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DEVELOPMENT OF LIVEWORKSHEET ASSISTED TEACHING MATERIALS FOR STUDENTS' MATHEMATICAL PROBLEM-SOLVING ABILITY

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ABSTRACT

Problem-solving ability is one of the hard skills that students need to solve everyday math problems. The learning model is felt to be in line with the ability to solve mathematical problems, namely the problem-based learning model because learning can be oriented to the ability to solve various problems, especially those related to the application of learning materials in everyday life. This study aims to develop teaching materials in the form of student worksheets with a problem-based learning model assisted by Liveworksheet on students' mathematical problem-solving abilities. This study used the development research method in two stages, namely preliminary design and formative evaluation design which was conducted on 50 junior high school students. Data collection techniques used are content validity by expert judgement and test. The instruments are expert assessment sheet and question sheet after content validity being conducted. Data analysis is done by finding the average of expert validation and learning achievement score. It is continued by comparing the score of validity and effectivity criteria. The results show that the student worksheets assisted by Liveworksheets, and the developed mathematical problem-solving abilities are categorized as very valid and effective.
Keywords: assisted teaching materials, liveworksheet, problem-solving ability

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INTRODUCTION

Teaching materials are materials that aim to assist teachers or educators in carrying out the learning process (Oktaviana & Susiaty, 2020). According to Muthoharoh et al. (2017), teaching materials function to add to and deepen the material provided, because teaching materials contain components that have been designed in such a way as to provide motivation and attraction in the form of problems related to real life. Teaching materials in schools have not been able to facilitate the objectives of teaching materials in assisting the implementation of learning (Kharisma & Asman, 2018). In line with that, Nu'man (2015) said that current

teaching materials generally contain definitions, theorems, proofs, examples of questions, and practice questions.

According to Kurniawan & Fitriani (2020), social arithmetic is mathematical material that reviews the completion of buying and selling activities in everyday life. Of course, this material is very important to be understood by students so that it can be implemented in everyday life. The fact that there are still many that solve social arithmetic material is difficult. According to Sapitri et al. (2020), many students have difficulty solving essay questions, students have difficulty understanding the meaning of the questions, and difficulty connecting them to mathematical forms. Seeing these things, teaching materials should be able to play an active role in improving student achievement, especially in social arithmetic material.

In addition to problem-solving abilities, learning models also need to be applied in the learning process. Choosing an inappropriate learning model can prevent students from mastering the material. The learning model that is felt to be in line with the ability to solve mathematical problems is the problem-based learning model. problem-based learning is closely related to the ability to solve mathematical problems. Anggiana (2019), mentions the problem-based learning model, namely learning that is oriented towards the ability to solve various problems, especially those related to the application of learning materials in everyday life.

The low achievement of social arithmetic learning outcomes and problem-solving abilities is due to learning methods, availability and quality of teaching materials, and the learning environment. Bela et al (2021) stated that the low ability to solve social arithmetic problems is due to limited teaching modules, teaching materials, or LKPD which contain detailed and complete social arithmetic material. So students often experience difficulties in applying formulas to solve problems (Dila & Zanthy, 2020). Andriani et al (2022)said that one of the causes of low learning outcomes in social arithmetic is teaching materials whose content is monotonous and less interesting for students. Social arithmetic is topic that is dominated by story problems. Therefore, it must be presented with variations that are interesting to students. Interesting teaching materials can be prepared by involving technology that is developing rapidly.

Technology is increasing from year to year, therefore teaching materials must adapt to the times. Based on this, it is necessary to renew teaching materials using technology. According to Nurdyansyah & Andiek (2017), educational technology is an ethical practice to facilitate learning and improve performance by creating, using, and managing technology appropriately according to resources. Thus, educators can collaborate on technology with teaching materials assisted by the Liveworksheets application. This technology-assisted teaching material provides benefits for students because these teaching materials can be accessed anywhere by all students and the delivery of material can be more interactive and interesting (Purnama & Suparman, 2020).

