

Development of Mathematical Student Worksheets Based on Scientific Approaches and PQ4R Learning Strategies on Associated Materials

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ABSTRACT

Purpose of the study: The purpose of this study was to produce math worksheets based on a scientific approach and PQ4R learning strategies on set material in class VII SMP and to find out whether worksheets based on scientific approaches and PQ4R learning strategies on set material for class VII SMP meet the valid, practical and effective criteria.

Methodology: This type of research is development research with the ADDIE development model. This study designed worksheets, gave tests to find out student learning outcomes, and gave questionnaires to find out the results of student responses. The instruments used in this study were material and design expert assessment sheets of worksheets, teacher and student response questionnaires and observation sheets, learning achievement tests, and student response questionnaires in use trials.

Main Findings: The process of developing student worksheets that have been carried out is followed by the validation stage carried out by material experts, obtaining a score of 95 in the "Good" category and design experts obtaining a score of 43 in the "Very Good" category. The individual trial phase scored 68 in the "Very Good" category.

Novelty/Originality of this study: From the analysis results, student responses reached 90.63% with very positive responses, and the learning outcomes test obtained 86.49% of student scores reaching the minimum completeness criteria. This means the worksheet is valid, practical, and effective for learning mathematics in junior high schools, especially in learning sets.

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1. INTRODUCTION

Mathematics is the science of numbers, the relationships between numbers, and the operational procedures used in solving number problems. Mathematics is a science based on deductive reasoning, namely the truth of a concept or statement that is obtained as a logical result of previous truths so that the relationship between concepts or statements in mathematics is consistent [1]–[3]. However, the current state of learning mathematics shows that in general most students complain about mathematics, because of the notion that mathematics is a difficult, boring and uninteresting subject. Mathematics learning in junior high school includes arithmetic, algebra, geometry and statistics. Algebra at school is material that students must learn, because algebraic concepts are widely used in everyday life, especially in the current era of digital technology [4]–[6]. However, among learning materials, algebra material is presented more abstractly. Because of its abstract nature, most students do not understand mathematical concepts because they are considered difficult and boring. One of the algebraic materials

in junior high school mathematics class VII is set material. One approach that can be used in learning algebra is the scientific approach.

Learning with a scientific approach is a learning process designed so that students actively construct concepts, through the stages of observing, formulating problems, submitting or formulating hypotheses, collecting data, drawing conclusions and communicating the concepts found [7]–[9]. In learning sets, it shows declarative knowledge, such as analyzing and understanding the meaning of sets, how to present sets, set relations and set operations. In declarative knowledge, good mathematical reading skills are needed, many sources of information, and reinforcement in the form of repetition in learning. And this is not facilitated by a scientific approach so that a preview, question, read, reflect, recite, review (PQ4R) learning strategy is needed.

Strategi pembelajaran PQ4R digunakan untuk membantu siswa mengingat apa yang mereka baca dan dapat membantu proses belajar mengajar di kelas yang dilakukan dengan membaca buku [10]–[12]. Dengan menggunakan strategi pembelajaran PQ4R diharapkan dapat tercipta suatu proses pembelajaran dimana siswa dapat belajar dengan mengingat informasi dari suatu bahan bacaan, serta dapat membantu guru mengaktifkan kemampuan siswa untuk memahami suatu materi pelajaran dan mengaitkan apa yang telah dipelajari dengan pengetahuan yang sudah mereka miliki. Dengan adanya strategi PQ4R dapat menyempurnakan LKS

Student worksheets (LKS) are printed teaching materials in the form of sheets of paper that contain materials, summaries, and instructions for carrying out learning tasks that must be done by students and refer to the basic competencies that must be achieved. LKS functions to increase student activity in participating in the teaching and learning process, train and develop process skills in students [13]–[15]. But in fact the worksheets used are practical and do not emphasize the process, the worksheets do not adequately explain the reduction of formulas, the material and questions in them do not accommodate students' needs for active learning, moreover the available worksheets are only in color. black and white and the complexity of the teaching materials presented make students less interested in reading.

This research is in accordance with previous research [13] but there are differences, namely in previous studies developing different teaching materials but with the same development method used by researchers. In addition, this research is in accordance with previous research [14] but previous research did not use learning strategies, only used the same learning approach as researchers did. The purpose of this study was to produce math worksheets and find out whether the resulting worksheets met the valid, practical, and effective criteria. With an effective learning process, the use of LKS in learning is expected to have a positive influence and a sizable contribution to student achievement. Therefore the implementation of this research is the result of LKS development for students.

