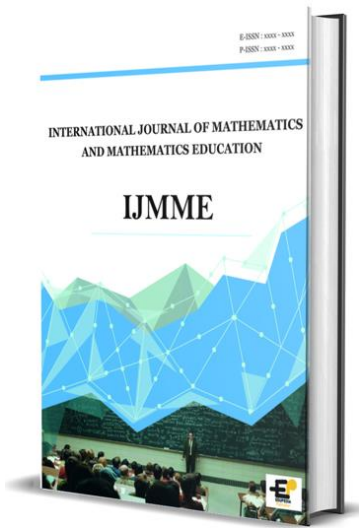

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Development of Mathematics Learning Tools Using Peer Instruction with Structured Inquiry Method Based on Local Culture Oriented on Mathematical Problem-Solving Ability

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To cite this article:

Ruswana, et. al. (2023). Development of Mathematics Learning Tools Using Peer Instruction with Structured Inquiry Method Based on Local Culture Oriented on Mathematical Problem-Solving Ability. *International Journal of Mathematics and Mathematics Education (IJMME), 1*(3), 227-235 https://doi.org/10.56855/ijmme.v1i3.739

IJMME International Journal of Mathematics and Mathematics Education

October 2023, Vol. 01, No. 03, 227-235 doi: 10.56855.ijmme.v1i3.739

Development of Mathematics Learning Tools Using Peer Instruction with Structured Inquiry Method Based on Local Culture Oriented on Mathematical Problem-Solving Ability

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Article Info

Article History

Received:
July 20, 2023
Accepted:
August 15, 2023

Keywords

Local Cultured
Mathematical
Problem-Solving
Ability
Local Cultured

Abstract

This research aims to describe the characteristics of mathematics learning tools and produce valid, practical and effective mathematics learning tools using the Peer Instruction with Structured Inquiry (PISI) method based on local culture which is oriented towards mathematical problem-solving abilities. This research is development research using the ADDIE development model. Data analysis was carried out in this research to determine the feasibility of the development product in terms of the validity, practicality and effectiveness of the learning tools being developed. The research results show that 1. mathematics learning tools using the PISI method based on local culture oriented towards mathematical problem solving abilities have several characteristics, namely: a) Learning activities carried out using the PISI method stage consist of 2 parts, namely Peer Instruction which indirectly leads to the Structured Inquiry stage; b) The problem investigated in learning is a problem with the local cultural context of Ciamis; c) The use of local cultural context makes the mathematical knowledge concepts obtained by students become more meaningful and students become aware of the importance of mathematics because mathematical concepts are also found in students' daily activities; d) The instrument used in assessing learning outcomes is in the form of mathematical problem solving ability test questions. 2. Mathematics learning tools using the PISI method based on local culture are oriented towards mathematical problem-solving abilities that meet the criteria of being valid, practical and effective.

Introduction

Learning mathematics helps cultivate students' problem-solving mindset and the process of actively addressing a given problem is referred to as problem-solving (Harini, 2023). Various sciences are based on mathematics. Considering that mathematics is important in life, school mathematics education must be optimised so that the goals of mathematics at school are achieved and mathematics is useful in life. Solving problems is one of the goals of mathematics. Mathematics is human sense-making and problem-solving activity" which means that mathematics is human reason and problem-solving activity

(Nurhayati & Nurandini, 2023). In the mathematics learning process, there are five process standards, namely communication abilities, representation abilities, connection abilities, problem-solving abilities and reasoning abilities (Ningrum et al, 2019).

The problem-solving process is one of the important elements for students in incorporating real-life problems (Harini, et. al., 2023). Problem-solving is an important activity in school mathematics because, in the process of finding solutions, students can gain experience in applying the knowledge and skills they already have to solve non-routine problems. Robert L. Solso and Siwono (Amalia et al, 2018) stated "Problem-solving is a thought that is directed directly to finding a solution or solution to a specific problem. Problem-solving is an individual process in overcoming obstacles or obstacles when an answer or method of answering is not clear". Nopriana, Herman, & Martadiputr, (2023), mathematics education students must receive learning and training so they can easily face these challenges in the future.

However, the facts in the field are that mathematical problem-solving abilities are not yet optimal. This means that the facts at school do not match the learning objectives that have been set and are expected to be achieved. To solve this problem, it is necessary to look for various alternative solutions so that the quality of mathematics learning is even better. One learning that can be used as a solution is Peer Instruction with Structured Inquiry (PISI).

