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Development of Occupational-based-Context Worksheets of Geometric Sequences and Series for Senior High School Students

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ABSTRACT
Mathematics activities should not just be a procedural problem. It should be presented in context, especially real-life contexts that students often encounter. One of the contexts that many students encounter in their daily lives is occupational context. By completing contextual-mathematical-activities, students do not just solve problems procedurally, but they need to understand the underlying mathematical-concepts so that they are able to identify what is known and what is being asked correctly, so that students are able to determine the right steps and formulas to apply in solving problems. Therefore occupational-context is potential to be used in developing mathematical activities. One of them is in learning concept of Geometric Sequences and Series. The use of occupational-context could help students understand the use of mathematical concept so it can help students gain better understanding on the concept they learnt. Therefore in this study it is developed students' worksheet (LKPD) based on occupational-context for concept of geometric sequences and series. Research method used is Research and Design (R & D), by applying ADDIE model, consist of analysis, design, development, implementation and evaluation stages. Result of this study shows that LKPD developed is valid and practical to be implemented in actual classroom. The implementation of the LKPD shows that LKPD is effective in helping students learn and understand the concept of geometric sequences and series. Furthermore, students give good responses for the use of LKPD. This is implied by the average percentage of students' responses is 82.67%.

Keywords: *Geometric-sequences; Geometric-series; Occupational; Context; Worksheets.*

INTRODUCTION

A mathematics learning is ideally presented with in real life context in order to prepare students with real life experiences so that they are ready when facing problem in real life. There are various contexts in everyday life. The use of context as basis for mathematical activities is in accordance with concept of mathematical literacy, which is mathematical activities are built using real-life contexts (Gradini, Firmansyah, & Saputra, 2021). One context that can be used as a mathematical activity is context related to jobs (Stacey 2015).

Context related to jobs, or usually called occupational context, is a context related to work environment of certain jobs or context related to lives of students at school. Some activities related to occupational context may include measuring, financing and ordering building materials, calculating salaries, quality control, scheduling, design/architecture, and activities related to decision making (Dewantara, 2019). In contrast to Dewantara (2019)'s statement above, Putra & Vebrian (2018) explain that occupational context can be a mathematical activity related to work at every level known to students, starting from the lowest level to the highest level. The use of occupational context as a mathematics learning activity can help students in building their understanding of mathematical concepts, assist students in problem solving activities, classify problems, and help students understand the use of mathematical concepts in various fields of work (Hidayah, 2018). Therefore occupational context is potential to be used in developing mathematical activities that are useful and meaningful.

Apart from the importance of mathematical abilities for students'academic life, based on interviews conducted by researchers with several high school students showed that many students had

difficulties in learning mathematics. One of the most common difficulties is students' difficulty in solving word problems. Moreover, based on the interviews with mathematics teachers and researchers' observations at Madrasah Aliyan Unggulan KH. Abd Wahab Hasbullah, it is known that students tend to solve problems or mathematical activities just by calculating numbers from the questions into mathematical formulas. However, because this is not accompanied by an understanding of the concept, students often mistakenly identify the information that must be used, and they mistakenly determine the correct formula to be used. This is in line with findings of several previous studies which show that students are accustomed to solve procedural math problems and they are not familiar with problem solving activities using contextual problems (Satiti & Verdianingsih, 2019; Pirmanto, Anwar, & Bernard, 2020). Several other studies have shown the same thing, especially in learning Geometric Sequences and Series, in which many students have difficulty identifying facts or information on questions, so that students are unable to determine and use the correct formula, and this results in students not being able to solve problems given (Wibowo, 2018; Hasanah, Nugraheni, & Purwoko; 2020).

Therefore, mathematical activities should not just be procedural problems. Mathematical activities should be presented in context, especially real-life contexts that students often encounter. One of the contexts that many students encounter in their daily lives is the occupational context. By completing contextual mathematical activities, students do not just solve problems procedurally, but they must understand the underlying mathematical concepts so that they are able to correctly identify what is known, what is being asked, and in the end students are able to determine the right steps and formulas to apply in solving problems (Satiti & Verdianingsih, 2019)

Mathematical activities can be presented in various forms. A collection of mathematical activities can be presented in the Lembar Kerja Peserta Didik (LKPD) or Student Worksheet. LKPD can be a printed teaching material in the form of sheets of paper containing materials and assignments for students that can refer to the achievement of basic competencies (Maimunah, Izzati, & Dwinata, 2019). Previous research has shown that the use of students worksheets can help students build their understandinf toward mathematical concepts in geometric sequences and series, as well as increase students' creativity (Wandari Kamid, & Maison 2018).