2. RESEARCH METHOD

The development model chosen in this study is the development model developed by Reiser and Mollenda Branch with the Analysis, Design, Development (development), Implementation, and Evaluation (ADDIE) flow. According to [8] after the instrument is constructed about the aspects to be measured based on a certain theory, it is then consulted with experts. In this case the expert test is carried out by several qualified experts, namely material/content experts and design experts. Limited trials were carried out in two stages, namely individual trials and small group trials. For individual trials carried out by one teacher who is experienced and competent in his field. While small group trials were conducted by 8-20 students, where the test subjects in small group trials were students with low, medium, and high abilities. This trial involved 30 subjects or one class. this aims to see student responses and learning achievement tests on the use of LKS based on scientific approaches and PQ4R learning strategies on set material

In testing this usage, the researcher tested the set material LKS in a real class, namely one class in class VII SMP Negeri 11 Jambi City. The research was conducted at SMPN 11 Jambi City and was conducted from 1 September to 5 October 2015. The type of data in this development research is a type of quantitative data. These data are content validation data and LKS designs from relevant experts, data on students' and teachers' perceptions of LKS based on scientific approaches and PQ4R learning strategies on set material, observation sheets of learning activities and data on students' post-test results.

The instrument used was a closed questionnaire given to a team of experts to validate the product in terms of material and design. However, the expert team was also asked to comment freely on the teaching materials. In addition there is also an instrument used is a post test questionnaire. Closed questionnaires were given to implementation class students who had used worksheets. Giving this questionnaire aims to see student responses to the use of worksheets and post tests or learning outcomes tests are test items used to determine student learning outcomes after participating in teaching and learning activities.

Data analysis technique is done by descriptive analysis. The data analyzed included quantitative data on the assessment scores of material experts and teaching material design experts, teacher and student questionnaires using a rating scale.

3. RESULTS AND DISCUSSION

After going through a development process whose stages include: first, designing math worksheets based on a scientific approach and learning strategies preview, question, read, reflect, recite, review (PQ4R). Second, validating to a material expert and design expert regarding math worksheets based on a scientific approach and PQ4R learning strategies. For worksheet assessment by material experts, the total score of 95 is included in the category $91.8 < X \leq 113.4$ which is good. For LKS assessment by design experts the assessment is a total score of 43 included in category $X > 42.01$ which is very good. But there were several suggestions and comments made by the material and design validators, so the researchers revised the worksheet based on these comments/suggestions.

After the LKS has been validated and revised, the next step is to try out the LKS in formative evaluation. Individual trials, namely to one math teacher. Then a small group tryout, namely 10 students with different levels of intelligence based on selection by the teacher who teaches mathematics, and a large group tryout, namely students in one class. From the results of individual trials with one of the teachers, a total score of 68 was obtained, including in category $X > 67.2$, so this LKS was included in the "Very Good" category. From the results of the small group trials with 10 students, the total score in the range of 57-75 was included in the "Good - Very Good" category. While the results of the large group test with a total of 34 students obtained a total score in the range of 62-74 included in the "Good - Very Good" category. And the observation sheet of the implementation of learning which was taken using a questionnaire to observe student activities obtained an average activity of all aspects of the assessment (75.59%) included in the good or active category.

In the next stage, the researcher conducted a pilot test on students in one class. From the analysis of student response questionnaire data, a percentage result of 90.63% was obtained with the criteria of "Very Positive". From these data it can be concluded that LKS can attract students' interest and motivation in the process of learning activities, especially in the set material. The results of the post-test data analysis or student learning test results show that the calculation of the percentage of students who complete with a completeness score of ≥ 70 is 86.49% of students achieving the criteria for passing grades and exceeding the class completeness requirements (classical completeness), namely 85%, with 32 students declared complete and 5 students declared incomplete. The test results show that the developed LKS has a potential effect on students' ability to understand concepts. And this shows that LKS affects learning outcomes, the use of LKS helps students achieve mastery in studying set material.

The purpose of this study was to produce math worksheets and find out whether the resulting worksheets met the valid, practical, and effective criteria. With an effective learning process, the use of LKS in learning is expected to have a positive influence and a sizable contribution to student achievement. Therefore the implementation of this research is the result of LKS development for students.

4. CONCLUSION

Based on the results of development research and discussion of the development of teaching materials in the form of student worksheets (LKS) based on a scientific approach and learning strategies preview, question, read, reflect, recite, review (PQ4R) on set material in class VII SMP Negeri 11 Jambi City, it can be concluded that the validity of the developed LKS can be used and the effectiveness of the LKS is seen from the responses of students with very positive category values and the completeness of students after using the LKS exceeds the class completeness requirements. The purpose of this study was to produce math worksheets and find out whether the resulting worksheets met the valid, practical, and effective criteria. With an effective learning process, the use of LKS in learning is expected to have a positive influence and a sizable contribution to student achievement. Therefore the implementation of this research is the result of LKS development for students.

