

Development of Scientific Approach-Based Teaching Materials to Improve Students' Mathematical Literacy

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ABSTRACT

Teaching materials are one of the important elements that affect the success of the teaching materials used in the learning process is the module. Scientific-based teaching materials are teaching materials which contain 5M scientific stages including the Observing, Communicating stages. The facts in the field show that there is a lack of use of scientific based text books, students at school only use the Student Worksheet (LKS) as a learning reference. Mathematical literacy is very important in learning mathematics, because mathematical literacy is an individual's ability to formulate, apply, and interpret mathematics in various contexts, including the ability to reason mathematically and use procedural concepts, facts, and mathematical tools, to describe, explain and predict a phenomenon or event. The scientific stage in the developed teaching materials are in accordance with the characteristics of mathematical literacy.

Keywords: *Scientific_Teaching_Materials; Students'_Mathematical_Literacy*

INTRODUCTION

Education is one of the most important things in a country, because education can determine, show and teach the future of the nation's children. Without education, we as the nation's children will not be able to read and write fluently. According to Euis Fajriyah (2018) As stated in Law Number 20 of 2003 concerning National Education, education is a conscious and planned effort in order to realize learning activities and learning processes so that students can actively develop their potential to have spiritual strength, self-control, religion, personality, noble character, intelligence. As well as the skills needed by himself, the community, the nation, the State. Education has 2 kinds, namely formal and informal education. Informal education includes: home schooling, private lessons, pursuing packages, while formal education includes schools in general (Khotimah & Verdianingsih, 2019).

Curriculum is a set of rules and plans that discuss the objectives, content, learning materials and guidelines used for the implementation of certain activities. The process of learning the 2013 Curriculum for all levels is carried out using a scientific approach. The learning process must cover three domains, namely attitudes, knowledge, and skills (Wardani, 2020). The 2013 curriculum expects the final result, namely an increase and a balance between the ability to become good human beings (soft skills) and humans who have the skills and knowledge to live properly (hard skills) from students which include aspects of competence, attitudes, skills, and knowledge (Rusindrayanti & Santoso, 2015). The literacy is also needed by a student, because with literacy alone, students' knowledge will increase and students' thinking processes will be more creative (Umardiyah & Rohmah, 2021).

PISA is one of the researches developed by some of the developed countries in the world gathered in the Organization for Economic Cooperation and Development (OECD) which is located in Paris, France. PISA is held every three years by the Organization for Development Cooperation (OECD) and the Economy. PISA monitors the results of student learning outcomes in each participating country which includes three literacies: mathematical literacy, reading literacy and scientific literacy. The general objective of PISA is to measure the extent to which 15 year old students in OECD Countries (and other countries) acquire skills in mathematical and scientific literacy to provide good participation in the surrounding community (Khoirudin et al, 2017). From the PISA research report, the mathematics scores of Indonesian students show that they are significantly below the international average.

In 2000, the achievement of mathematics literacy for Indonesian students aged 15 years was in 39th rank

out of 41 participating countries. The achievement of students' mathematical literacy was always low at the PISA held in 2003, which was ranked 38th out of 40 countries, and ranked 50th out of 57 participating countries. Next in PISA 2012 the achievement of mathematical literacy of Indonesian students continues to decline to rank 64 out of 65 countries. These results show that the mathematical literacy of Indonesian students based on international research is still not satisfactory. The mathematical literacy ability referred to here is the mathematical literacy ability in PISA, namely the ability of students to formulate, use and interpret mathematics in various contexts including reasoning mathematically and using concepts, procedures, facts and mathematical tools in explaining and predicting phenomena. Mathematical literacy skills help someone to recognize the role of mathematics in the real world and make the considerations and decisions needed as citizens. Therefore, mathematical literacy skills are very important for students in dealing with various problems in everyday life (Mardiana, 2018). Therefore, it is necessary to develop teaching materials that support to improve students' mathematical literacy skills. The teaching materials developed are in the form of modules based on a scientific approach.

METHOD

This research took place at MTs Bustanul Ulum Jombang. The population in this study were all students of MTs Bustanul Ulum Jombang class VII, totaling 17 students. Then the object of research is the material Relations and Functions. This research is a type of Research and Development (R&D) research. According to Hanafi (2018) Research and Development (R&D) is a research method used to produce certain products and test the effectiveness of these methods. In the field of education, research and development or Research and Development (R&D) is a research method used to develop or validate products used in education and learning. Mathematics learning also needs to be supported by teaching materials that can encourage students to learn independently which leads students to find concepts through discovery as suggested in the 2013 Curriculum learning.

RESULT AND DISCUSSION

Result

The demand for students' ability in mathematics is not only to have the ability to count, but the ability to reason logically and critically in problem solving. Solving this problem is not merely a problem in the form of routine questions but rather the problems faced daily. According to Khotimah & Nasrulloh (2019) PISA develops six categories of students' mathematical abilities that show the cognitive abilities of students. The level of mathematical ability according to PISA is presented in table 1 below.

