# Development of a Digital Module with an Ethnomathematic Nuance with the Problem Based Learning Model to Improve Solving Capability Primary School Student Problems

## Bayu Anggara[1], Zaenuri[2], Ellianawati[3]

[1,2,3]Department of Primary Education, Post graduated, Semarang State University, Semarang, East Java, Indonesia

Corresponding Author: Bayu Anggara

## ABSTRACT

Problem solving skills for primary school students are very important. Because problem solving ability is an understanding of how to solve problems in everyday life. One of the learning models that can improve problem solving skills is the Problem Based Learning model. Ethnomathematics is a learning approach that is carried out by teaching mathematics by linking mathematics to a person's cultural work. This research aims to develop a digital module with ethnomathematics nuances with a problem-based learning model to improve elementary school students' problem-solving abilities. This research uses a research and development (R&D) design with the ADDIE model. The subjects in this research were 33 class V students at SDN Pudak Payung 02. Data collection techniques in this research were observation, interviews, questionnaires and tests. The data analysis techniques for this research include analysis of media validation results, analysis of media practicality data, analysis of classical completeness, and analysis of student test results. The results of this research include: 1) A digital module with ethnomathematics nuances with a problem based learning model; 2) The digital module with an ethnomathematics nuance with a problem based learning model is very valid with an overall average score of the media validation test of 0.87 and the digital module developed is of very practical quality with an overall average score of the media practicality test of 93%; 3) The classical completeness value of testing the potential effects of digital media with an ethnomathematics nuance using the problem based learning model obtained high effectiveness results with a percentage of 88%; 4) The digital module with an ethnomathematics nuance with a problem based learning model was declared effective with the difference between the pretest and posttest scores, as well as the results of the n-gain test with an average of 0.55 classified as medium. The conclusion of this research is that digital modules with ethnomathematics nuances with problem-based learning models are effectively used to improve elementary school students' problem-solving abilities.

*Keywords:* digital module, ethnomathematics, problem-based learning and problem-solving abilities.

## INTRODUCTION

Education is a planned effort in the learning process so that individuals can develop and grow into human beings who have responsibility, creativity, knowledge, health and noble character (Inanna, 2018). Ramdan et al., 2018)explains that studying mathematics can improve each individual's abilities, namely the ability to solve problems, think logically, critically and systematically. In line with the National Council of Teachers of Mathematics (NCTM), there are five main abilities in learning mathematics, namely problem solving, mathematical communication, mathematical reasoning, mathematical

connections, and mathematical representation (Nikmah et al., 2020). Problem solving ability is a high level mathematical thinking ability. However, conditions in the field of mathematical problem solving are still low (Nadhifah & Afriansyah, 2016).

Based on the results of the Program for International Student Assessment (PISA) survey in 2018, Indonesia was ranked 64th out of 65 countries that took part in the test (Oki Setiawan, 2021). The average mathematics score of Indonesian students is 375, quite far below the average score of the Organization for Economic Cooperation and Development (OECD). PISA measures the ability of 15 year old students to implement problems in real life. In this test students are not only required to display the skills they have learned, but also to extrapolate and implement them in conditions they did not previously understand.

Students' low problem solving abilities cannot be separated from mathematics learning activities (Szabo et al., 2020; Arofah & Noordyana, 2021; Muslihah & Suryaningrat, 2021). So far, it seems that mathematics learning does not touch the substance of problem solving (Chen et al., 2019). Students tend to memorize mathematical concepts, so students' problem solving abilities are very poor (Verschaffel et al., 2020 ;Damianti & Afriansyah, 2022). Students are not encouraged to look for their own ideas, only teachers always play an active role in the teaching and learning process. This is supported by Narohita's opinion as quoted by (Purwoto et al., 2022) who stated that mathematics learning in the classroom is still dominated by teachers because teachers are pursuing curriculum targets to complete learning material within a certain period of time. Teachers also put more emphasis on students memorizing concepts, especially practical formulas that students can use in answering general tests or national exams, without actually seeing the benefits of the material being taught in everyday life. Thus, students will increasingly think that studying mathematics

has no meaning in their lives. All of this will ultimately lead to low student achievement in mathematics. In fact, problems in daily life should ideally be the beginning of learning mathematics. This is because problems in everyday life are the initial basis for forming students' knowledge and training problem-solving abilities (Ratnawati & Nanang, 2014; Latifah & Luritawaty, 2020)

