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Constructtivism Mathematics Learning with Search, Solve, Create, and Share (SSCS) Model to Improve Mathematics Disposition and Student Concept Understanding of Limit Function Materials of XI Natural Science Class

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Abstract

The objectiveof this study is to determine the implementation of constructivism learning through*search, solve, create, and share*to improve concept comprehension ability in limit function of XI graderswhich is effective with a valid and practical instrument and refers to the modified Plomp model. The concept comprehension ability testdatawere processed by using t-test, proportion z, sample t-test, regression, and Gain test. The results of learning instrument development are as follows: (1) The averageof syllabus is 4.38, Lesson Plan 4.42, book 3,98, Students' Worksheet 4.35, and concept comprehension ability test4,00; (2) this learning is effective, it is marked by achieving: a) the concept comprehension ability of experiment class fulfillsthe Minimum Mastery Criteria, b) the disposition and activeness respectively have a positive effect on KPK, c) KPK experimental class with an average of 81.24 better than control class is 71.18, d) Increasing the experiment test class by 59%. Based on the validation results, it is obtained by a valid instrument and test results, it is obtained effective learning, then the objective of the development of the instrument is achieved.

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INTRODUCTION

Education is a very important factor and cannot be separated from one's life, whether they are in family, society, and nation. The progress of a nation is determined by the success level of education. The success of education will be achieved a nation does an effort to improve the quality of education of the nation itself. Education is a conscious effort to grow the potential of human resources. Education can be interpreted as a process with certain methods so that students gain knowledge, understanding, and ways of behave according to need.

Mathematics as a basic science that is learned in every level of education has a function as a tool, mindset, and science. Mathematics is a creativity that requires imagination, intuition, and discovery. The implications of this view on mathematics learning are encouraging initiative and giving different thinking opportunities, encouraging curiosity, asking questions, argumentability and predictability, rewarding unexpected findings as useful things, encouraging students to discover mathematical structure and design, encouraging students to appreciate the others' findings, and encourage students to think reflexively.

In the learning process, there is a cognitive component in each affective goal, conversely , there is an affective component on each cognitive goal. The affective aspects can affect the cognitive aspect, making it impossible to separate the cognitive domain with the affective domain in a lesson. With the enactment of School-Based Curriculum, it has encouraged teachers to integrate affective and cognitive componets in the learning. Affective component in this study is seen from the students' mathematical disposition (Depdiknas, 2006).

Everyone who studies mathematics will have mathematical skills. Mathematical proficiency can be owned by someone who has learned it, the skill consists of five components: 1) Conceptual Understanding; 2) Procedural Fluency; 3) Strategic Competence; 4) Adaptive Reasoning; and 5) Productive Disposition (Kilpatrick, et.al, 2001: 116).

Indicators of mathematics learning skill include; (1) recognize, (2) understand, and (3) apply the concepts, procedures, principles, and mathematical ideas (Sumarmo, 2007: 689). The conceptual understanding is a key aspect of learning. One of the important teaching objectives is to help students understand the main concepts in a subject, not just in terms of discrete facts. Understanding concepts will develop when teachers can explore topics in depth and provide them with an appropriate and interesting example of a concept.

Understanding of a concept is very important because if students master the concept of prerequisite materials then the students will be easy to understand the concept of the next material. In addition, according to Bell (1981: 117), students who master the concept can identify and work on new questions that are more varied. Therefore, teachers need to design lessons that can improve students' conceptual understanding of a material. Based on the writer's experience when she teaches in the high school and discussion with several mathematics teachers in high school in the preliminary study, it is known that there are various diversity problems that occur during the learning process of mathematics faced by the students. One of them is Productive Disposition, which is a component of mathematics skills. Productive attitude is the growth of positive attitudes and habits to see mathematics as something logical, useful and beneficial. Students' disposition towards mathematics at school has not seen in the lesson, therefore, it is necessary to change the learning model because disposition is one of the main factors that determine student's success in learning mathematics. Disposition is also formed if the other components have developed well before (Kilpatrick, et.al, 2001: 131).

One of the processes of building one's own understanding is in the Search, Solve, Create, and Share (SSCS) models. This model was first developed by Pizzini in 1988 on science subjects, then Shepardson refined this model in 1990 and said that this model is not only applied to science education, but also suitable for mathematics education. In 2000, the Regional Education Laboratories of an agency in the United States Department of Education issued a report, that the SSCS model was one of the learning models that obtained a Grant to be developed and used in mathematics and science (Pizzini, et. al, 1990).

