & Hisyam Selamat, 2017). Salehi (2019) said that several changes occur in the process of determining and selecting ideas in a team or group-based learning innovation. As a result, relevant group learning must be carried out (Aditya, 2020). This is expected to foster student-teacher collaboration in the administration of collaborative mathematics learning, which can foster critical thinking and problem-solving skills (Trisdiono et al., 2019). Collaborative learning is a transition of individuals with critical thinking skills who can develop skills and responsibilities via the learning process. Collaborative communicative learning strives to: i) foster more natural and humane collaboration among students; ii) foster collaboration and problem-solving skills; iii) foster social communication; and iv) foster student passion and drive. Students can gain experience with three principles through collaborative learning: individual accountability, group benefits, and attainment of learning success.

According to this explanation, collaboration skills in solving mathematical issues, are talents required by students to succeed in a learning setting where two or more students solve problems via understanding, effort, and integrating relevant information and skills. This means that collaboration skills in problem solving in addition to strengthening the knowledge of students must emphasize social abilities and mentality to realize learning goals. Everyone has a different mentality when it comes to issue-solving (Hannania et al., 2022). Learning experiences have an impact on creativity and imagination when it comes to problem-solving (Supandi et al., 2021). When it comes to math difficulties, it is common to find that some students struggle, have average abilities, and have amazing aptitudes. Skills, talents and knowledge among students differ according to the level of need in terms of problem solving. This is because a person can solve good challenges if they have a strong ability to overcome hurdles.

As a result, this paper has three research aims. First, characterize collaborative abilities based on reading indicators in mathematical problem solving. Second, characterize collaborative skills in addressing mathematical problems using discussion indicators. Finally, discuss the ability to collaborate using signs of expressing ideas in mathematical problem solving. Based on these three objectives, there is a literature review which states that 21st century skills are a factor in determining individual skills. However, from the 21st century skills that are the most powerful and dominant determinants are communication and collaboration skills as demographic determinants of education holistically (van Laar et al., 2020).

LITERATURE REVIEW

Communication

Important communication is integrated in the learning process. Effective communication can increase motivation and apply independent character (Kayode, 2018). In addition to this, communication acts as a moderation of the learning system to test cognitive, skills and social abilities (R. Ahmad & Ghavifekr, 2018). Management of communication in learning through social systems and learning interaction patterns to create life skills-based learning (R. Ahmad & Ghavifekr, 2018). Communication here becomes more complex and effective in accordance with the development of information and technology.

Learning Management

Ideal learning management is important to support the learning process. Arranging learning management (planning, implementing and closing) becomes the dominant factor for the future (R. Ahmad & Ghavifekr, 2018; Muthmainnah et al., 2021) . This does not rule out the role of school leaders. The role of the principal, school culture and teacher competence affect the management of learning (Ardliana et al., 2021). This means that ideal learning management is a benchmark for the learning process that creates student innovation and creativity.

Collaboration

Collaborative skills mean working in pairs or groups that are knowledge-based, interdisciplinary and specialized. Collaboration skills are related to developing critical thinking skills, analyzing both individual and group problems (Aslamiah et al., 2021). Teacher motivation is needed to facilitate and achieve optimal learning goals (Adewale et al., 2017). This is supported by Arbarini et al., (2020) that motivational learning models are effective for increasing student collaboration. Collaboration skills instill social skills including responsibility, interaction and always thinking critically. Collaboration becomes an important aspect in learning that gives changes to students so that they are more active, creative and superior.

RESEARCH METHODOLOGY

Research Design

The research method used is research and development. According to a previous study, research and development is the process of altering existing items and creating new products that can be measured for efficiency, effectiveness, and strength (Sutama, 2019). The ethnographic qualitative research design is used in this study. When it is their turn to build theory, qualitative research seeks to comprehend social phenomena from the perspective of participants. Ethnography is a research approach in which researchers learn about collaborative skills in solving mathematical problems in elementary school students during the 2021/2022 school year through planning, observation, field notes, interviews, and evaluations for six months (April-September 2022). This study process is adaptable and contextually built-in response to the realities of learning mathematics in the research domain.

The goal of this study was to investigate cooperating skills in solving mathematical problems based on student assessments and the findings of interviews with participants. The teacher assigns four math tasks to each student for evaluation. The researcher prepared a rubric for the answers to each question based on indicators of collaborative skills in solving mathematical problems to analyze the assessment such as 1) problem interpretation; 2) problem resolution through discussion; and 3) sharing ideas.

Research Objects and Subjects

The subject of this research was the Headmaster, the Mathematic Teacher, and the students at the IV grade of SD Muhammadiyah 1 Surakarta, Surakarta, Central Java, Indonesia, in the academic year 2021/2022. The headmaster is a woman with over ten years of teaching and driving instruction expertise. Both male and female math teachers have more than five years of teaching experience. Class IV is made up of 24 students, 11 boys, and 13 girls.

