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DEVELOPMENT OF MATHEMATICS LEARNING WITH PROBLEM BASED INSTRUCTION MODEL TO INCREASING SELF REGULATED LEARNING

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Abstract

The purpose of this research are to (1) produce a learning device PBI (Problem Based Instruction) mathematical models to enhance the independence of a valid student learning, (2) obtain the effectiveness of mathematics teaching model PBI and (3) determine whether the learning device to improve student learning practical independence. Type of this research is the development of research which refers to a modified model of Plomp. Learning tools developed consists of a syllabus, lesson plan, learning modules, and worksheet. The instrument used for data collection consisted of a sheet of validation, questionnaires student attitudes, student activeness observation sheets and questionnaires independent learning.
Data obtained through expert validation, liveliness student observation sheet, questionnaire independence of student learning and student attitudes questionnaire. The validity of the learning device is determined by the validation team of experts and peers, by five votes validator results obtained with the classification criteria of valid and very good. The effectiveness of learning obtained by observation sheets and questionnaires liveliness student learning independence, the result activeness of students categorized as active and independent learning student questionnaire results from the pretest and posttest gain test results obtained increasing most students experiencing learning independence. While testing the practicality of learning, field test results obtained from observation of the learning process, questionnaire response of the teachers and students to use learning tools all showing good results.

Keywords: *Learning Tool, Problem Based Instruction, Self Regulated Learning*

INTRODUCTION

The use of mathematical model of learning centered teaching activity as a learning resource with the procedure monotonous delivery of material, because students quickly saturated and less interested in following it well. This can cause the response and attitude of students is very low on the subjects taught. The low student response impact on student learning outcomes. In addition, the learning device used by teachers is also not yet clear learning model. To resolve the problem of low student learning independence, as well as the ability to solve problems by using the concepts have been understood, one effort that can be done is through learning model with the purpose of learning, learning materials, and the

condition of the student. One of the steps taken to resolve the problem in this research is to apply the learning of mathematics using the model of Problem Based Instruction (PBI). According Arends (in Trianto, 2009: 92), PBI is one model of learning in which students work on authentic problems with a view to construct their own knowledge, inquiry and to develop higher level thinking skills, develop independence and confidence. Meanwhile, according to Kennedy (2009: 74) in a shared learning process is expected to occur dialogic interaction resulting in a process of transformation concept collectively.

Results of research conducted by Rosita (2013) with the title Efforts Implementation Method Problem Based Instruction (PBI) to Improve Student Results showed that increased student learning outcomes using PBI. If the method is developed in a sustainable PBI, student learning outcomes that describe the ability to "intellegent memory" will continue to increase, resulting in the learning process the teacher is no longer on the student learning that is both ordinary memory but the teacher should develop the learning process "intellegent memory".

The problem of this research is how the development and results of the development of mathematical learning PBI uses a model to improve student learning independence is valid, whether the learning of mathematics were developed using models of effective regulation, and whether the learning of mathematics were developed using models PBI practical.

METHODOLOGY

Type and Procedures Research,This research is the development of the device. Learning tools developed in the form of a syllabus, SAP, learning modules, and a worksheet. It also developed research instruments in the form of sheets of the syllabus validation, SAP, learning modules, and worksheets, questionnaires independence of student learning, student attitude questionnaires and observations of process skills.

Development Learning Tool, development of the device with the model PBI mathematics to improve student learning independence refers to the general education development model of Plomp (in Rochmad 2009) modified from five stages into four stages, namely a preliminary investigation stage; the design stage; the realization phase/ construction; and the stage of the test, evaluation, and revision.: a**). The early stage of the investigation,**Its activity is to collect information History of mathematics learning problems and formulate rational thinking importance of developing learning models, identify and examine the theories that underpin the development of learning models. b**). The design phase, l**earning device to be designed include the syllabus; SAP; learning modules; and a worksheet. They will also be designed validation sheet, sheet questionnaire independent learning, student attitudes towards learning questionnaire and observation sheet process skills.c). **Realization Phase / Construction, i**ts activity is to create a syllabus; SAP; learning modules; and Worksheet. Learning tools that had been developed at this stage is called the first draft. d). **Phase Test, Evaluation and Revision,** at this stage, two main activities, namely (a) the activities of validation in the form of a draft validation activities 1, analysis of the results of validation, and revision; (B) draft field trial activities learning tools that have been validated. Chronology of the development of learning tools, and instruments in this study as illustrated in Figure 2.1 below.