Table 1. Level of Mathematical Ability

Stage	Indicator
1	<ul style="list-style-type: none">Using knowledge to solve routine problems in solving problems of general context
2	<ul style="list-style-type: none">Interpreting the problemSolving with formulas
3	<ul style="list-style-type: none">Carry out procedures in solving problemsCan choose problem solving strategies
4	<ul style="list-style-type: none">Work effectively with models and be able to select and integrate different representations
5	<ul style="list-style-type: none">Working with models for complex situations
6	<ul style="list-style-type: none">Using reasoning in solving mathematical problemsMake generalizations, formulate and communicate the findings

The table above describes the level of mathematical ability developed by PISA. As shown in table 1, the mathematical literacy assessment carried out by the PISA study consists of 6 levels or levels. The higher the level, the questions will require a high level of interpretation in a context that is completely unexpected by students. The scientific-based module is a module in which there are scientific stages that are packaged in 5M activities in accordance with the scientific approach. The role of teaching materials that encourage students to learn independently is the completion of "alternative solutions" which are presented in the module

Table 2. Learning activities on teaching materials

Learning Activities	Activities Description
Let's Observe	Students observe the examples, cases, or problems presented
Let's Asking	Students are given the opportunity to ask questions to the teacher regarding the problems observed or things that are not understood related to the material to be studied
Let's collect Information	<ul style="list-style-type: none"> Students collect information by reading the examples presented in the book Students try to understand the concepts/materials studied by working on the questions provided
Let's Associate or Let's Reason	Students process the information that has been collected to make conclusions regarding the concept/material being studied
Let's Communicate	Students are given the opportunity to convey concepts/materials to friends both in small groups and in large classes

Relation and Function Module with a scientific approach with 5M scientific stages:

- Let's Observe Activities are very useful for fulfilling the curiosity of students, so that the learning process has a high meaning.

Ayo Kita Amati

Diketahui himpunan $A = \{1, 2, 3, 4\}$ dan himpunan $B = \{a, b, c\}$. Pada tabel 1.1 ditunjukkan hubungan dari himpunan A ke himpunan B yang dinyatakan dalam bentuk diagram dan himpunan berurutan. Kedua bentuk itu merupakan relasi.

Tabel 1.1 Memahami Relasi

No	Diagram Panah	Himpunan Pasangan Berurutan
1.		
2.		

Figure 1. Observe Activities

- The Let's Ask Activities is done by asking questions about information that is not understood from what is observed or questions to get additional information about what is observed.

Ayo Kita Mananya

Terkait dengan fokus perhatian pada Tabel 1.1, coba buatlah pertanyaan yang memuat kata-kata berikut: "aturan" atau "relasi"

Contoh pertanyaan:

- Mengapa semua contoh pada Tabel 1.1 dikatakan relasi?
- Apakah ada contoh yang bukan merupakan relasi?

Figure 2. Ask Activities

- Activities Reasoning is a follow-up to the beta. This activity is carried out by digging and collecting information from various sources in various ways.

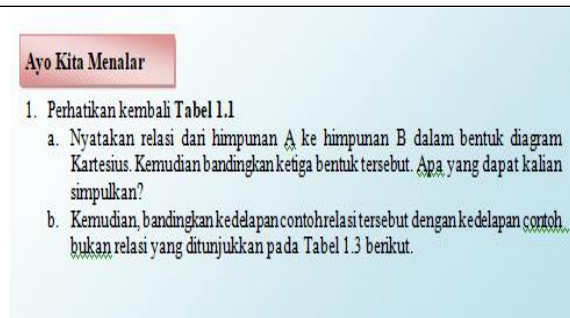


Figure 3. Reasoning Activities

- Sharing activities are carried out by discussing the results of the answers to other groups, in this case students are active actors.

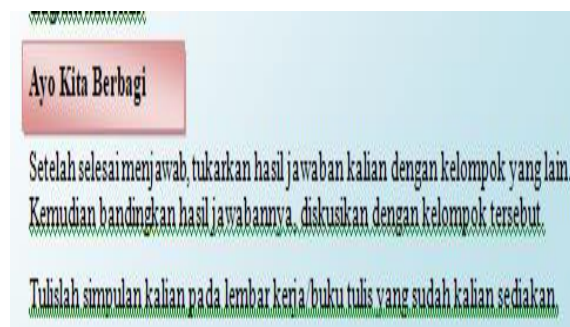


Figure 4. Sharing Activities

- Let's try Activities is done by doing experiments or trying to do simple problems