Currently, the development of arithmetic teaching materials is still based on low-level mathematical thinking skills such as increasing understanding of concepts (Andriani et al., 2022), it has not been designed to involve technology and it is only based on a scientific learning approach (Bela et al., 2021) or problem-based learning (Beka et al, 2021). The novelty in this study is social arithmetic teaching materials in the form of student worksheets which were developed using a problem-based learning model assisted by the Liveworksheet application to hone students' mathematical problem-solving abilities. Thus, this article examines the

development of social arithmetic teaching materials using the problem-based learning model assisted by the Liveworksheet application on students' mathematical problem-solving abilities.

METHODS

This research uses a development research model (Purwitaningrum & Prahmana, 2021). According to Audina et al. (2021), development research is research that is used to produce certain products and test the validity of these products. Development research consists of two stages, namely preliminary design and formative evaluation design (Hidayat, Rohaeti, Ginanjar, & Putri, 2022). This study aims to develop teaching materials in the form of student worksheets with a problem-based learning model assisted by Liveworksheet on students' mathematical problem-solving abilities.

The data in this research are the suitability of teaching materials obtained from experts and problem-solving abilities which illustrate the effectiveness of teaching materials. Data collection techniques used are content validity by expert judgement and test. The instruments used are expert assessment sheets and question sheets. Expert assessment sheets are prepared to assess the suitability of the teaching materials produced and to prove the validity of the content by experts. The question sheet contains questions about social mathematical problem-solving abilities. The validity of the content had been proven by experts.

All data in this study were processed using Microsoft Excel in the form of descriptive statistics to describe the stages of development, responses, and constraints during development. Furthermore, the data is compared to the validity and effectivity criteria. The developed mathematical problem-solving abilities are categorized as very valid and effective.

In the preliminary design stage, the researcher determines the place, subject, implementation schedule, resources search. Then the formative evaluation design stage is divided into three stages, namely self-evaluation, designing the prototype, and field testing. Self-evaluation is further divided into two stages, namely analysis (conducting interviews) and design (designing teaching materials). Designing the prototype is divided into expert reviews (validation of teaching materials by practitioners), individual tryouts (validation of teaching materials by students), and small-group tryouts (developing teaching materials before field testing). The last stage is field testing, namely testing the final results of teaching materials. While the validation of teaching materials is calculated using the following formula.

$$Vah = \frac{Tse}{Tsh} \times 100\%$$

where

Vah = Expert validation; Tse = Total empirical score achieved; Tsh = Expected total score

Table 1. Validation Criteria

Validation Criteria	Validation Level
$80\% < V \leq 100\%$	Very Valid (can be used)
$60\% < V \leq 80\%$	Valid (may be used without revision)
$40\% < V \leq 60\%$	Valid enough (can be used but needs revision)
$20\% < V \leq 40\%$	Invalid (recommended not to use)
$0\% < V \leq 20\%$	Invalid (should not be used)

(Modification of Sofyani & Akbar (2013))

The effectiveness test uses the formula and criteria of Sugandi et al. (2021) as follows.

$$E = \frac{f}{N} \times 100\%$$

where

E = Final grade; f = Acquired score; N = Maximum score

Table 2. Criteria for Testing Effectiveness

Validation Criteria	Validation Level
81% - 100%	Very effective
61% - 80%	Effective
41% - 60%	Effective enough
21% - 40%	Ineffective
0% - 20%	Very ineffective

RESULT AND DISCUSSION

1. Preliminary Design

At this stage. The research was conducted at one of the Junior High Schools in Cimahi City. The research subjects were 50 students. The students were divided into 10 students who were involved in individual tryouts, 15 students who were involved in small-group tryouts, and 25 students who were involved in field tryouts.

2. Formative Evaluation Design

a. Self-Evaluation

In the analysis phase, interviews were conducted with the mathematics teacher concerned including the development of social arithmetic teaching materials, the feasibility of teaching materials, student responses to teaching materials that were usually given by the teacher, and the extent to which students' problem-solving abilities were level.