Data Collection Technique

Exploration and interpretation of study data gathered by field notes and observations, interviews, and documentation (Creswell, 2012). The purpose of observations and field notes is to observe and document mathematical learning activities. To learn more about the learning paradigm and collaborative activities in solving arithmetic problems at each starting ability level, interviews were held with the school headmaster, mathematics teacher, and students. Documentation is carried out in order to assess the archives of the first grades of subjects and math problems.

Data Validity

The data's validity is assessed by using a triangulation of sources and procedures (Sutama, 2019). Source triangulation is used to check the trustworthiness of data by evaluating data collected from participants. The existing data is then described and classified into three types: identical data, dissimilar data, and specific data. The researcher then reached conclusions before requesting the subject's permission to collect the data.

Technique triangulation is used to validate data by applying several procedures to the same subject (headmaster/teacher/student). Data from document analysis, for example, is then investigated using interviews, observations, and field notes. When the three procedures provide different results, the researcher must consult with the subject to determine which is correct, or take into account all distinct points of view.

Data Analysis Technique

The data were analyzed inductively (Creswell, 2012). This process is carried out in tandem with data collection. The first section of field notes is a description of the data, data sources, data collection methodologies, and the environmental situation in which the research is being conducted. The second section focuses on the research's findings and next steps. This reflection seeks to connect the initial conclusions or theories about research findings with deeper data exploration and knowledge. Field notes are expected to be prepared in this section so that the researcher can make inferences from the findings when the investigation is completed. Data analysis entails gathering information, reducing it, presenting it, and generating conclusions.

RESULTS

Collaborative math problem-solving skills contribute to a happy mood, good teamwork, exchanging ideas with other friends, respecting others, and strengthening interpretative and calculating skills. Collaboration skills provide opportunities to think more openly, think more deeply and be able to increase cooperation between students. Student collaboration skills can be seen when solving problems in the learning process. In result, excellent communication is established, and the character of students is visible.

In their interviews, the two math teachers said the same thing, which was corroborated by the headmaster's remark as follows:
"Students' collaboration skills in solving mathematical problems are seen in preliminary activities, core activities to closing activities. Mathematics teachers always show a friendly, humanistic, and characterful attitude".

According to the teacher, the habit is intended to teach kids how to respect others (between teachers and students, and students and students). In the preliminary activity, the teacher plans how the five minutes at the beginning of the lesson will impress and arouse the enthusiasm of students to learn. For example, with an apperception, an ice breaker or material reinforcement is given, but it is fun. Core activities are important to foster students' understanding and knowledge regarding the material provided by the teacher. This requires teacher creativity and innovation to improve student understanding and learning outcomes. Closing activities usually tend to be

monotonous, for example the teacher concludes the learning that has taken place and ends by praying together. However, the demands of the current learning process in closing activities, the teacher in addition to concluding, must provide reflection and evaluation for students, the goal is for teachers to know the extent to which students are able to understand the material.

Friendly, humanist and with character, which means teachers tend to be friendly, polite and knowledgeable in learning mathematics more humane (mutual respect) to create learning with character and fun. Furthermore, these habits can influence pupils to recognize the need to constantly think positively and nicely when learning; being more curious; become more talkative; and improve their capacity to learn mathematics. This study focuses on three markers of collaborative skills in mathematical problem solving: i) problem interpretation; ii) problem resolution through discussion; and iii) sharing ideas.

Indicators of Collaboration Skills Based on Problem Interpretation

The teacher cultivates the character of students in the collaborative mathematics learning process. Mathematics learning collaboration skills encourage students to actively take part and explore innovative ideas. Before students explore innovative ideas, they must remember and reflect on what material they have learned. This makes students learn more meaningfully according to their needs. Problem interpretation is the first indicator of collaborative problem-solving skills employed in this study. This indicator assesses pupils' ability to evaluate, comprehend, and interpret the data or information provided in the problem or question. Students participate in numerous tasks during the problem-solving process, such as defining goals to be reached and activities to carry out tasks. Students benefit from problem-solving when they recognize the connection between mathematics and other disciplines or the real world as an educational intervention using collaborative learning methodologies. This means problem solving as the basic key to further understanding the material and being able to provide relevance and implement it into everyday life.

Figure 1. Collaboration of problem interpretation indicators

Figure 1 depicts a problem interpretation in learning. The teacher gives incentives, stimulus, and material lighters to promote pupils' curiosity and critical thinking processes in problem solving. Interpretation of the problem here aims to provide reflection for students to recall the material that has been mastered and provide meaningful learning for students. Collaborative learning methods on problem interpretation indicators will have a positive impact on students' mathematical problem-solving abilities because they place students in groups and assign them tasks that require them to rely on one another to complete the tasks assigned by the teacher, resulting in shared responsibility. After students understand the problem interpretation, they will know and understand how the learning process takes place.