Referring to the description above, it is necessary to increase the use of contextual math problems. One of them is a math problem that is presented in the occupational context. Mathematics problems and assignments can be presented as Student Worksheets (LKPD). Therefore, in this study, contextual Student Worksheets (LKPD) were developed on Geometric Sequences and Series materials. The context used is the occupational context. So this research is about developing LKPD in occupational context on geometric sequences and series for XI grade students of Senior High School (SMA/MA).

METHOD

Research and Development (R&D) is used as research approach. This study adapts the ADDIE development model with five stages, namely analysis, design, development, implementation and evaluation (Sugiyono, 2018). The stages in the ADDIE model are interrelated and structured systematically. The following figure shows the stages of development research by applying the ADDIE model.

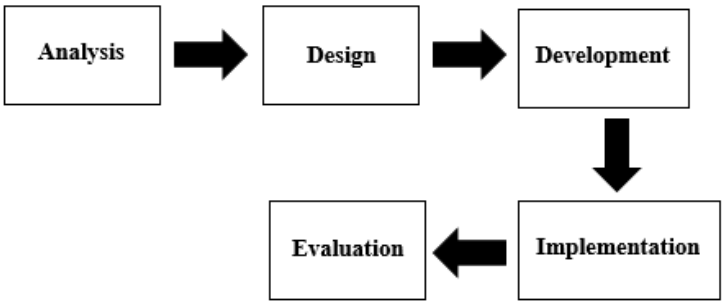

Figure 1. The steps of ADDIE development model (Sugiyono, 2018)

The results of this study are in the form of teaching material products in the form of Student Worksheets (LKPD) based on occupational context on geometric sequences and series concepts for students of class XI SMA/MA. LKPD developed through a trial process, starting with expert testing (expert validation). The subjects of the expert validation are lecturers of mathematics education and teachers of mathematics subjects. In addition, a practical assessment of the LKPD developed was also carried out. This practicality assessment is carried out by mathematics subject teachers as practitioners.

After the LKPD has obtained a proper assessment from the expert (expert validation) and is enhanced according to expert reviews and advices, then the LKPD is tested in the actual class. Subjects in this study is class XI-MIPA 1 at Madrasah Aliyah Unggulan K.H.Abd. Wahab Hasbullah Bahrul Ulum. The students who are the test subjects in this study were also asked to fill out student response questionnaire. This questionnaire was completed at the end of the trial process. The results of student responses and the results of the practicality assessment by teacher are used as a reference for researchers in determining the level of practicality of the LKPD.

RESULT AND DISCUSSION

Result

The following is a description of the research results according to the stages of the ADDIE model research.

- ***Analysis***
- Needs Analysis

  In the needs analysis stage, the researcher observed teaching and learning activities. In addition, the researchers also conducted interviews with several students and teachers of mathematics. The results of interviews with several students showed that students had difficulties in learning mathematics. One of the many difficulties encountered is the difficulty of students in solving story problems. Based on the results of interviews with mathematics teachers and observations of researchers, it is known that students tend to solve problems or mathematical activities given by simply entering numbers from the questions into mathematical formulas. However, because this is not accompanied by an understanding of the concept, students often mistakenly identify the information that must be used, and they mistakenly determine the correct formula to process the known information. So that in the end students are not able to solve the questions or assignments given correctly. In addition, based on the results of interviews, it is also known that learning mathematics rarely uses teaching materials/learning media that can facilitate students in the process of contextual learning activities. This causes learning to be less meaningful so that their learning motivation is low.
- Material Analysis

  Analysis of learning materials includes determining learning materials tailored to the applicable curriculum in schools and the needs of students. Without realizing it, the concepts of geometric sequences and series are widely applied in everyday life. One of them in various fields of work. Therefore, a review of various activities related to work that are familiar to students is carried out. Then, several work contexts are taken and used that require the ability of geometric sequences and series to be developed as mathematical activities and tasks. Therefore, the material developed in this study is geometric sequences and series.

