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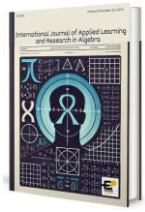

Development of Teaching Modules in Problem-Based Mathematics Learning to Improve Junior High School Students' Mathematical Literacy

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Abstract

Based on the observations and interviews at State Junior High School 8 Tangerang, data was obtained from the teaching modules at the school. Explaining the material in the teaching module has not improved students' mathematical literacy skills. The aim of this research is: (1) to develop a teaching module as a learning module on social arithmetic material for class 7 of State Junior High School 8 Tangerang, (2) to determine the feasibility of the teaching module, (3) find out the assessment of class seventh students at state junior high school 8 Tangerang regarding the development of teaching modules. This research is a development research or Research and Development (R&D) type. The steps in this research are potential and problems, collecting information, product design, product validation, product improvement, and product testing. The instrument used in this research was a learning media validation sheet. Based on the validation results by media and material experts, the average was 4.50 out of a maximum score of 5.00, and learning practitioners averaged 4.57 out of a maximum score of 5.00, categorized as very feasible. The results of the teaching module trial received a very good response from students, with an average of 3.88 out of a score of 4.00, meaning that the teaching module was very suitable for use in the learning module.

Keywords: Teaching modules; Problem-based mathematics; Mathematical literacy.

To cite this article

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1. Introduction

As a basic science, mathematics has an important and useful role in developing science and technology. Mathematics education can also help students prepare to play a role in society and face challenges in an increasingly complex digital era. Mathematics lessons are given to students at all levels of formal education so that students can think logically, analytically, critically, and creatively. This is by the process standards for classroom learning regulated in Minister of Education and Culture Regulation No. 65 of 2013, which states that the learning process in educational units is interactive, inspiring, fun, challenging, motivates students to participate actively, and provides sufficient space for initiative, creativity and independence by the student's talents, interests and physical and psychological development

Mathematics is important in everyday life and can train students' accuracy, honesty, and persistence. In the attachment to Minister of Education and Culture Regulation no. 58 of 2014 concerning the junior high school curriculum, which contains models that are used as estimates in solving problems and can make conclusions from existing events followed by the ability to understand problems, make strategies in solving problems, solve strategies for existing problems, and get solutions to resolve existing problems (Kemendikbud, 2014; Hidayat et al., 2018). Based on the objectives of mathematics, learning leads to mathematical literacy because it has the meaning of ability to formulate, carry out, and conclude everyday life problems, including mathematical thinking, concepts, procedures, and facts to be able to describe, explain, and estimate an event (Madyararti et al., 2019). Literacy For All is a slogan by UNESCO in 2016, emphasizing that every human being has the right to become "Literate" as capital to face life. There are five components, including the five mathematics learning competencies in mathematical literacy: mathematical problem solving, mathematical communication, mathematical reasoning, mathematical connections, and mathematical representation. (NCTM, 2000; Madyararti et al., 2019).

Problem-based learning is a form of approach that focuses a series of student activities to find solutions to real-life problems provided by the teacher so that critical thinking abilities increase (Meilasari et al., 2020). Through a problem-based learning approach, student activities will improve and develop active learning, which impacts learning outcomes (Yustitia & Kusmaharti, 2022). Based on research by Kiawati, Junedi, and Tabrania et al., (2023), it was concluded that the mathematical literacy abilities of students who use the problem-based learning model are better than conventional learning models, and to improve students' mathematical literacy abilities using the problem-based learning model is better than conventional learning model. This problem-based learning involves problems in students' daily lives to develop students' skills in solving mathematical problems independently. Questions related to everyday life can interest students and motivate them to solve them. So, in learning

mathematics, problems related to everyday life are presented so that students can solve them and get used to actively participating in learning. Thus, problem-based learning can be an option in mathematics learning that has a great opportunity to achieve mathematics learning goals.

However, based on the results of an interview with the teacher, a mathematics teacher at state junior high school 8 Tangerang, students literacy abilities stated that students' literacy abilities were low. The observation test was conducted on 29 seventh-grade students for a preliminary study. From the results of the students' answers, only some could answer the questions correctly. In question number (1), 59% answered correctly, and students usually answered incorrectly because they operated the calculations incorrectly. In question number (2), as many as 45% of students answered correctly, but students usually answered incorrectly due to difficulties in determining the problem asked in the question. In question number (3), 72% of students answered correctly. Usually, students do not fill in the answer to this question. In question number (4), 28% of students answered correctly; usually, students answered incorrectly because some students had difficulty determining the problem asked in the question and some students did not fill in the answer to the question. In question number (5), 38% of students answered correctly; the remaining students answered incorrectly because the students did not fill in the answer.