Furthermore, in the design stage, the researcher designed teaching materials in the form of student worksheets with the Liveworksheets-assisted problem-based learning model for the ability to solve mathematical problems in social arithmetic material. This student worksheet focuses on the feasibility aspects of content, presentation, graphics, and language.

Analysis of Junior High School curriculum showed that generally, social arithmetic is served to attain conceptual understanding ability and daily problem solving. Based on the results of the interviews, it is known that the learning model is used to convey social arithmetic material using lecture learning methods. This is done because of the limited time for learning and the lack of students' problem-solving abilities. The process of teaching and learning activities, especially social arithmetic material, does not use teaching materials, special props are used. While students' responses to social arithmetic material find it difficult to imagine the real problems given by the teacher. Students need interactive teaching materials that are arranged from easy problems to difficult problems, from real problems to abstract problems, and from simple problems to complex problems. Next, design teaching materials according to the problem-based learning indicators on the Liveworksheet.

b. Designing the Prototype

At the expert review stage, teaching materials are validated by practitioners, media experts, and material experts.

Table 3. Validation Results for Prototype I

Validator	Percentage
Validator 1	80%
Validator 2	76%
Validator 3	92%
Validator 4	98%
Average	**87%**

Based on Table 3 the average percentage is 87%, the worksheets of a prototype I assisted by Liveworksheets are very valid and can be used. Validation was carried out simultaneously with individual tryouts, namely providing teaching materials to 10 students who had studied social arithmetic to get input and suggestions from students. The prototype I validation changes to prototype II.

Table 4. Feedback and Suggestions for Prototype I

Before	After
The cases given are too many and not focused on the core material as follows. Story 1 Dinda sells chocolate at her school. Dinda spends Rp. 50,000.00 to make chocolate. With these raw materials, Dinda can make an average of 75 chocolates for Rp. 1000.00 per chocolate. Papa that week there weren't many students who bought his chocolate, so only 40 chocolates were sold. Story 2 Kale is a junior high school student as well as a famous poster seller in Bandung. Once a week he buys raw materials for making posters in the amount of Rp. 50,000.00. With these raw materials, he was able to make 75 posters for Rp. 10,000.00 per poster. Usually, Kale sells posters through Instagram, but one day he got an order for 50 posters.	Each material presented should contain one problem and each case will be solved by students according to the problem-based learning stage. Dinda sells chocolate online. Once production he spends Rp. 500,000.00 for 5000 pieces. One package of chocolate consists of 8 pieces with a price per package of Rp. 5000.00. Usually, the chocolate sold out in less than 10 days, but one day the chocolate sold out for more than 10 days. While the survival time of the chocolate is 10 days. Dinda found two customers who gave two stars to the online sales application. This will have an impact on the turnover he receives, turnover decreased by 4%.
Previously there were no practice questions at the end of teaching materials.	After being validated, the end of the teaching material contains practice questions according to problem-solving abilities.

Table 5. Validation Results for Prototype II

Validator	Percentage
Validator 1	80%
Validator 2	76%
Validator 3	92%

Validator	Percentage
Validator 4	98%
Average	**87%**

Based on Table 5, the average percentage increased by 1% in prototype II to 88%, so the student worksheets assisted by Liveworksheets are very valid and can be used immediately. Then a small-group tryout was carried out, namely giving prototype II to 15 students who were different from before to do the second validity test. Feedback and suggestions will be used on prototype III.