- ***Design***

At the design stage, the researcher created a content framework and compiled the LKPD material. The developed worksheet contains a collection of mathematical tasks and activities using the work context. The underlying mathematical concepts are geometric sequences and series.

- ***Development***

At the development stage, the following steps were carried out.

- Before conducting the expert trial (expert validation), the researcher re-examines the developed LKPD.
- Expert validation is carried out to determine the feasibility of the LKPD before the product is implemented in trials on students in the real class. Expert validation in this study was carried out by one mathematics education lecturer and one mathematics teacher as a practitioner. Validation was carried out using an expert validation questionnaire. The components assessed include the contents of the LKPD, the material presented, and the presentation of the LKPD. Researchers compiled expert validation questionnaires according to indicators and assessment components.

To assess the validity, the following references are used.

$$P = \frac{\sum x}{\sum xi}\ x\ 100\%$$

Description:

P : Percentage (valid)
∑x : Total number of answer scores
∑xi : The total number of highest answer scores

As a reference for giving meaning and making decisions, the following references are used.

Table 1. The Qualification of Product Validity Level

No	Percentage	Validity Criteria
1.	80%– 100%	Valid
2.	60% – 79%	Sufficiently valid
3.	40% – 59%	Less valid
4.	0% – 39%	Invalid

(Syafaáh, 2018)

The developed LKPD is declared feasible and can be continued to the Implementation stage if the LKPD obtains a minimum assessment of "Sufficiently valid" and has been revised according to expert advice/input/validator.

Based on the results of expert validation, an average rating of 94.63% was obtained. These results meet the “Valid” criteria. Thus, it can be concluded that the LKPD developed is feasible to go to the next stage, namely the implementation stage, where the LKPD is tested in the actual class.

- In addition to expert validation, a practical assessment was also carried out. The practicality assessment is carried out by the mathematics teacher as a practitioner. This practicality assessment is carried out at the implementation stage. However, an assessment questionnaire has been prepared at the Development stage as part of the instrument development. The practicality assessment questionnaire is prepared according to the practicality component indicators of teaching materials.

- ***Implementation***

At the implementation stage, LKPD trials were carried out in actual classes. The subjects of the trial were the students of Madrasah Aliyah Unggul K.H.Abd. Wahab Hasbullah Bahrul Ulum, class XI-MIPA 1. In this implementation stage, students learn concept of geometric sequences and series using the worksheet (LKPD) developed in this study. There are 16 students as subject of the implementation stage.

Based on the results of the evaluation of students' understanding after learning activities using the LKPD, an average class score obtained is 79.56. Kriteria Ketuntasan Miimal (KKM) or minimum completeness criteria for mathematics at Madrasah Aliyah Unggul K.H.Abd. Wahab Hasbullah Bahrul

Ulum is 78. Evaluation of learning outcomes shows that 75% of students get results above the KKM. While 24% of students get results below the KKM.

In addition to the implementation stages, the students are also asked to provide feedback on the use of LKPD. This is done through filling out student response questionnaires at the end of the implementation phase. The results of the student responses along with the practicality assessment by the teacher are used to determine the practicality of the LKPD. To assess practicality, the following references are used.

$$P = \frac{\sum x}{\sum xi}\ x\ 100\%$$

Description:

P : Percentage of practicality
∑x : Total number of answer scores
∑xi : The total number of highest answer scores

As a reference for giving meaning and making decisions, the following references are used.

Table 2. The Qualification of Product Practicality Level

No	Percentage	Practicality Criteria
1.	80%– 100%	Practical
2.	60% – 79%	Sufficiently practical
3.	40% – 59%	Less practical
4.	0% – 39%	Impractical

(Syafaáh, 2018) with researcher modification.

The minimum criteria for practicality are "Sufficiently Practical".