To improve students' mathematical literacy skills at state junior high school 8 Tangerang, there needs to be a learning model that allows students to express all their ideas, the freedom to express ideas, develop their critical thinking skills, and the opportunity to develop problems given by the teacher (Islamiyah, et al., 2024; Loska, Ayuni & Ainirohmah, 2024). So that literacy skills can grow well. According to Roebiyanto, Goenawan, and Harmini et al. (2017), problem-solving ability is an ability students should have. Based on research conducted by Sari and Khiyarunnisa (2017), shows that problem-based learning can improve mathematical literacy skills.

Based on the background above, one of the efforts that can be made to improve students' mathematical literacy skills is to innovate mathematics learning. (Wardono, 2015:94). One of the innovations in mathematics learning is using learning models in mathematics learning. The learning model that can be used is problem-based learning. Research by Istiandaru et al. (2015) states that problem-based learning can improve students' mathematical literacy skills. Based on this research, researchers are interested in conducting a research entitled "Development of Problem-Based Mathematics Learning in Improving Junior High School Students' Mathematical Literacy on Social Arithmetic Material".

2. Methods

The research model used to produce a teaching material product in the form of a Teaching Module in this research is research and development. Sugiyono (2018) states that research and development are used to produce certain products and test their effectiveness. According to Borg and Gall (Ainin, 2023), development research is a research design that aims to develop problem-based teaching modules to improve students' mathematical literacy skills in social arithmetic material.

The research procedures carried out by researchers in this development were adapted from the development steps proposed by Sugiyono (2018) but had limitations. Borg & Gall

(2019) stated that limiting research to a small scale is possible, including limiting research steps. The implementation of development steps is adjusted to the needs of researchers. The following explains the research procedures in this study: Emzir (2014) and Ririn (2018).

This research collected data based on the potential problems at State Junior High School 8 Tangerang. Based on the problems obtained, solutions were required to overcome these potentials and problems. The problems found in the Teaching Module are as follows: The Teaching Module currently used cannot motivate students to learn; The presentation of the Teaching Module is less able to guide students to find solutions to problems, so students are teacher-centered. The final result of research and development activities is a new product design with specifications. At the product design stage, the teaching materials are in the form of Teaching Modules designed to apply a problem-based learning model to improve students' mathematical literacy skills.

This research was carried out in class seventh of State Junior High School 8 Tangerang for the 2023/2024 academic year. The trial phase is carried out to determine the suitability of a teaching module before it is used in the learning process. Before the teaching module the researcher created is implemented in schools, the teaching module the researcher created will first be tested on the product, either testing the teaching module's content or testing the teaching module's feasibility. The trial design was carried out using expert validation and empirical validation (field trials). The learning model development product is submitted to expert validation by providing a questionnaire to the validator to assess the feasibility of the development product and provide criticism and suggestions for improvement, while testing by students is carried out by submitting a response questionnaire after field testing the product in learning activities. Testing is carried out to obtain criticism and suggestions for product improvements.

Two types of data are used, namely quantitative and qualitative. The following is an explanation of each of these data. Quantitative data is the process and average value from the questionnaire validation sheet to see whether the problem-based teaching module is feasible. From the results of the post-test scores, it can be seen whether there has been an increase in mathematical literacy. Qualitative data are observations, criticisms, and suggestions from validators regarding problem-based teaching modules developed to improve students' mathematical literacy skills. The data collection instruments used were observation and questionnaires. Observation is an activity that systematically records events, behavior, objects seen, and things needed to support the research being carried out. In general, researchers collect as much data or information as possible. In the next stage, researchers must carry out focused observations, namely narrowing down the data or information needed so that researchers can find patterns of behavior and relationships that continuously occur. However, researchers are not directly involved with the activities of research subjects and are only independent observers (Samsusilowati, 2016). Meanwhile, according to Sugiono (2019), a questionnaire is a data collection technique that gives respondents a set of questions or written questions to answer.

