Model Development Project Based Learning To Improve Mathematical Reasoning and Motivation

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Abstract. This study aimed to develop a model Project Based Learning in order to improve students' mathematical reasoning and motivation by meeting valid, practical, and effective criteria. The development model in this study used the ADDIE which consists of 5 stages, there are Analysis, Design, Development, Implementation, and Evaluation. The instruments used consisted of (1) validation sheets, (2) practicality questionnaires from teachers and students, (3) mathematical reasoning tests, and (4) motivation questionnaires. The quality of the validity of the guide books fulfilled valid. For the validity of the tests and the questionnaire met the criteria of moderate validation. The practicality quality of the model developed fulfills the practical. The effectiveness criteria can be seen from the increase in the results of tests of reasoning and motivation questionnaires with the percentage of classical completeness \( \geq 75\% \). Data pre-test mathematical reasoning obtained a percentage score of 38.96% increased to 77.12% obtained from the data post-test and the average data score post-test of 77.12 above the KKM (70) with classical completeness reached 87.50% \( \geq 75\% \). The pre-test result of the student motivation obtained a percentage score of 54.78% \( \leq 75\% \) increased to 79.80% \( \geq 75\% \).

1. Introduction
The process of teaching and learning in schools is often heard and found various problems, especially in mathematics where not a few students who see mathematics as a boring, scary, even scary and difficult when compared with other subjects. Solutions to overcome this need more effective teaching methods.

Hidayah Nur & Satrianawati [1] explained that "to carry out the maximum process a teacher needs to design learning that can facilitate student learning styles. But learning activities that take place in schools so far are generally still largely dominated by teachers. According to Sardiman [2] said that "in the activities of managing teaching and learning interactions, teachers must have at least two basic assets, namely the ability to design programs and the skills to communicate the program to students". The lack of teacher initiative to innovate learning models certainly has an impact on student motivation and low mathematical reasoning abilities. Until now the role of the teacher in building motivation and mathematical reasoning abilities of students, especially in learning mathematics is still very limited[3]. Though motivation and mathematical reasoning abilities are very influential on student learning outcomes[4]. According to Lestari & Yudhanegara said that "motivation is a power, encouragement or strength, both coming from oneself or from outside that encourages students to learn". This means that a teacher must be able to provide encouragement to learn by motivating students. Besides motivation, mathematical reasoning ability is also important to be improved. According to Tina Sri Sumartini [5] "mathematical reasoning as an activity or thought process to draw conclusions or make new statements based on previous statements and the truth has been proven". Based on these problems, the researcher is interested in conducting a research development under the title "Development of Models Project Based Learning Through Jigsaw To Increase Mathematical Reasoning and Student Motivation in Junior High School Mathematics Learning".

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Through the learning model \textit{Project Based Learning} students will interact actively and positively in groups. Simply put, Warsono & Hariyanto [6] defines "Project Based Learning as a teaching that tries to link technology with everyday life problems that are familiar with students, or with a project in school". Furthermore described by Annapri Nurfidyanty & Sry Agustina [7] explains that "the results of the project, the students independently to build knowledge, improve the ability to solve problems, develop thinking skills and communication" From the results of the project and produce which can be used as a learning medium.

Using the method \textit{Jigsaw}, students work together with their peers in a mutual cooperation atmosphere and have many opportunities to process information and practice communication skills because in this method \textit{Jigsaw} students are required to understand a material, especially mathematics, then the student must be able to teach it to other students [8]. According to Fathurrohman said that "type cooperative learning \textit{Jigsaw} is a cooperative learning technique that consists of several members in a group who are responsible for mastering the learning material and are able to teach the material to other members in the group"[9].

2. Methods
This study uses a research and development approach or \textit{Research and Development (R&D)}. This type of development is oriented towards producing and testing a product. According to Sugiyono [10] that "research and development methods are research methods used to produce certain products, and test the effectiveness of these products". This development research uses the ADDIE development model which stands for \textit{Analysis, Design, Development or Production, Implementation or Delivery and Evaluations}. The steps described in the ADDIE model are explained by Mulyatiningsih [11] as follows:

1. \textit{Analysis}
   At this stage, the main activity is to analyze the need for the development of learning models \textit{based on project learning} through \textit{jigsaw} and analyze the feasibility and requirements for developing a new model.

2. \textit{Design}
   The results at this stage are in the form of a guide model \textit{project based} learning through \textit{jigsaw}. In addition to the manual, a questionnaire will also be designed to measure student motivation, student and teacher responses to measure the practicality of the instrument as well as tests to measure the level of student mathematical reasoning.

3. \textit{Development}
   Because at the design stage a model has been designed \textit{project based learning} through \textit{jigsaw}, at this stage of development learning tools are prepared using \textit{project based learning} through \textit{jigsaw} including RPP, teaching materials, and LKP. And at this stage the product validation process is also carried out including test instruments and questionnaires. The results of product validation in the form of expert response score data were converted to five scale qualitative data with a formula reference adapted from Sa'adun Akbar (2013: 73), while for instrument validation using Aiken validity adapted from Retnawati [12].