There are 12 indicators in the student response questionnaire. Based on the results of student responses, the average percentage of assessment is 82.67%. This shows that the results of student responses meet the assessment with the "Practical" criteria. As for the results of the practicality assessment by mathematics teachers, 94.44% were obtained, and met the "Practical" criteria. Thus, based on the results of student responses and practicality assessments by the teacher, the results obtained that meet the "Practical" criteria for the developed LKPD.

- ***Evaluation***

At the Evaluation stage, the researcher evaluates the results of the implementation stages and responses of students. Based on the results of expert validation, it is obtained the average rating of 94.63%, and it meets the “Valid” criteria so that they are eligible for the next stage, that is the implementation stages. The results of the implementation in the actual classroom shows a good response from the students. It can be seen from the results of student responses with an average percentage of 82.67%. In addition, the results of the practicality assessment by mathematics teachers, it is obtained 94.44%. Based on the results of student responses and teacher’ assessments, the LKPD meets the “Practical” criteria. Thus, the occupational context worksheets for geometric sequences and series material developed in this study are valid and practical.

Discussion

Based on the results of the needs analysis, it is known that one of the difficulties that many students encounter is the difficulty of students in solving word problems. The results of interviews with mathematics teachers and the results of researchers' observations show that students tend to solve problems or mathematical activities given by simply operating numbers from questions using mathematical formulas. However, because this is not accompanied by an understanding of the concept, students often mistakenly identify the information that must be used, and they get difficulty in determining the correct formula for the given problems. So that students are not able to solve the questions or assignments given correctly. This is in line with the findings in several previous studies which showed that in working on mathematical

problems or activities, students tended to simply operate only the numbers given, without understanding the context, situations and concepts underlying the problems (Satiti & Verdianingsih, 2019; Pirmanto, Anwar, & Bernard, 2020). Furthermore, several other studies have shown similar things, especially in solving word problems containing the concept of Geometric Series and Series (Wibowo, 2018; Hasanah, Nugraheni, & Purwoko, 2020).

In addition, based on the results of interviews, it is also known that learning mathematics rarely uses teaching materials/learning media that can facilitate students solving contextual learning activities. This causes learning to be less meaningful so that their learning motivation is low. This result is in accordance with the findings of several previous studies which showed that less meaningful mathematical activity resulted in low motivation and interest in learning for students (Satiti, Maslakhah, & Verdianingsih, 2022). Therefore, the use of context-based mathematics problems is necessary. So that what students learn in school is related to their real life, one of which is the context of their daily work. Thus academic activities will be meaningful for students.

Based on the results of the implementation of the LKPD, a good response was obtained from the students for the use of the LKPD. This is indicated by the average percentage of the assessment of the use of LKPD by students of 82.67%. In addition, referring to the results of the evaluation of students' understanding, an average class score of 79.56 was obtained, with details of 75% of students getting results above the KKM, and 25% of students getting results below the KKM. This shows that the use of LKPD in the occupational context is effective in helping students understand the concepts of geometric sequences and series. These results are in line with the findings in the research of Wandari Kamid, & Maison (2018) which showed that the use of the developed worksheets could help students understand mathematical concepts in the geometric sequences and series.

CONCLUSION

Based on the discussion of the results of the research above, it can be concluded that: 1) The development of LKPD in the occupational context on geometric sequences and series concept for class XI SMA/MA students uses the ADDIE model, which consists of the stages of analysis, design, development, implementation, and evaluation. 2) Based on the results of expert validation, namely mathematics education lecturers and mathematics subject teachers, the percentage of assessment was 94.63% which this result met the "Valid" indicator. 3) LKPD in occupational context on geometric sequences and series material is not only valid but also practical. This is evidenced by the results of the practicality assessment by mathematics teachers of 94.44%, and the results of student responses that are 82.67%. The results of the practicality assessment by the teacher and the results of the student responses meet the "Practical" indicator. 4) The results of the implementation of the LKPD in the occupational context in learning geometric sequences and series indicate that the LKPD is effective in helping students learn and understand the concept of geometric sequences and series.

This development research is limited to the development of printed Student Worksheets (LKPD) teaching materials on geometric sequences and series. In accordance with today's technological developments, it is necessary to develop technology-based teaching materials. In addition, teaching materials can be developed for other mathematical materials and subjects.

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