

## Developing problem-based learning electronic student worksheet for number pattern topic

**Khasna Salma Atsila, Puguh Wahyu Prasetyo\***

Mathematics Education Department, Universitas Ahmad Dahlan, Jl. Jend. Ahmad Yani, Tamanan, Banguntapan, Bantul, DIY 55191, Indonesia

\*Corresponding E-mail: [puguh.prasetyo@pmat.uad.ac.id](mailto:puguh.prasetyo@pmat.uad.ac.id)

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### ABSTRACT

The background of this research is the lack of technology-based learning materials, teachers, and students' need for the variety of new learning materials in SMP Negeri 1 Bantarkawung. This study aimed (1) to produce problem-based learning electronic student worksheets for number patterns and (2) to know the usefulness of problem-based learning electronic student worksheet for number patterns in terms of validity and practicality. It was the R&D (Research and Development) using ADDIE (Analyze, Design, Development, Implementation, and Evaluation) model. This research was conducted in class VIII A SMP Negeri 1 Bantarkawung involving six students in a small class trial and twenty-eight students in a big class trial. The research instruments were interview guidelines and questionnaires to material experts, media experts, and students' responses. The results showed that students' electronic worksheets were valid and practical. The evaluation by students' electronic worksheet material expert got 70,50, categorized as very valid. The review from media experts showed that Students' Electronic Worksheet got 68,50, which was classified as very valid. Meanwhile, the small class trial got 62,84, categorized as practical. Moreover, the big class trial got 65,39, and was classified as practical.

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### Introduction

Student worksheet is a printed teaching material usually in the form of a sheet containing material, a summary, and accompanied by implementation instructions or steps that must be followed by students with orientation to Basic Competencies that must be achieved (Prastowo, 2011). Meanwhile, according to Trianto (2010), student worksheet is a guide for students whose use aims to develop aspects of student thinking in the form of directing investigation activities or problem solving in accordance with indicators of achievement of results that must be achieved by students.

Student worksheets as one of the complements of learning have an important role in planning and implementing student activities. Indicators of student worksheets include: (1) Title, subject, semester, place; (2) study instructions; (3) competencies to be achieved; (4) competency achievement indicators; (5) supporting information; (6) work steps; (7) practice questions.

When the researcher interviewed the mathematics teacher for class VIII A at SMP Negeri 1

Bantarkawung, the researcher observed that the worksheets used still looked simple, only consisting of monotonous and non-variative questions and answer columns.

Based on the results of filling out questionnaires by students through *google forms*, data obtained from 19 respondents obtained 16 students or 84.2% of the total respondents said that they needed a variety of new teaching materials and as many as 3 students or 15.8% of the total respondents did not really need variety of teaching materials. The mathematics teacher also conveyed that from the two materials that had been taught, more students did not understand the number pattern material, students still had difficulty when asked to find a pattern from a known number. Therefore, the researcher took the initiative to create a worksheet with number pattern material whose preparation refers to the latest curriculum, namely Permendikbud No 37 of 2018.

Researchers prefer to develop E-Worksheets compared to E-Modules because teachers have used mathematics E-Modules from the government and feel the need for variations of new worksheets teaching materials because the previous ones were still in printed and simple form. In addition, this is because in this new habit, technology has become one that has an important role in the world of education.

According to Jamilah (2020) online learning in this new habitual period can be used by educators as an opportunity to make a transformation from being less familiar with technology to being more familiar with technology.

Internet-based technology and multimedia technology in learning can be an alternative that can be used. In the world of education itself, there are many *platforms* that can be used to support learning activities so that they can be more interesting and maximal. Examples of technology in learning can be in the form of *flipbooks*, *liveworksheets*, interactive learning videos, and many others. One of the innovations in worksheets teaching materials is *liveworksheets*.

*Liveworksheets* itself is a web-based E-Worksheets *platform* that requires an internet connection, this can allow students to work in distance learning conditions or in class if there are supporting facilities such as devices/tablets or computers. Students can collect the results of their work via email.

The advantage of *liveworksheets* when compared to other media such as *flipbooks* is that they have various variations of answer-filling features because the orientation of the *liveworksheets* itself is for the manufacture of electronic-based student worksheets. The features in question are for example connecting with arrows, *drag and drop*, *drag and down* and so on. Whereas *flipbooks* are more oriented towards creating modules, so there are not enough features for filling out answers.