The results of observations carried out in the city of Lubuklinggau by giving problem-solving ability questions precisely in class V of SDN 56 Lubuklinggau in August 2023, obtained information that of the 33 students who were the observation sample, there were 46% of students who got a score below 50, 39% of students got a score below 50. scores between 51-70 and 15% of students got scores above 70. These results show that there are still many students who have scores below 70, which means there are still many students who experience difficulties in problem solving abilities. The teacher said that after the pandemic, students' motivation to learn decreased because they were used to learning using the help of their smartphones to complete school assignments. This results in teaching and learning activities carried out at school becoming unattractive for students. Teachers play an important role in the learning process. The teacher's role in learning is to make the knowledge taught to students well received (Yestiani & Zahwa, 2020). Apart from that, teachers are the key to student success in teaching and learning activities, because teachers are people who interact directly with students, so that teacher behavior can have a direct influence and be imitated by students. (Sumar, 2020)

Based on the results of observations, the problem that occurs is that the learning system in schools is dominated by teachers, while students only come, sit, listen, record material and work on questions given by the teacher. Another problem that occurs is that teachers in the learning process do not connect or associate mathematics learning with real things based on student activities or events. When choosing a learning model that is suitable for mathematics, one must pay

attention. One model that is suitable to accompany mathematics learning is the problem based learning model. The problem based learning model has previously been used in previous research. This is in line with the findings of (Sari et al., 2021) in her research "The Effect of Problem Based Learning on Problem Solving and Scientific Writing Skills" which showed that the problem based learning model used in her research had a significant influence on increasing students' ability to solve problems and improve scientific writing skills.

Ethnomathematics is a learning approach that is carried out by teaching mathematics by linking mathematics with the nation's own cultural works such as tourist attractions, food, handicrafts and traditional games and also involving the needs and lives of the people (Yestiani & Zahwa, 2020). Using traditional food in learning as a conveyor of lesson material can also be used as a way for teachers to introduce and preserve existing local culture so that it does not experience extinction amidst rapid developments. (Retta, 2016; Hutauruk, 2018)

Based on the problems and research of previous studies that have been conducted with the title "Development of a Digital Module with an Ethnomathematics Nuance with a Problem Based Learning Model to Improve Elementary School Students' Problem Solving Abilities" it is important to do this.

## LITERATURE REVIEW

The results of previous studies also state that through learning using the Problem Based Learning model can significantly improve students problem solving skills Rahmatsyah & Dwiningsih, 2021), Rochsun & Agustin, 2020), Patri & Heswari, 2021), Purwoto et al., 2022), Feriyanti et al., 2019), Florentina Turnip & Karyono, 2021). The results of previous studies further strengthen the results of this study that ethnomathematics nuanced learning integrated with the Problem-based learning model is effective in improving students' problem solving skills.

## MATERIALS & METHODS

The type of research used is research and development (Research & Development) using a descriptive approach. Research and development is a research method that is oriented towards developing a particular product with stages and testing the effectiveness of the product. In this research, a digital module product with an ethnomathematics nuance will be developed with a problem based learning model to improve the problem solving abilities of class V students. After the product is developed, validation and testing of the product's effectiveness in mathematics learning in class V at SD Negeri Pudak Payung 02 is needed.

This research adapts the ADDIE development model which is an instructional development process with 5 stages, namely analysis, design, development, implementation of research and evaluation. According to Product development steps, this research and development model is more rational and more complete than the 4D model. This model can be used for various forms of media development and teaching materials.

The subjects in this research are students, especially in class V at SDN Pudak Payung 02 and experts who will validate the media being developed. The total number of students in class V at SDN Pudak Payung 02 is 33 students consisting of 18 boys and 15 girls. The research subjects were divided into small group trials and field trials with 6 people each in the small group trial and 27 people in the field trial. Sample selection in small groups was randomly selected in coordination with the fifth grade elementary school teacher.

The digital module validity test was obtained based on the results of a questionnaire that was filled in by linguists, media experts and material experts. The data obtained from filling out this questionnaire is in the form of quantitative data which will be calculated as an average of this data using the following formula.

$$\mathbf{v} = \sum S / [\mathbf{n(c-1)}]$$

(Febriandi et al., 2019)

**Table 1 Interpretation of Digital Module Validity**

| Correlation coefficient | Interpretation of Validity |
|---|---|
| $V > 0{,}80$ | High |
| $0{,}60 \le V < 0{,}80$ | High enough |
| $0{,}40 \le V < 0{,}60$ | Enough |
| $0 \le V < 0{,}40$ | Bad |

(Azwar, 2015)