4. Implementation
   Implementation of an activity using the products or models that have been developed in real conditions that class. The subjects in this study were mathematics teachers and class students VIIIC, amounting to 24 people at MTs NW Rumbuk.

5. Evaluation
   At this evaluation stage, researchers make improvements (revisions) of the product if it has not yet reached the practical and effective criteria based on the practicality and effectiveness criteria that have been established. Data about the practicality of the learning model was obtained from the teacher's response questionnaire and student response questionnaire[13]. The results of the teacher's response questionnaire in the form of score data were converted to five scale qualitative data, with a reference formula adapted from Sa'adun Akbar [14] and for the results of student responses analyzed by finding the percentage score and matching it with the formula reference adapted from Sa'adun Akbar [14]. Data regarding the effectiveness of the learning model obtained
from the analysis of the learning outcomes score in testing the level of mathematical reasoning and student motivation. Scores obtained by students were analyzed using a reference formula adapted from Sa’adun Akbar [14]. As for the model, it is said to be effective if the results of tests of mathematical reasoning levels and student motivation are on average ≥ 70 and the percentage of completeness ≥ 75% of students reach KKM (70).

3. RESEARCH RESULTS AND DISCUSSION
The model project based learning through jigsaw compiled in the form of a guidebook has been validated by 3 mathematicians[15]. The results of the validation are then analyzed and the final results are obtained as follows.

| No | Validator                  | Pencapaian nilai | kriteria |
|----|----------------------------|------------------|----------|
| 1  | Validator I (material)     | 55               | Valid    |
| 2  | Validator II (material)    | 52               | Valid    |
| 3  | Validator III (language)   | 44               | Valid    |

Remarks: Eligible to use

The test to test the mathematical reasoning and student motivation questionnaire was validated by 2 mathematicians. The results of the validation are then analyzed and the final results are obtained as follows.

| No | Validator | Average for test | Average for questionnaire |
|----|-----------|------------------|--------------------------|
| 1  | Validator I | 4,2              | 4,2                      |
| 2  | Validator II | 4               | 4                        |

The coefficient is 0,78 0,78
Category: Medium Validity
Description: Eligible to use

The practicality questionnaire was mathematics teacher and gradestudent VIIIIC at NW Rumbuk MTs after using the method project based learning through jigsaw. The results of the teacher's assessment indicate that the application of the method that has been developed is already practical, which can be seen in the following table.

| No | Teacher responses | Student responses |
|----|-------------------|-------------------|
| 1  | Number of respondents | 1               | 24               |
| 2  | Number of questions | 8               | 15               |
| 3  | Total score       | 38               | 322              |
| 4  | Percentage score  | -                | 89,44%           |
| 5  | Criteria          | Practical         | practical        |

Based on the results of the acquisition of scores from the provision of mathematical reasoning tests and motivation questionnaires to 24 students before using the model project based learning through jigsaw (data pre test) and after using the model (post test) indicates an increase in yield and effective models used. This can be seen in the following table.
Table 4. Data Pre Test and Post Test Student Learning Outcomes Class VIIIC

| No | Aspect               | Pre Test Score | Information | Post Test Score | Information |
|----|----------------------|----------------|-------------|----------------|-------------|
| 1  | Average              | 38,96          | ≤ KKM (70)  | 77,12          | ≤ KKM (70)  |
| 2  | Percentage score     | 38,96%         | Not high    | 77,12%         | Not high    |
| 3  | Percentage of classical completeness | 0% | Not Effective (≤ 75%) | 87,50% | Effective (≥ 75%) |

Based on the results of the provision of motivation questionnaires on the data pre-test shows that low motivation is inversely proportional to the data post test which shows students are highly motivated seen from several related motivational indicators.

Table 5. Percentage Score For Each Indicator Motivation

| Indicator                                                                 | Pre test | Post test | Pre test | Post test |
|---------------------------------------------------------------------------|----------|-----------|----------|-----------|
| There is desire or desire to succeed                                       | 55,42%   | 79,79%    | Simply motivated | Motivated |
| There is encouragement and needs in learning                               | 54,16%   | 82,50%    | Simply motivated | Highly motivated |
| The existed of hopes and ideals of the future                             | 57,08%   | 83,75%    | Simply motivated | Sangat Motivasi |
| The existence of rewards in learning                                       | 53,33%   | 76,94%    | Simply motivated | Motivated |
| The existence of interesting activities in learning                       | 55%      | 75%       | Sufficient motivated | Motivated |
| The existence of a conducive learning environment                          | 54,17%   | 78,75%    | Sufficient motivated | Motivated |
| **Combined percentage**                                                   | 54,78%   | 79,80%    | Sufficient motivated | Motivated |

4. Conclusion

From the results of research and development of models project based learning through jigsaw that has been carried out at MTs. NW Rumbuk, obtained data that shows that the model developed has fulfilled valid, practical, and effective criteria so that it can be said that the model project based learning through jigsaw is feasible to use. So it was concluded generally that the model was suitable to be used as teaching material in class VIII of SMP/MTs.

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