This is relevant to the results of interviews with mathematics teachers in class VIII A at SMP Negeri 1 Bantarkawung. The teacher said that students needed a variety of technology-based teaching materials. Researchers also received information that school have computer laboratories that are not functioning optimally, usually only used when ANBK test (computer-based national analysis) and rarely used for learning activities.

Based on the results of interviews with students of class VIII A at SMP Negeri 1 Bantarkawung regarding their personal or non-private device or laptop facilities, data obtained that as many as 15 students or 78.9% have access, while 4 students or other 21.1% don't have that access. Other data also found that as many as 14 students (73.7%) needed material in the form of videos to study it again at home, while 5 other respondents (26.3%) did not feel the need for material in the form of videos. The needs of students for the material in the form of videos are certainly relevant to the need for technology-based teaching materials, in this case the researchers took *liveworksheets* to be used, in the *liveworksheets* there is also a feature to add videos from

youtube.

The process of preparing worksheets certainly requires a learning model. One of the learning models that can be used is *Problem Based Learning*. *Problem Based Learning* is a learning model in which the delivery of the material is given by presenting a problem that is related to the reality and can be easily found.

The positive thing about this model is that it can increase student activities, help apply their knowledge in understanding real-life problems related to the material and can develop students' critical thinking skills (Komariah, K., et al. 2019). This model is relevant to the characters that must be possessed in the 21st century, namely " *The characteristics and demands of the 21st century produce four learning characters of the 21st century, namely: (1). Critical Thinking and Problem Solving; (2) Creativity and Innovation; (3) Communications; (4) Collaboration*" (Astuti, et al., 2019). The main focus on the *problem based learning model* is relevant to problem solving points. The researcher chose the *Problem Based Learning model* because it was deemed appropriate to be applied to the number pattern material to be developed.

Based on the background of the problem described above, the researcher intends to create an E-Worksheets product using *liveworksheets* on the class VIII on Number Pattern material with the *Problem Based Learning learning* model, and in the manufacturing process *the Canva* application is also used to design images related to the problem.

Based on the identification of the problem and the limitation of the problem that has been described, the formulation of the problem is obtained as follows: (1) How to compile and develop an E-Worksheets based on *Problem Based Learning* using *liveworksheets* on the Number Pattern material?; (2) How is the feasibility of E-Worksheets based on *Problem Based Learning* using *liveworksheets* on the subject of Number Patterns in terms of validity and practicality?

The objectives of this development research are as follows: (1) Produce a product in the form of a Student Worksheet (E-Worksheets) based on *Problem Based Learning* on the Number Pattern material. (2) Knowing the feasibility of E-Worksheets based on *Problem Based Learning* on the Number Pattern material in terms of validity and practicality.

## Method

The method used in this research is *Research and Development* (R&D). In this study, it was limited only to product validation and practicality tests. The model used in this study is the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation), this model was chosen because it is considered relevant to the product to be developed, the stages are systematic, and each stage goes through an evaluation and revision so that it can be seen that the product is valid or not.

The test subjects of this study were 2 learning material experts and 2 learning media experts and students. The students referred to in this research trial were class VIII A at SMP Negeri 1 Bantarkawung. Students will be the subject of the implementation of the E-Worksheets product that will be developed. After implementing the product, students will be asked to fill out a questionnaire and provide input on the product that has been used. This study applied a trial through two stages, namely a small group trial of 6 students and a large group trial of 31 students, but in its implementation it was only applied to 28 students.

The data collection process used in this study is an interview guide to find out research problems, as well as questionnaires instrument for material experts, media experts, and students. The data will be used as a reference in seeing the validity and practicality of the E-Worksheets and as a benchmark in improving the E-Worksheets product from corrections by experts. The score was obtained by filling out a questionnaire instrument by the test subject with the assessment

category using five alternative categories of answers, namely 5 (Very Good), 4 (Good), 3 (Good Enough), 2 (Poor Good), and 1 (Very Poor).

Qualitative data in the form of input or suggestions for improvement from media experts, material experts, and students. These inputs and suggestions will be analyzed later, the results are used to improve or revise the E-Worksheets product. The quantitative data is in the form of scores or values obtained from filling out questionnaires by media experts, material experts, and students. The data determines the completeness value of the E-Worksheets by calculating the average score of all trial respondents and then analyzing which results determine the validity and practicality of the E-Worksheets product.

The average results that have been obtained are then converted to see the results on a Likert scale with 5 classifications referring to the conversion table according to Sugiyono (2009).