The practicality test was carried out with the aim of testing digital modules with ethnomathematics nuances with a practical problem based learning model to use or not using a questionnaire and calculated using the following formula:

$$P = \frac{\sum x}{\mathrm{n}}$$

Information:
P : Percentage of student responses
$\sum x$ : Total score for each criterion chosen by students
n : Number of ideal scores

**Table 2. Validity and Qualification Level Guidelines**

| Achievement Level | Qualification | Decision |
|---|---|---|
| 81 - 100 | Very good | Very Practical |
| 61 - 80 | Good | Practical |
| 41 - 60 | Enough | Less Practical |
| 21 - 40 | Not enough | Not practical |
| 0 - 20 | Very less | Very Impractical |

## RESULT

This development stage consists of developing a digital module with ethnomathematics nuances with a PBL learning model. The digital module contains Mathematics learning material about fractional number calculation operations for fifth grade elementary school students. The development stage consists of developing a digital module with ethnomathematics nuances with a PBL learning model, validation with language experts, media experts, and material experts. This development aims to produce valid learning media products.

## Material Expert Validity Test

The material validity test was carried out by Mrs. Ike Kurniawati, M.Pd. Validation of this material was carried out with the aim of finding out the suitability of the material in the digital module with ethnomathematics nuances of the PBL model with the material on fractional counting operations. The validation instrument used is divided into 15 with 4 alternative answers. The score obtained in the material validation test was 57. Based on these results, the overall validity interpretation of the material validity test obtained a score of 0.93 with a high classification.

## Language Expert Validity Test

Dr. Agung Nugroho, M.Pd, linguist and lecturer in the Indonesian language and literature study program at PGRI Silampari University, expert in language validation tests. The instrument used in the language validity test is a questionnaire which is divided into 14 questions with 4 alternative answers. This activity is carried out once. The language feasibility test was carried out with the results of the digital media module with ethno-mathematics nuances being developed which could be used without revision. The score obtained from the language validity test is 50 with a high classification.

## Media Expert Validity Test

The third validity test is media validity carried out by Mr. Prof. Dr. Tri Joko Raharjo, M. Pd as a Postgraduate lecturer at Semarang State University. The questionnaire filled out as a media validity test instrument consists of 13 questions with 4 alternative answers. The score obtained from the media validity test is 46 with a high classification. The conclusion from the results of the media validity test is that the digital module with ethnomathematics nuances that was developed can be used without revision.

The assessment of the validity of the ethnomathematics nuanced digital module with the PBL learning model was carried out by 1 media expert, 1 language expert, and 1

material expert. The results of media validity test calculations can be seen in Table 3.

**Table 3. Media Validity Test Calculation Results**

| Expert | Amount Question | The score Obtained | *Aiken V* | Category |
|---|---|---|---|---|
| Materials | 15 | 57 | 0,93 | High |
| Linguist | 14 | 50 | 0,85 | High |
| Media | 13 | 39 | 0,84 | High |
| Average | | | **0,87** | **High** |

## Media Practicality Test

Student response questionnaire scores and teacher response questionnaires are used to analyze the implementation of digital modules with ethnomathematics nuances with the PBL learning model. The media practicality test was divided into two groups, namely small groups and large groups.

The results of the media practicality test in the small group test were obtained from calculation results using the formula $P = \frac{\sum x}{n} x$ 100% so $P = \frac{53}{60} x$ 100% = 88% with very practical qualifications. Apart from small group testing, practicality testing was also applied to field testing which was carried out on 27 class V students at SDN Pudak Payung 02.

The findings of the media practicality test in field trials were obtained from the results of calculations carried out using the formula $P = \frac{\sum x}{n} x$ 100% so that $P = \frac{241}{270} x$ 100% = 0,89 with the qualification of very practical.

## DISCUSSION

Development research produces digital modules with ethnomathematics nuances with a problem-based learning model. The ADDIE development paradigm used in this media development research includes 1) analysis, 2) planning, 3) development, 4) Implementation, 5) Evaluation. This process is completed to obtain a digital module with ethnomathematics nuances that teachers can use in carrying out the learning process. The following sections explain these stages in detail.

## Analysis Stage

The initial stage carried out was to carry out observations at SD Negeri Pudak Payung 02.

These observations were carried out to obtain information regarding the data needed by researchers in the form of activities carried out in the learning process, methods applied in learning and media used during the learning process. From the results of these observations, it was found that students were happier and more enthusiastic about learning with pictorial media, so in this study the researchers developed a digital module with ethnomathematics nuances with a PBL learning model for fifth grade elementary school students.