Zamnah and Ruswana (2018) argued that Peer Instruction (PI) is a didactic that is often used in lectures interspersed with short conceptual questions (Conceptest) which are designed to reveal misunderstandings and to involve students to be active during lectures. Structured Inquiry is the lowest level type of inquiry where students are assigned to carry out investigations based on the problems given by the teacher and students at each stage receive all instructions. The PISI learning stage consists of two sections, namely Peer Instruction (PI) and Structured Inquiry (SI) (Aisyah, 2016). PI stages consisting of a brief lecture (BL), concept test (CT), and the remaining explanation demonstration hands-on activity (RDH), while the SI stages consist of five stages, namely engagement, exploration, explanation, elaboration, and evaluation (Suppapittayaporn et al. 2010)

Lively local culture in the center society is usually born of encouragement community spirituality and local rites which is spiritually and materially very important for a social life village community environment (Setyaningrum, 2018). Local culture is a phenomenon that is close to students, so this local culture is an issue that will be investigated in Peer Instruction with Structured Inquiry (PISI) learning. The culture highlighted in this research is local in the Ciamis area. Local culture holds many life values that can be learned so it should be preserved and used in the context of problems in learning. Apart from that, cultural context can also help students to appreciate mathematics more. As stated by Schutes and Shannon (Wentzel et al, 2019), students will increase their appreciation of mathematics after learning using the culture that exists in society.

Cultural developments have an impact on the formation of mathematical thinking that is linked to

everyday life and vice versa. Regarding the relationship between the two, Ernest (Muyassaroh and Sunaryati, 2021) stated that Mathematics is the main element of culture, art, and life which permeates and underlies science, technology, and all aspects of human culture. Mathematics is a form of human culture and has been integrated into almost every aspect of human life throughout the world.

The formulation of the problem in this research is: 1) What are the characteristics of mathematics learning tools using the Peer Instruction with Structured Inquiry (PISI) method based on local culture which is oriented towards mathematical problem-solving abilities and self-regulated learning? 2) What is the feasibility of junior high school mathematics learning device products using the Peer Instruction with Structured Inquiry (PISI) method based on local culture which is oriented towards mathematical problem-solving abilities and self-regulated learning?

Method

This type of development research is the type of research used in this research, to produce a product, namely a learning tool using the Peer Instruction with Structured Inquiry (PISI) method based on local culture. The learning tool produced in this research is the Learning Implementation Plan (RPP) and its complete components. The ADDIE development model is the development model used in this research, which has five stages, namely Analysis, Design, Development, Implementation, and Evaluation (Branch in Nababan, 2002).

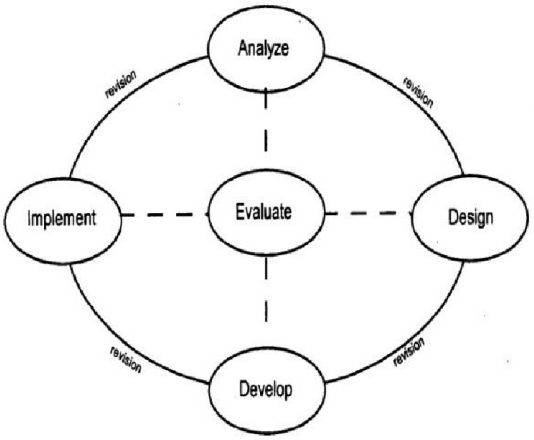

Figure 1. ADDIE model

The research was carried out at MA Mujahidin class X. The sampling used in this research was a purposive sampling technique, which means that samples were taken using certain considerations (Sugiyono, 2013). The instrument used is a test in the form of descriptive questions, a test used and structured based on indicators of mathematical problem-solving. Data collection techniques in the research are test and non-test techniques. The test technique is a test of mathematical problem-solving ability in the form of description questions. Data analysis was carried out to determine the feasibility of the development product by looking at the aspects of validity, practicality, and effectiveness of the learning tools being developed.

