ATLANTIS PRESS
Advances in Social Science, Education and Humanities Research, volume 253
3rd Asian Education Symposium (AES 2018)

The Practicality of the Mathematics Learning Model Constructivism-based Think Create Apply

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***Abstract*—This study is aimed to develop a model of Constructivism-based Think Create Apply (TCA) that meets the practical aspects. This development product is a model of Constructivism-based TCA, Teacher's Work Guide book and Student Learning Guide book for optimized mathematics learning that emerges the principles of mathematics learning. This development is carried out with the hope that practical learning models are expected to improve students' creativity and productivity and can solve mathematical problems. This research uses a Plomp model which consists of three phases: preliminary research, prototype phase, and assessment phase. In the preliminary research phase, need analysis, student analysis, curriculum analysis, concept analysis, and book analysis have been done. In the prototype phase, mathematics book design based on constructivism was carried out in mathematical material, then formative evaluation was carried out to determine the practicality of the book. The assessment phase is assessed by a practicality test. Utilization of Teacher's Work Guide book is categorized as very practical. Then for the utilization of Student Learning Guide book is categorized as very practical. This constructivism-based TCA Learning Model is very effective in the classroom. This can be seen from the increasing student learning activities.**

Keywords—practicality; plomp model; constructivism-based Think Create Apply (TCA)

I. INTRODUCTION

The change of paradigm in mathematics education emphasizes learning mathematics in situations that are realistic and contextual, able to construct solutions, and the interaction between students as well as the interaction between students and educators. This change has a lot in common with the paradigm of the Realistic Mathematics Education (RME) theory that developed in the Netherlands [1] and the theory of Contextual Teaching and Learning (CTL) that developed in the United States of America. The foundation of thinking (philosophy) of contextual learning is the Theory of Constructivism. This theory also becomes the basis for thinking from the constructivism approach. Mathematics learning outcomes of students are influenced by various factors, both internal and external factors. There are three main factors that influence learning outcomes, namely: cognitive ability, achievement motivation and quality of learning. The quality of learning involves the quality of the learning process carried out, in this case concerning the learning model used. In order to address this situation, in the process of learning mathematics needs to apply learning models. In fact, based on field observations conducted in several Islamic schools through questionnaires and interviews with several teachers. They have difficulty choosing the right learning model and approach in teaching mathematics. This study also revealed that the learning patterns carried out by most of the teachers in Jambi and Muaro Jambi districts were still conventional. Conventional mathematics learning used by teachers is only inclined to solving mathematical problems rather than understanding a concept [2]. Conventional learning patterns often provide unsatisfactory learning conditions and results, because they do not provide sufficient space for students to learn, especially to make passive students not creative; they only hearing explanations from the teacher. It does not provide adequate space and time for students to be able to construct their own knowledge, because teachers prefer to pursue curriculum goals and teach mathematics by using formulas to get fast results, give examples of problems, then do the exercises, if the questions given are not the same as the example then students cannot work on questions. From some of the descriptions above the writer can conclude that the number of students who are unable to solve the problem due to the learning process that is less meaningful so that the students' ability to solve problems is low. Thus, the task of the teacher is not just teaching knowledge to students, but helping students to learn. The teacher is also expected to enable students to master concepts and solve problems by thinking critically, logically, systematically, and structured. Mathematics teacher has the task of trying to enable students to solve problems because one of the focuses of mathematics learning is problem solving, so that the basic competencies that must be possessed by each student is a minimum standard of knowledge, skills, attitudes and values that are reflected in mathematics learning of with the habit of thinking and acting solving problems by constructing students' own knowledge from more meaningful learning outcomes [3]. Vygotsky's theory emphasizes the sociocultural nature learning. Vygotsky said that child development cannot be separated from social and cultural activities [4]. Social interaction, namely the interaction of the individual with other people, is an important factor to encourage or trigger a person's cognitive development. Interaction with other people provides stimulation and assistance for the child to develop [5]. The mental processes carried out or experienced by a child in their interactions with others are internalized by the child. Furthermore, Vygotsky

argues that the learning process will occur efficiently and effectively if the child learns cooperatively with other children in an atmosphere that is supportive, through mentoring or mentoring someone who is more capable or more mature, for example, a teacher. Based on some of the problems that have been mentioned above, therefore it is necessary to make a learning model that is the development of mathematical learning models TCA based on Constructivism or simpler according to the needs of students. This model was created to refine previous learning models such as Think Pair Share and Think Talk Write described earlier. After this learning model was validated by several experts in mathematics and mathematics education, the result was "TCA learning model based on constructivism with a very valid category". After that, the author worked with teachers in two schools.

II. METHOD

The type of research is design research, and also called research and development. A simpler definition of research and development is a research method used to produce certain products, and test the effectiveness of these products [6]. The product produced in this study is a valid, practical and effective Create Apply Constructivism Mathematics Learning Model.