## Planning Stage

At this planning stage the aim is to create, develop and at this stage it is also carried out by making an initial design for a digital module with ethnomathematics nuances with a PBL learning model for fifth grade elementary school students. The design is adapted to the material to be studied or presented in the learning process. As for the initial design, there is a cover for a digital module with an ethomathematics nuance with a PBL learning model, material on fractional number operations, then the second part explains the steps of the PBL learning model, in the third part there is an understanding of fractional numbers and examples, the fourth part explains the nature of fractional number operations, part The fifth explains the operation of calculating fractional numbers, then for the final part questions are given to determine the knowledge students have gained in the learning process.

## Development Stage

This development stage consists of developing a digital module with ethnomathematics nuances with a PBL learning model. The digital module contains Mathematics learning material about fractional number calculation operations for fifth grade elementary school students. The development stage consists of developing a digital module with ethnomathematics nuances with a PBL learning model, validation with language experts, media

experts, and material experts. This development aims to produce valid learning media products.

## Implementation
Next, at the implementation stage, the media being developed is said to be valid by the three validators. This digital module was tested on class V students at SD Negeri Pudak Payung 02 for the 2023/2024 academic year, consisting of 6 students in small group tests and 27 field trials. And it was tested on the class teacher to get results on the practicality of the media by filling out a teacher response questionnaire.

## Evaluation
The final stage in this development is the Evaluation stage. At the evaluation stage, the product being developed is assessed from the aspects of validity, practicality and effectiveness. The validity aspect can be seen from the validation questionnaire by the three validator experts, namely language experts, material experts and media experts. The practical aspect can be seen from the responses given to the class teacher and students, and the effectiveness aspect can be seen from the pretest and posttest learning results.

## Discussion of Validity Test and Media Practicality Test
The validity of digital modules with ethnomathematics nuances with the PBL learning model to improve problem solving abilities is obtained from calculating questionnaire scores for material experts, language experts and media experts. Material validation is carried out by an expert who understands and is experienced in the material on fraction calculation operations. The score given by the material expert was 0.93 with a high classification (very valid). The digital module which is valid in terms of material illustrates that the digital module with ethnomathematics nuances developed is suitable for application in class V of elementary school and the existing material is suitable for use in learning to improve

problem solving abilities. In line with this, Radeswandri et al., 2021) suggests that teachers can use digital modules as a learning medium to help students learn. The material presented in the media developed is material that is adapted to facts, developments in science, and is presented in an interesting way for students (Aini et al., 2018). The preparation of the material in the digital module is designed by including the context of the material discussion into light conversation between the characters in the digital module being developed.

Validation of the language in the digital module with ethnomathematics nuances with the PBL learning model to improve problem solving abilities, resulting in an average score of 0.84 with a high classification (very valid). Language validation in the digital modules produced is carried out by lecturers who actively teach in the Indonesian language and literature study program. Digital modules with ethnomathematics nuances developed using Indonesian adapted to EYD. (Jannah et al., 2021) stated that the use of Indonesian based on EYD in designing learning media really helps make it easier for readers or the use of the learning media being developed. Media validation carried out on digital modules with ethnomathematics nuances with the PBL learning model to improve problem solving abilities obtained a score of 0.84 with a high classification (very valid). Designing learning media for students, especially elementary school students, should display lots of interesting images so that students are interested and focused in carrying out the learning process. Based on (Mahardika, 2021). research results, images or illustrations should be included in learning media to motivate students and foster students' curiosity about the material being taught.

## Discussion of Potential Effect Tests
The potential effect test of the developed media was obtained from the results of calculating students' classical mastery scores after using digital modules with ethnomathematics nuances with the

developed PBL learning mode. Student completion in conducting research is guided by the Mathematics KKM class V at SDN Pudak Payung 02, namely 70. If a student scores >70, the student is said to be complete. Based on data from media potential effect tests, small group tests on the media being developed obtained a media potential percentage of 83%, while field tests obtained a potential percentage of 88% with each classification being very effective. This provides a conclusion that digital modules with ethnomathematics nuances with a PBL learning model have a high potential effect if used as a medium for implementing learning in the classroom.

**Discussion of Media Effectiveness Test**
The effectiveness of digital modules with ethnomathematics nuances with a PBL learning model has moderate effectiveness for increasing basic numeracy literacy obtained from the results of pretest and posttest data processing carried out in small group tests and field tests. The instruments used are assisted by a digital module which aims to make it easier for students to understand the material on fractional number operations. In line with this, İlhan (2021) stated that digital modules are suitable for motivating students in learning, which makes digital modules seen as a practical and efficient medium for use anytime and anywhere.