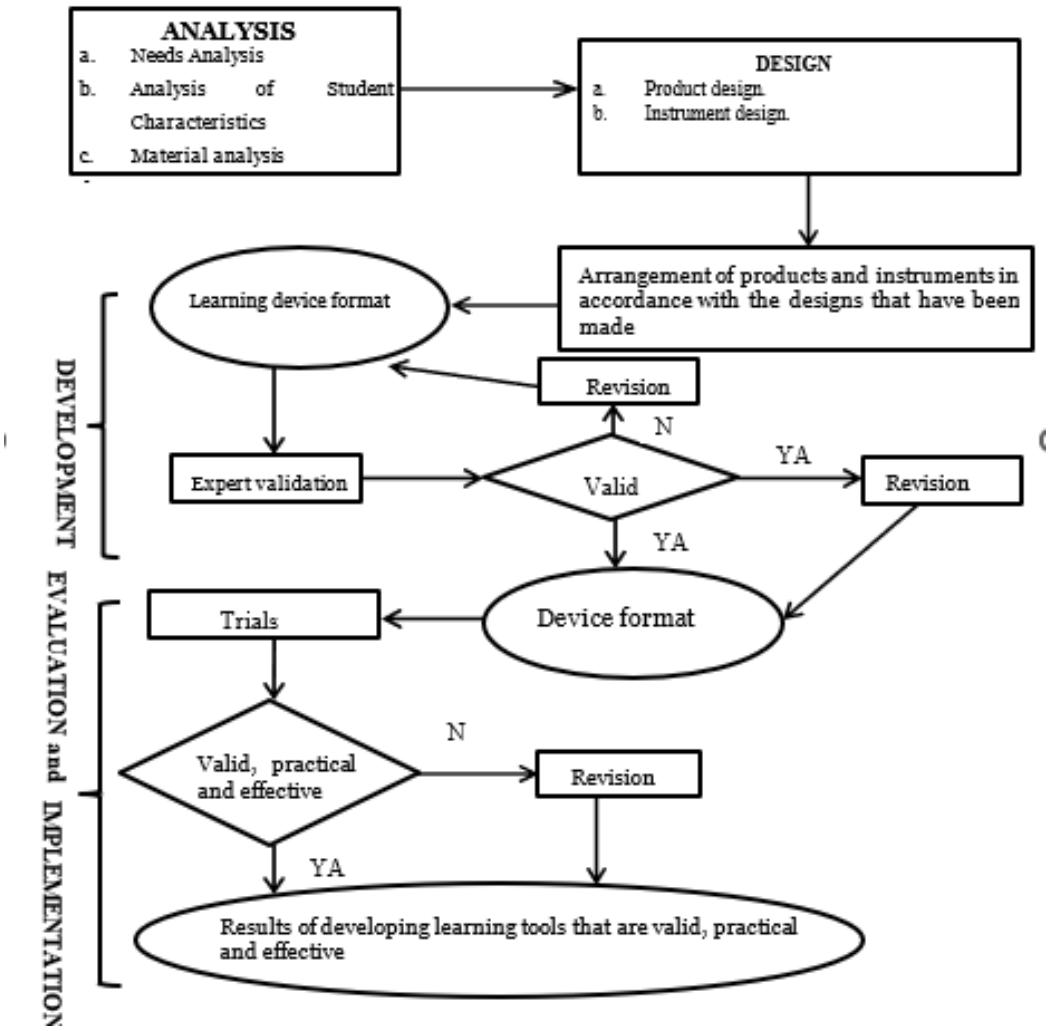

Figure 2. Learning Device Development Scheme

Results

The validity of the learning tools is obtained from expert validation results which show that the RPP assessment is in the very good category so that the mathematics learning tools using the local culture-based PISI method which is oriented towards students' mathematical problem-solving abilities and self-regulated learning have met the valid criteria so they are suitable for use with revisions. based on several expert suggestions and ideas.

Mathematics learning device products have met practical criteria based on:
a. The teacher's assessment of the learning tools is in the very good category.
b. Observation of learning implementation at each meeting of learning implementation is greater than 80%.

Because the product meets practical criteria, this means that the product can be used and utilized easily by teachers and students. PISI's mathematics learning device product based on local culture which is oriented towards mathematical problem-solving abilities and self-regulated learning has met the

effective criteria because the average result of the mathematical problem-solving ability test is more than 75, and the average score of the self-regulated learning questionnaire is more than 75. of 74.8. Kania, Fitriani, & Bonyah, (2023), many authors described mathematics can help improve a person's ability to think.