3. Results and Discussion

The preparation and development of the teaching module use the development model proposed by Sugiono (2018) with restrictions. Borg and Gall (2019) stated that it is possible to

limit research scarcity. The implementation of development steps is adjusted to the needs of researchers.

In this research, the potential and problems obtained based on observations made at State Junior High School 8 Tangerang show the teaching modules obtained from the school. Explaining the material in the teaching module cannot motivate students to learn to understand the material discussed and has not accustomed students to solving mathematical problems. These conditions tend to make it difficult for students to learn independently. Ultimately, the learning process will be teacher-centered and inadequate in training problem-solving abilities. For this reason, teaching materials are needed with packaged material that considers students' needs, makes it easier for students to understand the material presented, and can improve their mathematical literacy abilities. This research collected data based on the potential problems at State Junior High School 8 Tangerang. Based on the problems found, we were required to provide solutions to overcome these potentials and problems. The problems with the teaching module are as follows: The teaching module currently used cannot motivate students to learn; the presentation of teaching modules is less able to guide students to find solutions to problems, so students are teacher-centered.

The final result of this research and development activity is a new product design, complete with specifications and a barcode link to the YouTube site regarding discussion of the material and example questions so that students can learn independently. At the product design stage, the teaching materials are in the form of teaching modules designed to apply a problem-based learning model to improve students' mathematical literacy skills. Writing teaching modules using the Canva program and Microsoft Word. Learning objectives are prepared under competency standards in social arithmetic material such as selling price, purchasing price, profit, loss, discount, tax, single interest, gross, net, and tare. The teaching module design was created to make it easier for students to understand social arithmetic material and improve their literacy skills.

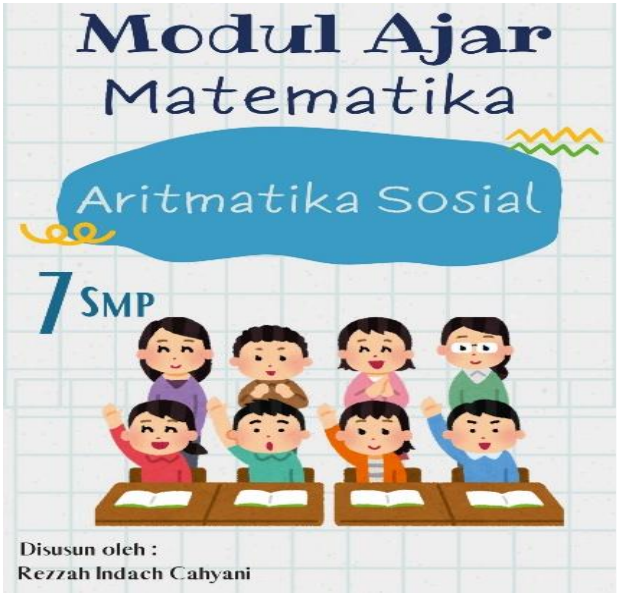
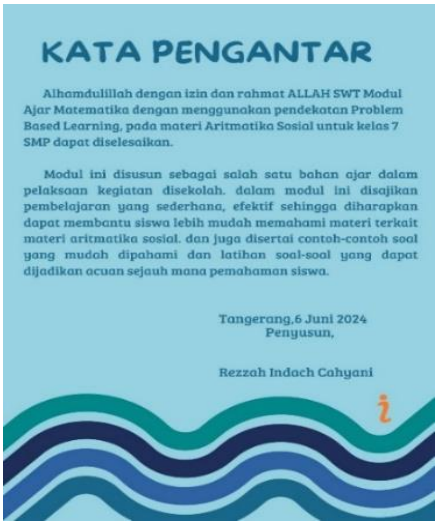


Figure 1 The front cover

The front cover is designed with various layouts, color choices, variations of letters, and images that suit the characteristics of the teaching material. The layout displays using attractive images and colors. The cover consists of the title of the book according to the subject matter being developed (Social Arithmetic), the type of teaching material being developed (Mathematics literacy skills with problem-solving) for class seventh of the state junior high school students, and the compiler by Cahyani.


KATA PENGANTAR

Alhamdulillah dengan izin dan rahmat ALLAH SWT Modul Ajar Matematika dengan menggunakan pendekatan Problem Based Learning, pada materi Aritmatika Sosial untuk kelas 7 SMP dapat diselesaikan.