Testing the effectiveness of digital modules with ethnomathematics nuances with the PBL learning model was carried out in class V of SDN Pudak Payung 02 with a total of 33 students. The first meeting involved dividing students into two groups which were used as small group test subjects and field tests. Next, distribute pretest questions to find out how far they have mastered the material on fractional counting operations. After students complete the questions given, an explanation of the media will be used at the next meeting. The second meeting provided assistance to students in using digital modules with ethnomathematics nuances with a PBL learning model to

increase their abilities regarding the material on fractional counting operations. A digital module has been developed which contains material on the basic concepts of fractional number calculation operations.

Learning activities are carried out by students independently accompanied by the author. The digital modules developed can also be used in student learning at home by paying attention to the guidelines stated in the digital modules. Learning activities continue until students complete the material in the digital module developed. After students understand the basic concepts of fractional number calculation operations with the help of the questions in the digital module developed, the author gives the same questions in the posttest activity at the end of the lesson. Based on the pretest and posttest results obtained by each group which were determined at the beginning of the learning activity, the author can calculate the data so that the author can conclude whether the digital module being developed can provide changes or not in the implementation of learning.

The average pretest score before using the digital module with ethnomathematics nuances was 41 with a minimum score of 20 and a maximum score of 65. After implementing the digital module with ethnomathematics nuances with the PBL development model in class V of SDN Pudak Payung 02, the average posttest result was 74. with a maximum score of 90 and a minimum score of 60. The data that was obtained through the pretest and posttest for class V SDN Pudak Payung 02. was then tested for normality of the data. The results of the data normality test obtained a score of 0.22, so it can be concluded that the data is normally distributed.

After the normality test was carried out, the data was subjected to a t test with the hope that there would be differences between the pretest and posttest results. The results of the t test show that there are differences in student scores before and after using the digital module with ethnomathematics nuances using the PBL learning model. After

data processing activities using the t test were carried out, the data obtained was calculated using the n-gain test to determine the effectiveness of using digital modules with ethnomathematics nuances with the PBL learning model to improve elementary school students' problem solving abilities.

Based on the n-gain test calculation on the pretest and posttest results of class V students, the average pretest score was 27 and the average posttest score for all students was 74. This data was calculated using the n-gain test formula with a calculation result of 0.55 which if qualitatively classified as medium effectiveness. Based on the results of the n-gain test calculations, it was concluded that digital modules with an ethnomathematics nuance with a PBL learning model can improve the problem solving abilities of elementary school students. In line with this, Kusumadewi (2020) explained that digital modules are better than conventional books so that digital modules are very effective in improving students' abilities.

The digital module with ethnomathematics nuances with the PBL learning model was declared effective for improving problem solving abilities because there was a significant difference in the pretest and posttest results of class V students at SDN Pudak Payung 02. The pretest score for class V students had an average of 41, while the posttest score for class V students SDN Pudak Payung 02 obtained an average of 74. This is in line with research by Kusumadewi (2020) and Chaidam & Poonputta (2022) which states that digital modules and PBL learning models can be effective

## CONCLUSION

The following are conclusions from research into the production of digital modules with ethnomathematics nuances using the PBL learning model to improve elementary school students' problem-solving abilities: Through the ADDIE development model which includes five steps, namely analysis, design, development, implementation and evaluation, it produces a digital module with

ethnomathematics nuances with a PBL learning model which will be used in research to improve the problem solving abilities of fifth grade elementary school students at SDN Pudak Payung 02. The resulting module is software in the form of a flipbook which includes understanding and practice questions for each discussion of the material. Validity and Practicality of digital modules with ethnomathematics nuances with a PBL learning model which were developed based on the results of linguistic feasibility tests, appropriateness of material content, and the feasibility of digital modules with ethnomathematics nuances with PBL learning models obtained an average score of 0.87 based on the results of the validity test of the three components. Highly Certified (Very Valid). Test the practicality of digital modules with ethnomathematics nuances with the PBL learning model obtained from filling out student response questionnaires and teacher responses after using the developed module. Based on the results of the two trials on product practicality, the overall results were 93% of the maximum percentage of 100%, this states that the digital module with an ethnomathematics nuance with the PBL learning model developed has met the practicality requirements with the Very Practical qualification.

The effectiveness of digital modules with ethnomathematics nuances with the PBL learning model which was developed to improve problem solving abilities was declared effective based on the results of the paired t test which showed that there was a difference in the average pretest and posttest data, and the n-gain results obtained an average of 0.55 with medium criteria.

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