Discussion

Analysis

The analysis stage is carried out on needs, student characteristics, and material.

a. Needs Analysis
   Based on the results of interviews and observations, it is necessary to develop learning tools, one of which is a learning implementation plan. The learning implementation plan that is developed should be more systematic and organized by the student's personality so that the insights gained by the student become more substantial. The local culture-based PISI method can be used as a learning preference in developing learning implementation plans.
b. Analysis of Student Characteristics
   The characteristics of students, especially class XI MA Mujahidin students based on interviews and observations, are:
   1) Students are less responsive in the learning process, for example when the teacher asks a question and only a few students respond.
   2) Students are more enthusiastic when the teacher talks about things outside of the lesson.
   3) Many students still don't know the local culture of Ciamis.

   Peer Instruction (PI) and Structured Inquiry (SI) are stages of PISI. In PI students are given problems, materials, and materials but students are not told the expected final results. In SI students are guided to discover, investigate, and develop specific findings.
c. Material Analysis
   The material analyzed is adapted to the curriculum used by MA Mujahidin. Based on the curriculum used, one of the materials studied by class XI students is statistics.

Design

During the design phase, learning tools were prepared in the form of lesson plans which were designed using the PISI method based on local culture. The assessment instruments designed include mathematical problem-solving ability test instruments.

Development

The development stage is carried out to follow up on the results of the design stage. In this stage, what is carried out is expert validation and product changes resulting from validation. The result is draft 2 which consists of learning tools and assessment instruments that are valid and ready to be tested.

a. Learning implementation plans.

b. Expert Validation

Expert validation is carried out by expert teachers to assess the validity of the learning tools developed. The assessment category for the RPP created is very good with an average score of 103.5. It can be concluded that the quality of MA mathematics learning tools using the local culture-based PISI method meets valid criteria.

Table 1. Validity Assessment Results of Learning Implementation Plans for Each Aspect

No.	Aspect	Assessment score		Average
		Validator 1	Validator 2	
1.	Identity	10	10	
2.	Formulation of learning objective and indicators	14	13	
3.	Material selection	13	12	
4.	Selection of learning methods	8	8	
5.	Planning learning activities	28	30	
6.	Selection of learning resources	8	10	
7.	Drawing up an assessment	8	9	
8.	Language use	12	14	
	Total	101	106	103,5
	Assessment category			Very good

c. Product Revision

The results of the validator become a reference in revising Draft 1 which is referred to as Draft 2. Draft 2 is a learning tool that has been revised and is valid, so it is ready to be tested in the field.

Application

Learning tools that have been validly applied to research subjects. Then a trial was carried out to produce data, namely data from teacher assessments, observations, and student tests for mathematical problem-solving abilities. This data will be used to assess learning tools in terms of the practicality and effectiveness of using learning tools.

Evaluation

This stage is carried out to assess the feasibility of the product being developed. Product feasibility is seen from three aspects, namely validity, practicality, and effectiveness. Product validity testing was carried out at the development stage, while at the evaluation stage, a practical analysis was carried out which was obtained from the data from the teacher's assessment of the learning tools and the percentage of implementation of learning activities and effectiveness was obtained from the results of the mathematical problem-solving ability test.

Conclusion

Based on the development results that have been presented, the following conclusions are obtained: Mathematics learning tools using the PISI method based on local culture oriented towards mathematical problem-solving abilities have several characteristics, namely: a) Learning using the PISI method stage consists of 2 parts, namely Peer Instruction (Brief Lecture, Concept Test, and Remaining Explanation or Demonstration or Hands-On Activity) which indirectly leads to the Structured Inquiry stage (Engagement, Exploration, Explanation, Elaboration, and Evaluation); b) The problem investigated is a problem with the local cultural context of Ciamis; c) The use of local cultural context makes students' mathematical knowledge concepts more meaningful; d) The instrument used in assessing learning outcomes is in the form of mathematical problem-solving ability test questions. Mathematics learning tools using the PISI method based on local culture are oriented towards mathematical problem-solving abilities that meet the criteria of being valid, practical, and effective. Nisa & Mulyaning, (2022), data from FGD was analyzed and presented in a table to be classified into sub-themes to know the relationship among sub-themes.