Modul ini disusun sebagai salah satu bahan ajar dalam pelaksaan kegiatan disekolah. dalam modul ini disajikan pembelajaran yang sederhana, efektif sehingga diharapkan dapat membantu siswa lebih mudah memahami materi terkait materi aritmatika sosial. dan juga disertai contoh-contoh soal yang mudah dipahami dan latihan soal-soal yang dapat dijadikan acuan sejauh mana pemahaman siswa.

Tangerang,6 Juni 2024
Penyusun,

Rezzah Indach Cahyani

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Figure 2 A series of words

The foreword is a series of words from the author expressing gratitude to the creator for allowing the author to complete the preparation of teaching materials and expressing the author's hopes for future teaching materials.


CAPAIAN PEMBELAJARAN

1. Peserta didik dapat menganalisis yang berkaitan dengan harga beli, harga jual, untung dan rugi.
2. Peserta didik dapat menganalisis yang berkaitan dengan bunga tunggal
3. Peserta didik dapat menganalisis yang berkaitan dengan diskon, bruto, tara dan netto

ii

Figure 3 Learning outcomes

Learning outcomes aim to provide information on the content or objectives of the material to be studied.

DAFTAR ISI

iii

Figure 4 The table of contents

The table of contents contains details of the material in the teaching module, accompanied by a complete list of pages from the teaching module to make it easier to find the language topic you want to search for. The detailed list of material in the book consists of selling price, purchase price, profit and loss, discount, single interest tax, gross, tare, and net.

PENDAHULUAN

Pada saat kalian pergi ke pasar tradisional atau pasar swalayan maupun tempat berbelanja, di manapun berada pasti menerapkan materi Aritmetika Sosial. Ketika kalian berkunjung ke pasar swalayan kalian akan melihat harga barang, harga diskon, membeli barang dengan pajak,dan lainnya. Materi aritmetika sosial ini merupakan materi yang dapat membantu dalam memecahkan permasalahan di sekitar kalian.

Tahukah kalian, apa sebenarnya yang dimaksud dengan aritmetika sosial? Aritmetika sosial adalah bidang atau cabang ilmu matematika yang mempelajari tentang Matematika pada kehidupan sosial, misal di bidang ekonomi, bidang geografi, bidang Sosiologi. Materi aritmetika sosial ini merupakan materi yang dapat membantu kalian dalam memecahkan permasalahan dalam kehidupan sehari-hari seperti perdagangan, perbankan, dan lain-lain. Untuk mempermudah mempelajari aritmetika sosial, kalian bisa melanjutkan membaca modul ini sampai benar-benar paham.

Figure 5 The Introduction

The table of contents contains details of the material in the teaching module, accompanied by a complete list of pages from the teaching module to make it easier to find the language topic you want to search for. The detailed list of material in the book consists of selling price, purchase price, profit and loss, discount, single interest tax, gross, tare, and net.

Figure 6 The illustrations contain

Illustrations contain the material that will be studied in this teaching module, making it easier for students to know what material will be discussed. The material discussed in this teaching module is social arithmetic, including selling price, purchase price, profit, loss, discount, tax, single interest, gross, tare, and net. It is designed to be as attractive as possible so that students want to read it and stimulate students to want to study this module.

Figure 7 The example questions

The example questions contain story questions appropriate to students' daily lives so that students are interested in studying and solving the problems in the questions. This example question was created to make it easier for students to understand by providing information on what is known, what is being asked, and how to answer or solve it according to the formula being discussed.

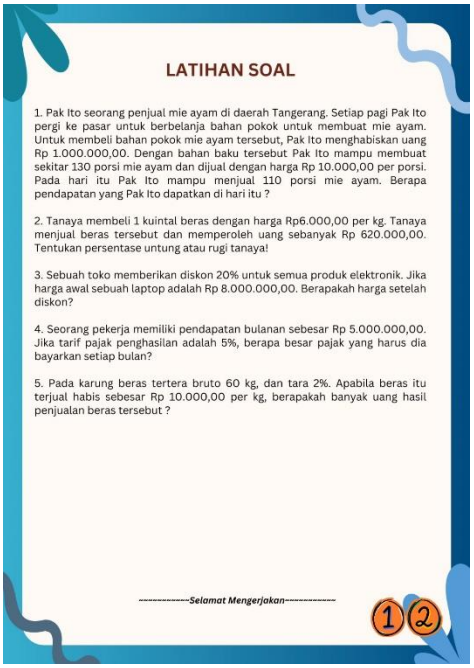


Figure 8 Practice questions

Practice questions contain questions regarding the material discussed in the social arithmetic material to evaluate the material studied previously. They function as a benchmark to find out whether students have understood the material discussed. This practice question was created to train students' reasoning and critical thinking.