Collaboration Skills based on indicators Solving Problems with Discussion

Solving problems by discussing between students are emphasized for independent learning, while the teacher is only a facilitator in learning. The teacher provides opportunities so that students and their groups can freely develop their thoughts, develop ideas or be creative in discussions.

On Sundays, mom goes shopping at the market. Mother bought 5 kg of oranges. 1 kg of oranges contains 15 oranges. The oranges will be put in 3 plastic bags with the same amount of contents. The number of oranges in the plastic bag is…	Answer: number of oranges bought = 5kg; number of oranges per 1 kg = 15 pieces; number of plastic bags = 3. The math sentence is: =(5x15):3 =75:3 =25 So, the number of oranges per plastic bag is 25

Figure 2. Solving the Problem by Discussion

Figure 2 depicts a teacher posing math problems to students in the form of story questions. Students are expected to solve the topic collaboratively in groups. Previously, they were requested to discuss in order to address a problem. During the discussion, students begin to explore knowledge and provide their own version of the best answer while still accompanied by the teacher. The teacher as a facilitator always assists students by providing clarifications, answers and motivation to improve student performance both independently and in collaboration. This means that with the guidance, direction, and motivation of the teacher, students are more likely to learn actively and emphasize the thinking process to solve problems. From there, students are trained to develop themselves and develop their character.

Teachers can assist students to develop their creativity in mathematical thinking by learning to solve problems together using collaborative skills based on problem solving indicators. In addition, the indicator of solving problems by discussion provides the best opportunity for students to think at a higher level, explore knowledge and express opinions/ideas that they already have. Based on this, students become accustomed to active learning. Learning is fun because in all learning activities students take part to achieve learning goals.

Collaboration Skills Based on Indicator of Idea Communication

Collaborative learning is a type of learning in which students are actively involved and immediately able to discuss ideas while learning. Collaborative learning, in addition to interpreting problems, as well as discussing how to solve problems, is also no less important, namely communicating ideas. After students remember knowledge, understand concepts and discuss to solve problems, now is the time for students to communicate ideas.

For example: Father bought 8 baskets of apples to resell. Each basket contains 40 apples. After arriving home, it turned out that there were 12 apples and 10 rotten fruits. How many apples does father still sell…? Based on these problems, students were able to communicate the results of the discussion orally as follows:

Figure 3. Communicating ideas

The picture shown above is an example of students being able to communicate ideas to solve problems. This requires students to be more daring to express and develop themselves in front of their friends. In addition to training their abilities and courage, it trains children to be more social (communication). Therefore, indicators solve problems by communicating ideas in addition to training and getting used to measuring students' abilities in front of their friends, namely instilling confident characters in students to communicate and socialize both in the school, family and community environment. Students can inculcate thoughts in their heads by sharing mathematical ideas and concepts they have. Students communicating ideas reflect on concepts to grow them into better knowledge.

DISCUSSION

Collaboration skills can help students learn mathematics. Similarly, knowledge in mathematics can be gained by asking questions, talking, solving problems, and gaining self-awareness (Acharya et al., 2022). This supports students to have more integrity, open thinking, communicative and play an active role in the learning process. In addition, collaborative learning also emphasizes the social conditions of students to support the learning process. Collaborative learning can help to enhance important abilities including emotional awareness, social, socio-cognitive, and leadership (Theodorakopoulos, 2022). Collaborative learning is an example of how students can see things from the perspective of others rather than just their own. Here, the teacher must have a prominent level of creativity in learning (Kaendler et al., 2016). Collaborative learning is the process of learning together in areas like implementation, problem-solving, and decision-making.

The implementation of learning, problem solving and decision making in the learning process becomes a component that supports each other so that cooperation between students and teachers is needed to achieve learning objectives. Based on this, students can develop metacognitive skills (Wismath & Orr, 2015). Collaborative learning is not the same as individual learning; rather, it demonstrates the distribution and involvement of intellect from one student to another in order to develop a new idea (Scager et al., 2016). Collaborative learning becomes an active learning strategy for students (Bosch, 2022). In addition, collaborative learning is the most advanced and sophisticated sort of learning when it comes to developing critical thinking skills in problem solving. Furthermore, collaborative learning develops students' critical thinking and higher order thinking (Alharbi et al., 2022). Problem-solving can boost students' activeness by providing them with the ability to understand concepts in problem interpretation (Albay, 2019; Simamora et al., 2017). The capacity of students to find answers to difficulties in the form of questions or math problems is referred to as their mathematical problem-solving abilities.