Development of Mathematics Learning Model TCA Constructivism uses the Plomp development design which has three stages or phases: (1) Preliminary; (2) Prototype Phase (Development or Prototyping Phase); (3) Assessment [7].

A. Development Procedure

1) Preliminary research: Phase the preliminary research phase aims to analyze the main problems that underlie the importance of constructivist-based TCA learning models. In addition, it also aims to prepare a conceptual framework that is used as a reference for conducting further studies. This stage is divided into 3 parts, namely (a) needs and context analysis (need and context analysis) and (b) literature review (review of literature); and (c) the development of a conceptual framework and further study work (development of the conceptual and theoretical framework for the study).

- Context Analysis of needs and context in this study is based on rationality the need for TCA learning models based on constructivism, analyzing the objectives and contents of mathematics subjects and analyzing student characteristics. The steps taken for the three stages are as follows: 1) Preliminary investigation of the need for learning model's constructivism-based TCA. This step is done to determine the problems in mathematics learning, resulting in less effective student learning outcomes in terms of cognitive, affective and psychomotor aspects. To obtain this data, observations and interviews with teachers and student. 2) Analyzing the Objectives and Content of Mathematical Subjects This step is done to find out the purpose and content of the mathematics subjects you want to achieve. The results of this analysis are described in the form of Learning Implementation Plans and teacher work guidelines and Student Learning Guidelines consisting of Group Worksheets and Individual Worksheets. 3) Analyzing Student Characteristics Students who will be analyzed are the X and XI students in the odd semester academic year. Characteristics of these students include the origin of school and the value of academic year before Semester Examination
- Literature review. Review Literature is done by analyzing theories and concepts related to the development of a constructivism-based TCA learning model. The theory and concept are selected, analyzed and reviewed according to research needs.
- Development of conceptual framework and theory. Framework The conceptual framework and theoretical framework are obtained from the analysis of the needs and context of the problem and a literature review. This conceptual framework and theoretical framework will be used to develop constructivist-based TCA learning models.

2) Prototype stage: This stage aims to produce a valid prototype. This stage consists of three steps of activities, namely (a) designing prototypes, (b) doing formative evaluations and (c) prototype revisions.

a) Designing prototypes: At this stage, the activities carried out are designing a component of constructivism-based TCA learning models, which include (a) designing syntax of TCA learning models based on constructivism (b) designing social systems or learning environments, namely situations or rules that apply in the TCA learning model based on constructivism, (c) Designing the principles of reaction, which is a picture for the teacher about how to respond to and respond to the behaviors shown by students in learning, (d) design support systems namely devices that support implementation learning process and the achievement of learning goals well. The results of the design were made in the form of a rational book model, Teacher Work Guidebook, and Student Competency Handbook, (e) designing instructional and accompanying impacts in learning.

*b) Conduct formative:*Evaluation Formative that is carried out to determine the quality of the development results of the TCA based learning model is based on constructivism, expert review, focus group and field trials (field test). The experts who acted as validators were mathematicians, mathematics education, education experts and language experts and mathematics teachers as practitioners. c. Prototype revision the revision of the prototype design is carried out based on expert input or suggestions. The practitioner must make sure that the prototype is categorized as valid so it is suitable for use. If the expert/practitioner recommends that the prototype is not feasible to use or needs to be revised it will be revised and the formative evaluation phase will be repeated. If the assessment of experts/practitioners has stated that the prototype is valid, the research continues to the assessment phase (assessment phase) [7].

c) Assessment stage: The purpose of this stage is to make a more in-depth assessment of the revised prototype. The assessment carried out is a summative evaluation, namely by conducting a practicality test and effectiveness test.

Activities at this stage are focused on field trials which aim to find out whether the learning model developed is active and effective. The test carried out was limited field testing (limited field test) [7].

III. Result and Discussion

A. *The Practicality of Learning Model "Constructivism based Think Create Apply (TCA)"*

There are three aspects of assessment in the practicality test of this learning model, namely: (a) observing the learning process of the Constructor-based TCA model; (b) assessment of the practicality of Teacher's Work Guide book by practitioners or teachers, and (c) the practicality of PBS books according to students. From the practicality of learning with this TCA model, it can be seen that these three aspects show value in the practical and very practical categories. The quality of the learning model that has been selected, determined, and developed has been fulfilled. Each practical aspect of the constructional-based TCA learning model will be discussed as follows.