Figure 9 The barcode

The barcode contains an explanation of the material and examples of questions that students can access independently with a cellphone directly connected to YouTube regarding the material discussed and how to do the questions. The barcode in this module aims to enable

students to learn independently, repeating the material wherever and whenever so that students can better understand the material being discussed.

Researchers with design expert validators and education expert validators carried out validation of teaching materials. The validator carries out validation, namely the assessment of teaching materials for each aspect asked about on the assessment sheet, seen from the components of the appropriateness of content, appropriateness of language, appropriateness of presentation, appropriateness of graphics, aspects of the problem-solving approach, and learning objectives. The validator provides comments and suggestions to improve the teaching materials in this validation. At the end of the validation, the validator provides conclusions regarding the overall suitability of the teaching materials for testing.

Product validation data in the form of developing teaching materials to improve students' mathematical literacy skills at State Junior High School 8 Tangerang was carried out in 2 stages. The first stage is obtained from the results of an assessment by one of the media and materials experts as a design expert. The second stage was obtained from the assessment results of one of the mathematics teachers at State Junior High School 8 Tangerang as validation from education experts. The data obtained is in the form of quantitative data and qualitative data. Quantitative data comes from assessment sheets using a Likert scale, while qualitative data consists of criticism and suggestions from each validator. Firmansyah conducted the media expert validation assessment as a lecturer at the Muhammadiyah University of Tangerang on June 21, 2024. At this stage, the validator assesses the product being developed. The assessment of material and media expert validators is based on 6 aspects: content, presentation, language, graphics, problem-based learning framework, and mathematical literacy ability. Below is a table of results for material and media experts to validate.

The content aspect consists of 7 questions with a percentage of 5.00 with the criteria "Very Good", the presentation aspect consists of 4 questions with a percentage of 3.50 with the criteria "Good", the language aspect consists of 4 questions with a percentage of 4.75 with the criteria "Very Good", the graphic aspect consists of 4 questions with a percentage of 4.50 with the criteria "Very Good", the PBL framework aspect consists of 6 questions with a percentage of 4.33 with the criteria "Very Good", the mathematical literacy ability aspect consists of 3 questions with percentage 4.67 with the criteria "Very Good"`. In this study, the teaching module's validation results were 4.50, which means valid or very good.

The validator assessment of the Social Arithmetic material was carried out by Bahar as a teacher at State Junior High School 8 Tangerang on June 21, 2024. The practical expert validator assessment is based on 5 aspects: ease of use, time efficiency, benefits, problem-based learning characteristics, and mathematical literacy ability. The following table presents the results of practical expert validation. The user-friendliness aspect consists of 7 questions with a percentage of 4.57 with the criteria "Very Good", the time efficiency aspect consists of 3 questions with a percentage of 4.67 with the criteria "Very Good", the benefits aspect consists of 3 questions with a percentage of 4.33 with "Very Good" criteria, the PBL characteristics aspect consists of 5 questions with a percentage of 4.80 with the "Very Good" criteria, and the mathematical literacy ability aspect consists of 4 questions with a percentage of 4.33 with the "Very Good" criteria, so it can be concluded that the average for all aspects is 4.57 with the

criteria "Very Good", so the teaching module on social arithmetic material can be tested on students.