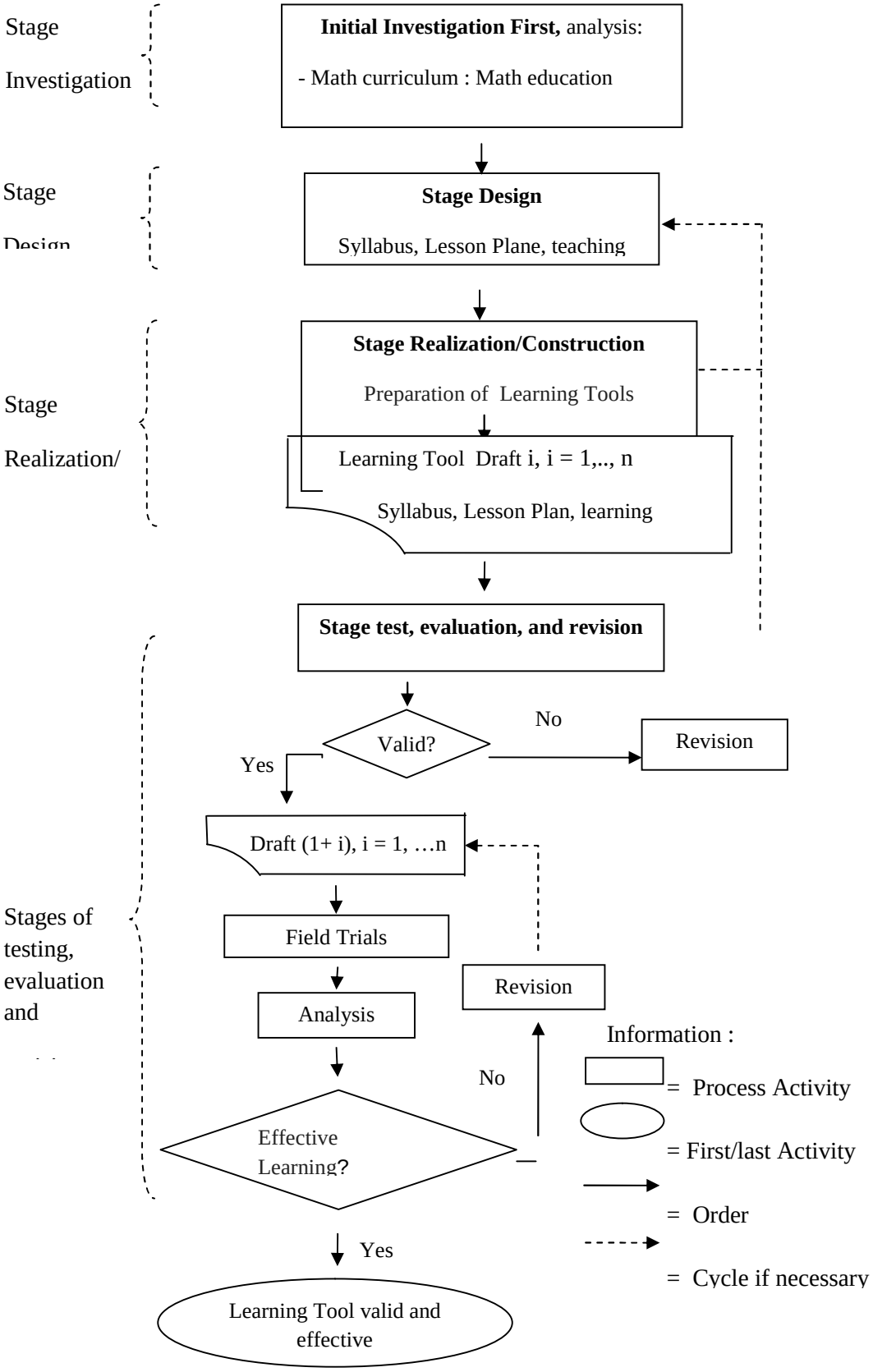

Figure 2.1. Scheme groove mathematics learning software development

Mechanical and Instrument Validation Data Collectors, The research instrument used to collect the data consists of a questionnaire Independence of Student Learning, observation sheet process skills of students, student attitudes toward mathematics questionnaire, and the validation sheet.