Collaborative learning affects students in solving problems on the grounds that collaborative learning supports understanding problems, making plans, implementing plans so that student performance will be better and more effective (Saadati, F., Reyes, 2019). Collaborative learning requires group members to actively interact with one

another by sharing their experiences so that communication between students and teachers and students will be more dynamic and show collaborative performance (Ansari & Khan, 2020). The teacher assigns mathematical problems and pupils are required to interpret them. Students are trained to remember and reprocess knowledge given to them by the teacher and his group. This means that students in collaborative learning, especially problem interpretation activities, require opportunities for them to be more open-minded to create meaningful learning.

According to Sulistyowaty, Kesumah, and Priatna (2019), there are steps of collaborative learning activities in problem solving, including instructing students on how to locate an idea for themselves and compiling mathematical problem-solving independently or in groups. Some advantages of collaborative issue-solving include: (1) grouping work into teams; (2) allowing each team member to explore numerous sources of knowledge; and (3) discovering new ideas (Sukmawati & Siswono, 2021). The primary aspect of issue solving through discussion is communication among group or team members, so students may solve difficulties collectively. Students can communicate with other students in mathematics by working together to solve a problem. Another factor in solving problems in discussion is creativity between group members, so students will solve problems by innovating.

According to the findings of this study, collaborative learning structured for discussion increases students' tenacity in completing assignments or problem-based questions with their team, consequently boosting thinking skills through debate. Actively taking part in the learning process can lead to discovery and acquiring of new knowledge. Therefore, students can think creatively in completing assignments or problems, and the ability of these students will be able to develop a learning curriculum. Not only critical thinking, as discussion activities also shape the character of students to respect each other's ideas/opinions that have been conveyed. That is, students do not only get skills in terms of knowledge but are trained to cultivate character in the learning process.

Communicating the intended idea is to present what they have done from the two previous activities. Students can improve their chances of communicating mathematical ideas in the form of representations by working in groups (Retnowati, 2017). This means that communicating ideas to solve problems is important for students as a supporter of critical thinking skills because by communicating ideas they are given more opportunities to explore knowledge and insights in general as well as make students more courageous to express themselves.

The indicator of communicating ideas indicates that students can present the outcomes of talks both orally and in writing in the form of drawings, diagrams, or real-world items into language, symbols, concepts, or mathematical models. Communicating ideas demands and trains students to be skilled in speaking, critical thinking and trains students' mental courage. The key to increasing students' abilities is for them to become accustomed to communicating verbally (Abdikarimova et al., 2021).

Students will have communication challenges in middle and high school if they do not have the ability to articulate ideas in problem-solving at the elementary school level (Prabawanto, 2019). Students' mathematical communication in diverse schools still needs to be improved (Purnama & Afriansyah, 2016). Therefore, mathematical ability analysis is still required to construct learning that assists students in developing mathematical communication abilities.

Students with self-confidence can communicate ideas in the form of clarifying concepts in solving difficulties that will be expressed (Rizqi, 2016) learning communication in mathematics can aid in the development of interaction and idea expression in the classroom. Starting from in class setting, students can master/manage class well, then with intense training they can socialize in public with high self-confidence.

This means that in communicating ideas, students are more challenged to think critically, and their psychological courage is more challenged. Thus, it is not only the main metacognitive ability but also able to develop the character needs of students. Therefore, the three indicators of collaboration skills in solving mathematical problems not only emphasize students' metacognitive abilities but also cultivate character in students.

CONCLUSION

Communicative child-friendly mathematics learning activities through collaborating skills in problem solving make a positive contribution to good attitudes, good cooperation, open thinking, communicative, exchanging ideas with other friends, respecting others, and improving interpretive and calculation skills. Communicative child-friendly mathematics learning activities through collaboration skills in addition to contributing to knowledge skills, collaboration skills contribute to the characterization of students. Cultivating the character of students in collaboration skills including respect for others, tolerance and being able to develop themselves independently. Improved collaboration skills based on three indicators, namely problem interpretation, solving problems through discussion, and communicating ideas.

Collaborative skills in solving problems related to aspects of problem interpretation are carried out by measuring students' abilities to analyse, understand, and give meaning to data or information that exists in problems or questions. The character emphasis on the problem interpretation aspect is that students are accustomed to having a high curiosity to create meaningful learning. The aspect of collaborating skills in problem solving related to the discussion aspect is carried out by thinking mathematically to learn to solve problems together. Students are required to think at a higher level, explore knowledge and express opinions/ideas that they already have.

Aspects of collaboration skills in solving problems related to aspects of communicating ideas are carried out with students being able to present the results of discussions both orally and in writing in the form of pictures, diagrams, or real objects into language, symbols, ideas, or mathematical models. In addition, by getting used to measuring students' abilities in front of their friends, namely instilling a confident character in students to communicate and socialize both in the school, family and community environment. Therefore, the three indicators of collaboration skills in solving mathematical problems not only emphasize metacognitive abilities but also cultivate character in students.

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