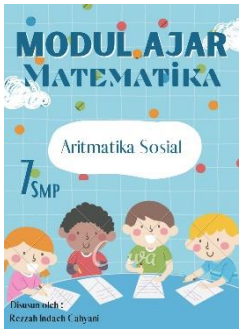
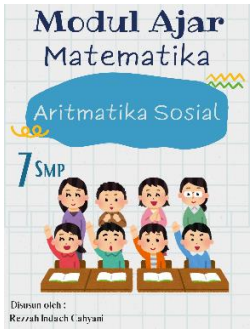
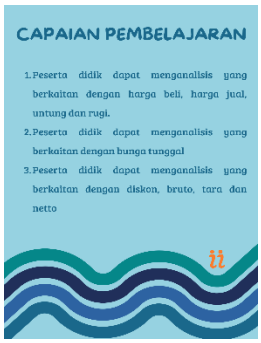
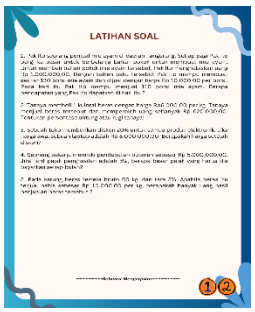
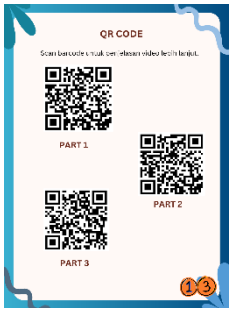
After an expert assessment of the product in the feasible category, a development trial is carried out. This trial consists of two stages: small group trials and field trials. Based on the data obtained, an analysis is carried out after the trial. The following are the analysis results of small group trials and field trials. In this study, the respondents in the small group trial were 10 people from class VIII state junior high school 8 Tangerang. After the trial, students are asked to fill out a questionnaire to know the students' responses after trying the product. Below is a table of small-group trial results. Based on small group trial results on teaching modules, an average percentage of 3.20 was obtained with the criteria "Good," which means it can be used. In the field trial, researchers involved 34 students in the seventh grade of the state junior high school 8 Tangerang. A large group trial was conducted to confirm the data obtained by giving a questionnaire. The following table presents the results of large-group trials.

Based on large-group trial results, this research consists of five aspects: ease of use, time efficiency, benefits, PBL characteristics, and mathematical literacy ability. The analysis of respondents' data on the ease-of-use aspect obtained a percentage of 3.11, according to the criteria "Good." The time efficiency aspect obtained a percentage of 3.44 with the criteria "Very Good." The benefits aspect obtained a percentage of 3.15 with the criteria "Good". The characteristic aspect of problem-based learning obtained a percentage of 3.98 with the criteria "Very Good". Aspects of mathematical literacy ability obtained a percentage of 3.71 with the criteria "Very Good," so the average percentage score for all aspects is 3.88 with the criteria "Very Good," then the teaching module on social arithmetic material is declared "Very Good."

The effectiveness of the product development in this research was assessed based on the results of the post-test on class seventh students at State Junior High School 8 Tangerang, totaling 34 people. The effectiveness test is carried out by calculating the post-test results (in attachment 9), then counting the number of students who have completed it, calculating the percentage of classical learning completion, and determining the effectiveness criteria for completing learning outcomes. The criteria score, if it is said to be complete, is 75. In the initial stage, the researcher first explains the material that will be studied; after that, students are asked to solve a problem in the teaching module. The teaching module developed already contains post-test questions that students will fill in later as the final step in the trial. The following is a table of students' post-test results.

The post-test results in the table show a total score of 2642 and an average score of 78. Of the 34 students who completed it, 21 completed it, so the effectiveness percentage was obtained at 62% in the "Good" category. Before teaching the social arithmetic material module, the developer consulted with media experts and learning practitioners to find good and interesting media so that students would be happy and enthusiastic about learning mathematics. After conducting consultations, the teaching module development process began and has received revisions to improve the product.

Table 1 - Product Revision

Number	Trials	The Sections that need revision	Parts that have been revised
1.	Design Expert (Media)	 There's a Canva logo, and it's too busy	 There is no Canva logo and the design is simpler
2.	Design expert (material)	There are no learning outcomes	 Created learning outcomes
3.	Design expert (material)	Practice questions are made per material; it will take much time during the research	 Practice questions are created as a final assessment of whether students have understood all the material discussed in the module
4.	Design expert (media)	Added barcodes so students can learn independently	

4. Conclusions

Based on the research and development results, it can be concluded that the teaching module meets good criteria so that it can be used as an alternative learning resource for students and teachers to support mathematics learning activities to train students' mathematical literacy skills using a problem-based learning model. According to the results of valid or very good design validation, expert practitioner validation that meets the very good criteria, and validation of student response data assessment with very good criteria, the teaching module on social arithmetic material is declared very good.

Conflict of Interest

The authors declare no conflicts of interest.

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