Recommendations

Mathematics learning tools using the PISI method based on local culture are oriented towards mathematical problem-solving abilities that meet the criteria of being valid, practical, and effective so they are worthy of being used as an alternative learning tool for classroom learning and can be used as a reference in compiling learning tools. more innovative mathematics. Local cultural values in Ciamis Regency need to be explored further so that they can add to students' knowledge and increase diversity in research.

Acknowledgements or Notes

Mathematics learning tools using the PISI method based on local culture are oriented towards mathematical problem-solving abilities that meet the criteria of being valid, practical, and effective so they are worthy of being used as an alternative learning tool for classroom learning and can be used as a reference in compiling learning tools. more innovative mathematics. Local cultural values in Ciamis Regency need to be explored further so that they can add to students' knowledge and increase diversity in research.

References

Amalia, A., Syafitri, L. F., & Sari, V. T. A. (2018). Hubungan antara kemampuan pemecahan masalah matematik dengan self-efficacy dan kemandirian belajar siswa smp. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *1*(5), 887-894.

Aisyah, R. S. S. (2016). Penerapan Peer Instruction with Structured Inquiry (PISI) untuk Meningkatkan Hasil Belajar Kimia Siswa. *EduChemia (Jurnal Kimia dan Pendidikan)*, *1*(2), 176-188.

Harini, et.al. (2023). Effectiveness of E-Worksheets on Problem-Solving Skills: A Study of Students' Self-Directed Learning in the Topic of Ratios. *International Journal of Mathematics and Mathematics Education* (IJMME), 1(2), 150-162, https://doi.org/10.56855/ijmme.v1i02.333

Kania, Fitriani, & Bonyah. (2023). Analysis of Students' Critical Thinking SkillsBased on Prior Knowledge Mathematics. *International Journal of Contemporary Studies in Education Vol*.02 No. 01, 49-58, https://doi.org/10.30880/ijcse.v2i1.248

Muyassaroh, I., & Sunaryati, T. (2021). Etnomatematika: Strategi melahirkan generasi literat matematika melalui budaya lokal Yogyakarta. *Dikoda: Jurnal Pendidikan Sekolah Dasar*, *2*(01), 1-12.

Ningrum, H. U., Mulyono, M., Isnarto, I., & Wardono, W. (2019, February). Pentingnya Koneksi Matematika dan Self-Efficacy pada Pembelajaran Matematika SMA. In *PRISMA, Prosiding Seminar Nasional Matematika* (Vol. 2, pp. 679-686).

Nisa & Mulyaning. (2022). Designing and Implementing HOTS-Oriented Learning by Mathematic Teachers. *International Journal of Contemporary Studies in Education Vol*. 01 No. 01, 47-55, https://doi.org/10.56855/ijcse.v1i1.54

Nopriana, et. al., (2023). Prospective Mathematics teachers'van Hiele's Geometry Thinking and Habits of Mind: A Description of Hard Skill and Soft Skill by Gender. *International Journal of Mathematics and Mathematics Education* (IJMME), 1(1), 51-60, https://doi.org/10.56855/ijmme.v1i1.231

Nurhayati & Nurandini. (2023). Analysis of Mathematical Investigations of Learners in Terms of Personality Type. *International Journal of Mathematics and Mathematics Education* (IJMME), 1(1), 51-60, https://doi.org/10.56855//ijmme.v1i1.232.

Setyaningrum, N. D. B. (2018). Budaya lokal di era global. *Ekspresi Seni: Jurnal Ilmu Pengetahuan dan Karya Seni*, *20*(2), 102-112.

Suppapittayaporn, D., Emarat, N., & Arayathanitkul, K. (2010). The effectiveness of peer instruction and structured inquiry on conceptual understanding of force and motion: a case study from Thailand. *Research in Science & Technological Education*, *28*(1), 63-79.

Wentzel, K. R., Muenks, K., McNeish, D., & Russell, S. (2017). Peer and teacher supports in relation to motivation and effort: A multi-level study. *Contemporary Educational Psychology*, *49*, 32-45.

Zamnah, L. N., & Ruswana, A. M. (2018). Meningkatkan kemampuan pemahaman matematis dan self-confidence melalui pembelajaran peer instruction with structured inquiry (PISI). *JPPM (Jurnal Penelitian dan Pembelajaran Matematika)*, *11*(1).

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