This SSCS learning model has the characteristic that the learning process includes four phases, they are, first, search phase which aims to identify problems, the second, solve phase which aims to plan problem solving, the third, create phase that aims to carry out problem solving, and the fourth is the share phase that aims to socialize the problem solving done. Based on these SSCS phases, it is expected to assist students in understanding the initial concept of knowledge both in groups and individuals. In order to support the learning, it is necessary to develop the constructivism learning instrument of SSCS model.

METHOD

This research was development research, that is instrument development of instrument of constructivism mathematicslearningof SSCS model to improve the ability of comprehension concept in limit function material of XI graders. The developed learning instruments included: (1) syllabus, (2) Lesson Plan, (3) teaching materials, (4) Students Worksheet, and (5) concept comprehension skills test on limit function material of XI graders. In this study, the researcher divided into several stages, which include preparation stages, implementation stages, and data analysis stages.

The subjects used in this study were students of class of XI Natural Science 1 Kendal in State Senior High School 1 Kendal, which consisted of 5 classes. The consideration of taking 3 classes as the trial subject of the research was conducted by random or sample random sampling (Sugiyono 2010: 93).

The independent variable in this study was the mathematical disposition and activeness of students. The measurement is based on a questionnaire given in the learning process and recorded in a questionnaire. The dependent variable in this study was the ability to understand students' concepts. This dependent variable will be revealed by the learning result instrument according to the cognitive domain, measured by the cognitive tests whose data were extracted from the essay test.

The development model invented by Plomp, it consisted of five stages: the initial investigative stage; the design stage; realization/construction stage; test, evaluation and revision stages; and implementation stage. The implementation stage was not conducted explicitly but it is integrated in the implementation of research, it is when conducting field trials of learning tools in the scope of the research subject. The implementation in a wider scope did not conduct in this study, because of the limitations of the situation and the conditions of the research implementation.

The developed research instruments in this study were (1) the validation sheet of the instrument, (2) concept comprehension test sheet, (3) the mathematical disposition questionnaire, (4) the student response questionnaire, and (5) the teacher response sheet towards the learning instrument.

The data analysis in quantitative research consisted of two analysis, they are analysis of prerequisite tests and analysis of research data. The prerequisite test analysis included normality test, homogeneity test, and completeness test.

Analysis of research data includes one-tail test, average comparative test, effect test, and ability improvement test.

RESULT AND DISCUSSION

Instrument Validation Results and Field Trial

The results of the expert validation can be seen in Table 1. The revised learning instrument is in accordance with the validator's advice, then they are tested to obtain inputs to refine the learning instrument. The field trial isconducted in the last week of April and 1st to 4th week in May which consisted of 4 meetings and 1 meeting for the final test ofconcept comprehension abilityin the experiment class and control class. It is chosenone class as control class and one class as trial instrumentclass (experiment class). Meanwhile, for the instrument trial is the concept comprehension ability test questions. Before the instrument trial, normality and homogeneity analysis isconducted for the instrument trial class and control class. During the trial process, it is conducted data collection that includes activeness observation data and students' disposition questionnaire data. Then at the end of the trial process, concept comprehension test is conducted to measure the ability to understand concepts in the experiment and control class.

Practical Test Results of Learning Instruments

Learning devices are said to be practical if after it has tested in the experiment class, it obtains the results: (1) the teacher's ability to manage learning well, (2) the response of students is positive, and the teacher responds well. The results of observing the teacher's ability to manage mathematics learning it is obtained an average total score of 4.24, it means that learning is conducted well. Based on the results of filling out the student response questionnaire, then it obtained the percentage of 92.96% of students who give a positive response, in other words, the students gave a positive response more than 75% and the average results of the teacher response questionnaire on the learning device are 4.67.

Students activeness Observations Result

Based on the process of data analysis of the students' learning after using constructivism mathematics learning with model search, solve, create, and share, the results are shown as follows.

1. Indicator for activeness in home preparation is 4.04;
2. The indicator for participation in starting learning is 4.64;
3. The indicator for activeness in the learning process is 4.30;
4. Indicator for activeness inclosing the learning process is 4.52.

Thus, it can be concluded that the activeness of students is good. This activity appears after doing the learning process by using the learning.

Students' Disposition Questionnaire Result

Based on data analysis process of learning disposition towardsstudents after using constructivism mathematics learning with model search, solve, create, and share, the result, it is obtained the percentage of students' learning disposition.

Learning Effectiveness Test Results

Data of research result is used to know the success level of the use of the instrument development result. The level of effectiveness is measured by four statistical tests, they are (1) learning completeness test; (2) effect test; (3) difference test; and (4) improvement test. The results of the four tests can be seen in the following explanation.