. **Data analysis technique. d**ata have been collected then analyzed to answer the problem formulation or the research hypothesis. Data obtained from the validator and the results of trials.; **a). Validation Results Data Analysis Expert,** data obtained from the validation result is analyzed descriptively to revise the learning device. To analyze the results of validation using analysis of average, which calculates the average of every aspect that comes from five people validator. The scale values for every aspect of 1 to 4, with the criteria as listed in Table 2.1

Table 2.1 Assessment Criteria Validator

Average Values	Clasification	Conclusion
0,00 < Va ≤ 2,00	Not Good	The device still requires intensive consultation
2,00< Va≤ 3,00	Deficien Good	The device can be used with many revisions
3,00 < Va≤ 3,50	God	The device can be used with little revision
3,50 <Va≤ 4,00	Very Good	The device can be used without revision

b). **Data Analysis Results of Trial** whiich is : 1). Analysis Instruments questionnaire Student Learning Independence, Questionnaires independent learning in this study was a questionnaire given to the material solve the problem of school mathematics selekta capita basis. The questions tailored to the indicators used to measure how much students learn independence of trials conducted in first-class testing instruments are useful to determine the validity and reliability. 2). Learning Effectiveness Analysis,test Mastery of Learning Outcomes. Test mastery learning outcomes are used to determine the ability of student achievement in school mathematics material selekta capita basis. To view the complete absence of the classical results of student learning as one of the criteria for the effectiveness of learning, the hypothesis will be tested with a test average of one party.

The formula used statistical tests: $t = \frac{\overline{x} - \mu_0}{\frac{s}{\sqrt{n}}}$ (Sudjana, 2005: 227)

As for seeing the individual mastery test will be conducted proportion of one party by using the formula: $z = \frac{\frac{x}{n} - \pi_o}{\sqrt{\frac{\pi_o(1-\pi_o)}{n}}}$ (Sudjana, 2005 : 233)

Test Gain Independence of Student Learning Based on pretest and posttest.To determine the increase in class Independence of Student Learning test based on the value pretest and posttest calculated by the formula *Normalitas Gain* (g) (Hake, 1998):

$$(g) = \frac{\text{pest} \quad \text{valu} - \text{pret} \quad \text{valu}}{\text{maksi} \quad \text{valu} - \text{mini} \quad \text{valu}} \times 100\ \%$$

Tabel 2.2 Criteria Acquisition *Normalitas Gain* (g)

Normalitas Gain (g)	Criteria
$(g) < 0,3$	Low
$0,3 \leq (g) \leq 0,7$	Moderate
$(g) \geq 0,7$	High

with measurable achievement indicators

RESULTS AND DISCUSSION

In this section will describe the results at every stage of the development of mathematical models of learning, especially in materials capita PBI selekta elementary school mathematics. Model development of learning tools used are referring to the general education development model proposed by Plomp (dalam Rochmad, 2009:55). Stages of development used in this study is (1) Preliminary Investigation; (2) Design; (3) Realization/ Construction; and (4) Test, Evaluation, and Revision.

The criteria used in assessing the learning device that has been generated based on the criteria Nieveen (1999). Such criteria assessing the quality of learning tools based on three aspects, namely: validity, practicality, and effectiveness. Learning tools developed in this study fulfills the validity of the content for content in accordance with the principles and characteristics of the learning model PBI. The results of the overall assessment by the validator to the learning tools developed are presented in Table 3.1

Tabel 3.1 Recapitulation Validation Results Learning Tool

		Validator						
No.	Tools	I	II	III	IV	V	Average	Clasification
1.	Silabus	3,70	3,60	3,80	3,70	3,20	3,60	Very Good
2.	SAP	3,56	3,42	3,50	3,50	3,25	3,45	Good
3.	Modul Pemb.	3,64	3,13	3,57	3,29	3,07	3,34	Good
4.	Worksheet	3,75	3,18	3,75	3,67	4,00	3,67	Very Good

Table 3.1 Based on the results of expert validation of the learning device indicates that the device developed averaged at intervals of 3.0 to 3.8 with good and excellent classification in accordance with the criteria established in chapter 3. It can be concluded that the value of construct validity learning tools in school mathematics material selekta capita basis in accordance with the model PBI meet the criteria valid.