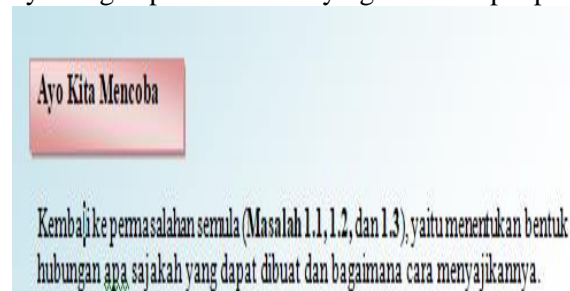


Figure 5. Try Activities

Discussion

Curriculum 2013 learning is a learning process using a scientific and contextual approach that emphasizes a scientific approach which includes: observing, asking questions, gathering information, and communicating. While teaching materials are an important part of the learning process as (Arsanti, 2018) Teaching materials are one of the important factors in the effectiveness of learning, especially at the Higher Education level. The lack of teaching materials can certainly affect the quality of learning or lectures. Teaching materials are materials or learning materials that are systematically arranged that are used by educators and students in PBM. So we can conclude that teaching materials are one of the teaching tools that help educators in teaching students in the form of learning materials that have been arranged in sequence and systematically.

CONCLUSIONS

Mathematical literacy is an individual's ability to formulate, apply, and interpret mathematics in a variety of contexts, including the ability to reason mathematically and use the concepts of procedures, facts, and mathematical tools, to describe, explain, and predict a phenomenon or event. While scientific-based teaching materials are teaching materials which contain 5M scientific stages including the stages of Observing, Questioning, Gathering Information, Reasoning, and Communicating. Based on the above study, scientific teaching materials have stages that are in accordance with the objectives of mathematical

literacy. Thus, the scientific teaching materials developed are able to improve mathematical literacy skills.

REFERENCES

- Arsanti, M. (2018). Pengembangan Bahan Ajar Mata Kuliah Penulisan Kreatif Bermuatan Nilai-Nilai Pendidikan Karakter Religius Bagi Mahasiswa Prodi PBSI, FKIP, UNISSULA. *KREDO : Jurnal Ilmiah Bahasa dan Sastra*, 1(2), 69–88. <https://doi.org/10.24176/kredo.v1i2.2107>
- Euis Fajriyah, 0401516004. (2018). Kemampuan Literasi Matematika Ditinjau Dari Gaya Kognitif Siswa Pada Model Double Loop Problem Solving Berpendekatan Rme-Pisa. [Thesis]. <http://lib.unnes.ac.id/>
- Hanafi, H. (2018). Konsep Penelitian R&D dalam Bidang Pendidikan. *SAINTIFIKA ISLAMICA: Jurnal Kajian Keislaman*, 4(2), 129–150.
- Khoirudin, A., Styawati, R. D., & Nursyahida, F. (2017). Profil Kemampuan Literasi Matematika Siswa Berkemampuan Matematis Rendah dalam Menyelesaikan Soal Berbentuk Pisa. *AKSIOMA : Jurnal Matematika dan Pendidikan Matematika*, 8(2), 33–42. <https://doi.org/10.26877/aks.v8i2.1839>
- Khotimah, K., & Nasrulloh, M. F. (2019). Kemampuan Literasi Mahasiswa Dalam Menyelesaikan Masalah Matematika Ditinjau Dari Gaya Belajar Global dan Kemampuan Matematika. *Prosiding Silogisme*, 1(1)
- Khotimah, K., & Verdianingsih, E. (2019). Pengembangan Media Pembelajaran Matematika Berbasis Adobe Flash Untuk Peserta Didik Kelas VIII. *Exact Papers in Compilation (EPiC)*, 1(4), 177-186.
- Mardiana, E. (2018). Pengembangan Bahan Ajar Berbasis Pendekatan Saintifik Meningkatkan Kemampuan Literasi Matematika Siswa Pascasarjana, Universitas Negeri Malang. *PRISMA, Prosiding Seminar Nasional Matematika*, 1, 87–91.
- Rusindrayanti, R., & Santoso, R. H. (2015). Implementasi Pendekatan Saintifik Mapel Matematika Kelas VII Tahun Pelajaran 2013/2014 pada Kurikulum 2013 DIY. *Pythagoras: Jurnal Pendidikan Matematika*, 10(1), 80–94. <https://doi.org/10.21831/pg.v10i1.9112>
- Umardiyah, F., & Rohmah, Z. (2021). Development of Teaching Materials on Geometry Materials to Develop Students' Critical Thinking Skills According to the Criteria for Critical Thinking 4C's. *APPLICATION: Applied science in Learning Research*, 1(2), 71-76.
- Wardani, D. K. (2020). Pengaruh Model Pembelajaran Generatif Terhadap Hasil Belajar Peserta Didik Pada Materi Lingkaran. *Exact Papers in Compilation (EPiC)*, 2(2), 259-264.