Mastery Test Results of the Class Average

By using the statistical test formula: , (Sudjana, 2002: 227) with: the

$$t = \frac{\overline{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$

mean value of students' mathematical creative thinking ability, μ_0 : the hypothesized mean value (Minimum Mastery Criteria): standard deviation of the sample: the number of samples. By using a significant level of 5% and df= (34 - 1) = 33 then, it is obtained t_{table} = 1.69, means $t_{count} \geq t_{table}$, then H1 is accepted, it means that the students' concept comprehension meets the Minimum Mastery Criteriathat has been determined that is 75. So, the students' concept comprehension in the experiment class reaches the class average mastery criteria.

Classical Completeness Test Results

The formula used to calculate classical completeness is as follows z = (Sudjana, 2002 : 233).

$$\frac{\frac{x}{n} - \pi_o}{\sqrt{\frac{\pi_o(1-\pi_o)}{n}}}$$

Information: $\frac{x}{n}$ = sample proportiom, z: the calculated statistical value, π_o : proportion that is hypothesized (80%). Next, the results are compared with the value of z_{table} with the test criteria of 5%. If $z_{count} > z\ (0.5\text{-}\alpha)$ then H0 is rejected as a result H1 is accepted, it means classical completeness exceeds 80%. The results obtained from the calculation after the experiment are as follows.

The number of students who complete learning with completeness 75 is (x) = 29, the number of students = 34, and the proportion score that is hypothesized (π_o) = 80% = 0.80, then, z = 1.81. By using a significant level of 5%, it is obtained z_{table} = 1.64, it means that $z_{count} > z_{table}$ then Ho is rejected, it means that the proportion of students who get a score of ≥ 75 has exceeded 80%.

Results of the difference test of concept comprehension

Based on the formula: $F = \frac{thehighestvariance}{thelowestvariance}$, it is obtained:

$$F = \frac{108.7124}{69.4923} = 1.564$$

At α = 5%, with df numerator = nb - 1 = 34 - 1 = 33 and df denominator = nk - 1 = 34 - 1 = 33 then F (0.025) (33: 33) = 2.00. The test criterion is H0 accepted if $F_{count} \leq F_{table}$ and s = 9.44

hence,

$$t = \frac{\overline{x_1} - \overline{x_2}}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$t = 4{,}397$

Based on α = 5% and df = (n1 + n2 - 2) = 34 + 34 - 2 = 66, the value of t_{table} = 1.67, it is obtained because t_{count}> t table, then Ho is rejected. This means that the value of the students' concept comprehension in the trial class is better than the control class.

According to the results, it also obtained the concept comprehension score of the instrument trial class is 81.24 and the concept comprehension of control class is 71.18. So the score of concept comprehension students in the trial class is higher than the control class.

The test results of the influence of the disposition and activeness of students towards the concept comprehension

Based on the disposition and activeness data, it is obtained the value of R Square = 0.590, which means that the two variables of student disposition and activeness have a joint effect on the concept comprehension variable of 59%, and the remaining 41% are influenced by other factors. The significance for activeness variables is 0.001 = 0.1% <5%, while for the disposition variable, the significance is 0,000 = 0% <5%. This means that each variable both activeness and disposition influence the concept comprehension.

Results of concept comprehension improvement test of the students based on the scores of initial test and final tests

The formula used to the Normality test of Gain <g> is as follows.

$$\langle g \rangle = \frac{initialscore - finalscore}{100 - finalscore} \times 100\ \%$$

Based on the results of the calculation, the results of the improvement in the concept comprehension are obtained from the students in the trial class with a low improvement level of 11.76%, medium of 64.71%, and a high level of 23.53%.

CONCLUSION

The learning instrument of mathematics constructivism with the search, solve, create, and share model on the limit function material of the XI graders SMA that is developed in this research has been declared valid after obtaining validation from expert team and peers. The instrument also practically can improve the concept comprehension ability based on the average ability of the teacher to manage learning by 4.67, students give a positive response of 92.96%, and the teacher responds with an average of 4.27. The results of the analysis on the effectiveness of the learning have achieved effective indicators, they are: mathematical creative thinking abilities of experiment class achieve completeness by exceeding 75 as Minimum Mastery Criteria and the proportion of 80%; (2) the ability to understand the concept of the experimental class is better than the control class; (3) the activeness and disposition of students in experiment class positively influence their conceptual understanding ability; and (4) there is an increase in the ability to understand the concept of students in experiment class significantly, which is 59%.

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