Table 6. Feedback and Suggestions for Prototype II

Before	After
The command after the case is given is still unclear so it can confuse students, as follows. Let's identify a given case. What can you find out from this case?	After the case is given, it must contain a clear work order as follows. Let's identify the problem that occurs. What can you find out from this case? How many chocolates were sold in 10 days?

c. Field Tryouts

Table 7. Effectiveness Test Results for Prototype III

Evaluation	Achieved Score	Percentage
S 1	42	70%
S 2	42	70%
S 3	36	60%
S 4	39	65%
S 5	39	65%
S 6	40	67%
S 7	39	65%
S 8	39	65%
S 9	39	65%
S 10	39	65%
S 11	44	73%
S 12	44	73%
S 13	43	72%
S 14	42	70%
S 15	48	80%
S 16	40	67%
S 17	34	57%
S 18	44	73%
S 19	44	73%
S 20	41	68%
S 21	47	78%
S 22	37	62%
S 23	47	78%
S 24	46	77%
S 25	49	82%
	Average	**70%**

At this stage, a trial of student worksheets according to prototype III with the help of Liveworksheet was carried out on 25 students with the problem-based learning stage. First, in the orientation stage, the researcher divided the students into several groups and then directed them to understand the case given. Both stages orient students to learn and write down data that is known and asked. The third is developing an investigation, students are directed to solve a given case. The fourth is presenting the results, group representatives will take turns presenting the results of the discussion. Fifth, evaluate the problem-solving process, students make conclusions from the learning activities that have been carried out. Finally, at the end of learning, a test was carried out to see the increase in students' mathematical problem-solving abilities. In addition to conducting trials on prototype III, effectiveness tests were also carried out. The effectiveness test is a product test that has been developed by involving students as product users (Sari & Susanti, 2016). The following are the results of the effectiveness test of teaching materials.

Based on Table 7, the average percentage for the effectiveness test of prototype III is 70% with effective criteria based on Table 2. It can be concluded that the student worksheets assisted by Liveworksheets are very valid and effective.

CONCLUSION

Liveworksheet-assisted student worksheets and the developed mathematical problem-solving skills are categorized as very valid with a percentage of 88%. The validity can be seen from the assessment results of media experts, material experts, and field practitioners on the developed student worksheets. Liveworksheet-assisted student worksheets with social arithmetic material developed have the potential to increase junior high school students' mathematical problem-solving abilities. This is based on the effectiveness of the final test given which is equal to 77% meaning that student learning outcomes are classified as effective so that they are able to show the use of student worksheets that are developed to have a potential effect.

REFERENCES

Andriani, N., Balkist, P. S., & Lukman, H. S. (2022). Pengembangan bahan ajar aritmatika sosial untuk meningkatkan pemahaman konsep matematis siswa SMP. *De Fermat: Jurnal Pendidikan Matematika*, *5*(2), 154–159. https://doi.org/10.36277/defermat.v5i2.84

Anggiana, A. D. (2019). Implementasi model problem based learning (PBL) untuk meningkatkan kemampuan pemecahan masalah matematis siswa. *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education*, *4*, 56–69. https://doi.org/10.30998/jkpm.v5i1.5179

Audina, N., Yuliani, R. E., & Muslimin, M. (2021). Pengembangan lembar kegiatan siswa (LKS) problem based learning (PBL) pada materi sistem persamaan linier dua variabel di kelas VIII SMP. *JURNAL PENELITIAN PENDIDIKAN MATEMATIKA*, *5*(2), 145–153.

Beka, Y. A., Wewe, M., & Rawa, N. R. (2021). Pengembangan bahan ajar modul setting pembelajaran berbasis masalah pada materi aritmatika sosial. *Jurnal Citra Pendidikan*, *1*(4), 654–662. https://doi.org/10.38048/jcp.v1i4.376

Bela, M. E., Wewe, M., & Lengi, S. (2021). Pengembangan modul matematika materi aritmatika sosial berbasis pendekatan saintifik untuk siswa kelas VII SMP. *Jurnal Cendekia : Jurnal*

Pendidikan Matematika, *5*(1), 391–400. https://doi.org/10.31004/cendekia.v5i1.461

Dila, O. R., & Zanthy, L. S. (2020). Identifikasi kesulitan siswa dalam menyelesaikan soal aritmatika sosial. *Teorema: Teori Dan Riset Matematika*, *5*(1), 17. https://doi.org/10.25157/teorema.v5i1.3036