Questionnaire independence of student learning, based on the indicators contained in the lattice - lattice instruments are six indicators of independence of student learning, namely: (1) independence against other people, (2) have the confidence, (3) behaves discipline, (4) have a sense of responsibility, (5) act on its own initiative, (6) exercise self-control.

Effectiveness,Instruments used in testing the effectiveness of the learning device is, (1) the activity of student observation sheet and (2) test learning independence. The observation of the activity of students and student learning independence test results were analyzed and used to

determine the effectiveness of the learning tools developed. Based on the analysis results showed that the activity of students, including the active category.

Practicality learning device that was developed based on the enforceability of the device in the classroom. Value practicality learning device obtained based on the field test. Obtained from field trials on observation of the learning process, the questionnaire responses of the teacher learning device, and the questionnaire responses of students to the learning device after participating in learning.

The ability of teachers to manage learning, based on observations obtained an average total score of 26.88 out of a total score of 36, meaning learning has been implemented well, relatively positive student response, student response is measured is the feeling of students to teaching component, student opinion against a component teaching, student interest, student comments on the readability and student comments to the media, more than 50% of the students gave positive feedback.

After the pre-test and post test and obtain the data, the researchers carried out tests to determine the gain increased levels of student learning independence obtained. As for the comparison of test results the gain can be seen in Table 3.3.

$$(g) = \frac{post\ \ valu - pret\ \ valu}{maksi\ \ valu - mini\ \ valu} \times 100\ \%$$

Tabel 3.2 : Test Results Student Learning Gain Independence

Index Gain	Interpretation	Frequency	Presentation (%)
≥ 0,7	High(H)	7	18,92
0,3 – 0,7	Medium (M)	18	48,65
< 0,3	Low (L)	12	32,43
Amount		37	100%

From table 3.2 above, it is known from all the students who totaled 37 people there are 25 students (67.6%) experienced an increase (gain) with the interpretation of "High". A total of 7 students (18.9%) experienced an increase (gain) with the interpretation of "Medium", the remaining 5 students (13.5%) experienced an increase (gain) with the interpretation of "Low". The gain of the test shows that most college students have increased student learning independence.

Tabel 3.3: Gain Test Results per Aspects of Student Learning Independence

Aspect	Pre test Score	Post test Score	Index Gain	Interpretation
Independency (I)	14	25	0,7	High (H)
Self management (SM)	14	28	0,53	Medium (M)
Disire for Learning (DFL)	10	15	0,3	Low (L)
Problem Solving (PS)	5	10	0,5	Medium (S)

The results of this study prove that the implementation of PBI learning model can improve student learning independence in the course Capita Selecta Mathematics Elementary School, as evidenced by an increase in student learning independence. However, there are aspects of

independence that need to be improved include aspects of self-management, awareness of learning and problem solving skills. Self-learning does not mean learning alone, independent study can be done together in study groups or with the lecturer. Self-learning is learning on their own initiative in identifying learning needs, formulating learning goals, identifying learning resources, select and define learning strategies, and evaluating learning outcomes.

CONCLUSIONS AND RECOMMENDATIONS

In general it can be concluded that the mathematics learning tools developed by the model of problem-based instruction (PBI) is valid, practical, and effectively improve student learning independence.
Suggestions in this study were (1) the learning of mathematics with a model PBI should be applied to other materials so that the application of learning is becoming more widespread, (2) need to be developed further variation of learning by using a model PBI (3) in the application of learning to use the model PBI need supervision to students, so that learning can be run effectively and efficiently.

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