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REFERENCES

- [1] A. Efendi and S. Maskar, "Studi Pendahuluan: Pengaruh Model Pembelajaran Flipped Classroom Terhadap Hasil Belajar Matematika Siswa Smk Islam Adiluwih," *J. Ilm. Mat. Realis. (JI-MR)*, vol. 3, no. 1, pp. 50–53, 2020.
- [2] S. Maskar, N. D. Puspangtyas, and D. Puspita, "Linguistik Matematika: Suatu Pendekatan untuk Meningkatkan Kemampuan Pemecahan Masalah Non-Rutin Secara Matematis," *Mathema J. E-Issn*, vol. 4, no. 2, pp. 118–126, 2022, [Online]. Available: www.oecd.org/pisa/,
- [3] N. Agustyaningrum, P. Pradanti, and Y. Yuliana, "Teori Perkembangan Jean Piaget dan Vygotsky Bagaimana Implikasinya Dalam Perkembangan Matematika Sekolah Dasar?," *J. Absis J. Pendidik. Mat. dan Mat.*, vol. 5, no. 1, pp. 568–582, 2022.
- [4] R. P. Dewi and E. A. Afriansyah, "Pembelajaran Matematika Berbasis Aplikasi Google Classroom pada Materi Bangun Ruang Sisi Datar," *Plusminus J. Pendidik. Mat.*, vol. 2, no. 1, pp. 39–52, 2022, doi: 10.31980/plusminus.v2i1.1580.
- [5] N. Saadah and I. Budiman, "Meta Analisis: Pengembangan Media Pembelajaran Matematika Interaktif Berbasis Adobe Flash Pada Jenjang SMP," *JPMI J. Pembelajaran Mat. Inov.*, vol. 5, no. 1, pp. 221–236, 2022, doi:

- 10.22460/jpmi.v5i1.221-236.
- [6] U. P. Ganesha and L. D. W. Maharani, "Fars Int J Edu Soc Sci Hum 1 (1); 2022 ; Fars Int J Edu Soc Sci Hum 1 (1); 2022 ;," vol. 1, no. 1, pp. 1–12, 2022.
- [7] F. A. M. Bria, M. A. U. Leba, and H. C. Tangi, "Penerapan Pendekatan Saintifik Pada Materi Larutan Elektrolit Dan Non Elektrolit Menggunakan LKPD Berbasis Lingkungan," vol. 1, no. 2, pp. 353–358, 2022.
- [8] R. H. Barus and J. Tampubolon, "Journal of Classroom Action Research.pdf," *J. Classr. Action Res. ...*, vol. 4, no. 4, pp. 1–6, 2022, doi: 10.29303/jcar.v4i4.2236.
- [9] Desvianti, "Jurnal basicedu," *J. BASICEDU*, vol. 4, no. 4, pp. 1201–1211, 2020.
- [10] Jumriah and Fitriani, "Peningkatan Kemampuan Membaca Pemahaman Siswa Kelas VIII A SMP Negeri 3 Unaaha Dengan Menggunakan Strategi PQ4R," vol. 2, no. 1, pp. 259–269, 2022.
- [11] A. P. Kusumajati and W. Ratnawati, "Upaya Meningkatkan Keterampilan Membaca Pemahaman Melalui Strategi PQ4R di Kelas 3B SD Negeri Telukan 02," vol. 4, no. 3, pp. 291–297, 2022.
- [12] U. Khaer, "Efektifitas Penerapan Strategi PQ4R dalam Meningkatkan Membaca Pemahaman Siswa Kelas VIII SMPN 4 Latambaga Tahun Ajaran 2021 / 2022," vol. 2, no. 2, pp. 266–271, 2022.
- [13] I. Yuniarti, R. Pangestika, and A. Ratnasari, "Pengembangan LKS (Lembar Kerja Siswa) Berbasis Etnomatematika pada Materi Bangun Ruang Kelas V di SDN Sindurjan," vol. 3, pp. 160–169, 2022.
- [14] A. Septian and M. Gustiana, "Pengembangan Lks Pada Materi Sistem Persamaan Linear Dua Variabel (Spldv) Berbasis E-Learning," *UNION J. Ilm. Pendidik. Mat.*, vol. 10, no. 1, pp. 78–89, 2022, doi: 10.30738/union.v10i1.12041.
- [15] K. Miranti, A. Rusyadi, and F. Fahmi, "Melatih Keterampilan Psikomotorik Siswa Melalui Penggunaan Lembar Kerja Siswa (Lks)," *J. Banua Sci. Educ.*, vol. 2, no. 2, pp. 93–98, 2022, doi: 10.20527/jbse.v2i2.106.