Hidayat, W., Rohaeti, E. E., Ginanjar, A., & Putri, R. I. I. (2022). An ePub learning module and students' mathematical reasoning ability: A development study. *Journal on Mathematics Education*, *13*(1), 103–118. https://doi.org/10.22342/jme.v13i1.pp103-118

Kharisma, J. Y., & Asman, A. (2018). Pengembangan bahan ajar matematika berbasis masalah berorientasi pada kemampuan pemecahan masalah matematis dan prestasi belajar matematika. *Indonesian Journal of Mathematics Education*, *1*(1), 34–46. https://doi.org/10.31002/ijome.v1i1.926

Kurniawan, A., & Fitriani, N. (2020). Analisis kesalahan siswa dalam menyelesaikan soal aritmatika sosial. *Journal On Education*, *2*(2), 225–232. https://doi.org/10.31004/joe.v2i2.308

Muthoharoh, M., Kirna, I. M., & ayu Indrawati, G. (2017). Penerapan lembar kerja peserta didik (lkpd) berbasis multimedia untuk meningkatkan motivasi dan hasil belajar kimia. *Jurnal Pendidikan Kimia Indonesia*, *1*(1), 13–22. https://doi.org/10.23887/jpk.v1i1.12805

Nu'man, M. (2015). *Pengembangan bahan ajar geometri transformasi berdasarkan problem based learning untuk memfasilitasi kemampuan komunikasi matematis mahasiswa Pendidikan Matematika UIN Sunan Kalijaga*. *Proceedings of Seminar Nasional Matematika dan Pendidikan Matematika UMS, 3 Juli 2015 (pp. 345-354)*. https://publikasiilmiah.ums.ac.id/xmlui/handle/11617/5968

Nurdyansyah, N., & Andiek, W. (2017). *Manajemen sekolah berbasis ICT*. Universitas Muhammadiyah Sidoarjo.

Oktaviana, D., & Susiaty, U. D. (2020). Pengembangan bahan ajar matematika diskrit dalam meningkatkan kemampuan pemecahan masalah matematis mahasiswa IKIP PGRI Pontianak. *SAP (Susunan Artikel Pendidikan)*, *4*(3). https://doi.org/10.30998/sap.v4i3.6280

Purnama, A., & Suparman, S. (2020). Studi pendahuluan: E-LKPD berbasis PBL untuk meningkatkan kemampuan literasi matematis peserta didik. *JKPM (Jurnal Kajian Pendidikan Matematika)*, *6*(1), 131–140. https://doi.org/10.30998/jkpm.v6i1.8169

Purwitaningrum, R., & Prahmana, R. C. I. (2021). Developing instructional materials on mathematics logical thinking through the indonesian realistic mathematics education approach. *International Journal of Education and Learning*, *3*(1), 13–19. https://doi.org/10.31763/ijele.v3i1.178

Sapitri, Y., Fitriani, N., & Kadarisma, G. (2020). Analisis kesulitan siswa SMP dalam menyelesaikan soal pada materi aritmatika sosial. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *3*(5), 567–574. https://doi.org/10.22460/jpmi.v3i5.p%25p

Sari, L. Y., & Susanti, D. (2016). Uji efektivitas media pembelajaran interaktif berorientasi konstruktivisme pada materi neurulasi untuk perkuliahan perkembangan hewan. *Jurnal BioCONCETTA*, *2*(1), 158–164. https://doi.org/10.22202/bc.2016.v2i1.1806

Sofyani, H., & Akbar, R. (2013). *Hubungan faktor internal institusi dan implementasi sistem akuntabilitas kinerja instansi pemerintah (SAKIP) di pemerintah daerah*. https://doi.org/10.21002/jaki.2013.10

Sugandi, A. I., Sofyan, D., & Maesaroh, S. (2021). Pengemabangan perangkat pembelajaran menggunakan deduktif induktif berbantuan geogebra dalam meningkatkan kemampuan berpikir kreatif siswa pada masa pandemi. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *4*(1), 149–160.