### Results and Discussion

The development of electronic students' worksheet produced three products. They are e-worksheet in number pattern topic. The e-worksheets can be accessed through the following link. E-worksheet 1 for number pattern topic part 1 (<https://www.liveworksheets.com/5-tm319489dd>), e-worksheet 2 for number pattern topic part 2 (<https://www.liveworksheets.com/5-za321319gt>), and e-worksheet 3 for number pattern topic part 3 (<https://www.liveworksheets.com/5-zo322112tp>).

The sample of the e-worksheet is presented in Figure 1.



Figure 1. Sample of e-worksheet using PBL approach

The results of product analysis in terms of learning materials are obtained based on products that have been revised in accordance with suggestions for improvement given by Learning Material Experts. Validator 1 is a mathematics education lecturer at Ahmad Dahlan University and validator 2 is a mathematics teacher. Aspects of the assessment include suitability, validity, relevance, consistency, systematic delivery of material, these aspects are taken and modified from Ramen in Sholehah (2021). The recapitulation of scores by material experts is described in Table 1.

**Tabel 1.** Recapitulation of scores by learning material expert

Total Score/Validator		Total Score
Validator 1	Validator 2	
71	70	141

According to the results of the calculation of the average score and referring to the table of validity criteria, the product is included in the very valid category in terms of learning materials with an average score of 68.5.

The results of product analysis in terms of learning media are obtained based on products that have been revised in accordance with suggestions for improvement given by Learning Media Experts. Validator 1 is a mathematics education lecturer at Ahmad Dahlan University and validator 2 is a mathematics teacher. Aspects of the assessment include media, attractiveness, learning design, and message delivery. The recapitulation of scores by material experts is described as follows.

**Tabel 2.** Recapitulation of scores by learning media expert

Total Score/Validator		Total Score
Validator 1	Validator 2	
71	70	141

According to the results of the calculation of the average score and referring to the table of validity criteria, the product is included in the very valid category in terms of learning media with an average score of 68.5.

Analysis of student responses aims to determine the practicality of the product and find out whether there is something that needs to be improved from the product being developed or not. Aspects of the assessment include content/material and media. The total score of the results of the student responses in the small group test and large group test is as follows

**Tabel 3.** Recapitulation of scores by students

Student Response	Number of Respondents (n)	Total Score
Small Group Test	6	377
Large Group Test	28	1831

According to the results of the calculation of the average score and referring to the table of practicality criteria, the product is included in the practical category with an average score of 62.84 in the small group test and 65.39 in the large group test.

The validation process carried out by material and media experts obtained a formative evaluation in which there were several revisions for the improvement of the E-Worksheets

product. After the researcher went through the revision process, the product got very valid results based on the assessment of material experts and media experts. Revisions from experts include adding videos of simple material in the form of videos, adding images that match the problem, improving spelling, and improving color composition.

The product that has been validated is then tested to get student responses. Based on the results of small group trials, the results obtained with practical criteria based on the table of practicality criteria. In addition, there is a summative evaluation by students where the revision of the error in filling in the correct answer on let's practice 3. After being revised, the product gets very practical results in the large group test. The revision in the small group test was to correct the input of the correct answer in the liveworksheets, because there was an error in the answer that was supposed to be correct but was detected wrong.

The product is declared valid and practical to use so that it can be said to be feasible to be applied to the learning process at school. The researcher also considered that based on the summative evaluation the product could help students in problem solving abilities. This research can also be used as a reference for the development of similar products in the future.

## Conclusion

Based on research and development of Problem-Based Learning Electronic Student Worksheet for Number Pattern Topic Using Liveworksheets, several conclusions were obtained as follows. First, the product that has been developed is an E-Worksheets based on *Problem Based Learning* on the subject of Number Patterns using *Liveworksheets*. Second, E-Worksheets based on *Problem Based Learning* on the subject matter of Number Patterns using *Liveworksheets* was declared valid and practical by material experts, media experts, and student responses so that it was suitable for use in the learning process.

Based on research and development of Problem-Based Learning Electronic Student Worksheet for Number Pattern Topic Using Liveworksheets, some suggestions are obtained if there is further relevant research, there are including E-Worksheets products are expected to be developed again in other learning models besides Problem Based Learning. Researchers hope that E-Worksheets can be developed on other subjects in the future. In its use, teachers can provide opportunities for students with above average abilities to work on them independently. Teachers still have to accompany students who have below average in mathematical abilities and provide direction and motivation to students.

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