1) Observation of mathematics learning process in constructivism-based TCA learning models: The results and data analysis of research on the learning process illustrate that the syntax, social system and the reaction principle of Constructivism-based TCA learning model are well implemented. In this study found that learning phases were observed to obtain practical and very practical results. From the findings, it can be seen that the learning process at two trial sites, namely: 1) Islamic School 1 Jambi, 2) Islamic School 2 Jambi city with constructivism-based TCA learning model starts from the orientation, thinking, creating and applying stages all material and activities based on constructivism theory, last reflection, and evaluation. The teacher as a practitioner in mathematics for Islamic School 1 Jambi has 1-year teaching experience and math teacher Islamic School 1 Jambi has almost 10 years of teaching experience. Before the trial was carried out, it was first provided an explanation of this constructivism-based TCA learning model for practitioners and observers. The research product was also given to practitioners two weeks before the trial was carried out so that if things were in doubt, it could be discussed well before the trial was carried out. The learning process is carried out as many as 7 meetings in each class. The aspect of observation assessment refers to the teacher's ability to manage to learn. The management of learning done by the teacher will be seen when applying the syntax, implementing the principle of reaction and the social system. Observations were carried out by two teachers, Miss. EY, who has also been explained the TCA model and aspects that are assessed in the observation sheet of the learning process. Reflection was carried out at the meeting with teachers and observers, to find out what things needed to be improved in each phase of learning, so that the process of implementing Constructivism-based TCA improved.

The following is elaborated on the results of Constructivism-based TCA implementation observations in each trial class.

Based on the results of observations and analysis of Constructivism-based TCA implementation in the trial / experimental class I, conducted 7 (seven) meetings. This Learning Model has a proper syntax to be used in the learning process with the total mean of the implementation of the learning model syntax for each sample class, namely Islamic School 1 Jambi 85.2% with a very practical category, Islamic School 2 Jambi 84.9% with very practical. Likewise, for the social system in the constructivism-based TCA learning model, it is found that the social system in the learning model is well implemented so that it is suitable for use in the learning process. Everything can be proven by the research findings for each experimental class, namely in Islamic School 1 Jambi 82.8% with a very practical category, and Islamic School 2 Jambi 80% with a very practical category. Whereas for the reaction principle the learning model is well implemented in the learning process with a very practical category for each experimental class, namely Islamic School 1 Jambi 83.4% with a very practical category, Islamic School 2 Jambi 81.2% with a very practical category. Seen from these findings is very good. To implement the reaction principle of constructivism-based TCA learning model based on constructivism, it is appropriate to be used in the learning process.

These results show the fulfillment of the quality of constructivism-based TCA learning models that have been selected, defined and developed. The teacher can carry out his role for each component of the learning model well. For example, the teacher functions as a mentor, facilitator, reflector, motivator, collaboration and responsibility in a very practical way. This can be seen from the mean implementation of the social system for each sample school, namely Islamic School 1 Jambi 85.5% with a very practical category, Islamic School 2 Jambi 83.5% with a very practical category.

Based on observations and deliberations with observers and practitioners, the reflections made for each sample class are as follows.

a) Islamic School 1 Jambi

- Meeting I, the reflection that was carried out was (1) the teacher needed to always motivate the students in group activities, (2) the teacher needed to explain the learning process first with constructivist-based TCA learning model, (3) the teacher needed to give a reward for the group work, and (4) teachers need to provide reinforcement of the results of group work, after the process of communicating in the form of presentations.
- Meeting II, the reflective that is done for further improvement is that the teacher needs to pay more attention to the activities of the students at the time of the group meeting, and the teacher gives more motivation so that students work optimally for each activity.
- Meeting III, reflective for improvement at this third meeting are (1) teachers need to pay attention to students in analyzing problems and providing guidance

when needed, (2) in providing reinforcement the teacher should also train students to analyze questions with mathematical symbols.

- Meeting IV; reflective for the improvement of the next learning process is the motivation needs to be given by the teacher to students at all times so that the fun learning process can be maintained.
- Meeting V; The results of the deliberations between teachers, observers, practitioners, and researchers to be reflective is so that the implementation of the learning process for each phase of learning must really maintain the set time so that the learning phase goes well, and gifts need to be given to each group member so that students are more excited work in groups.

b) Islamic School 2 Jambi

- Meeting I, the reflection that is done is (1) the teacher needed to always arouse students' motivation in group activities, (2) the teacher needs to explain in advance the learning process with a constructional TCA-based learning model, (3) the teacher needs to give a reward for the results of group work, and (4) teachers need to provide reinforcement of the results of group work, after the process of communicating in the form of presentations.
- Meeting II, the reflective that is done for further improvement is that the teacher needs to pay more attention to the activities of the students at the time of the group meeting, and the teacher gives more motivation so that students work optimally for each activity.
- Meeting III, reflective for improvement at this third meeting are (1) teachers need to pay attention to students in analyzing problems and providing guidance when needed, (2) in providing reinforcement the teacher should also train students to analyze questions with mathematical symbols.
- Meeting IV; reflective for the improvement of the next learning process is the motivation needs to be given by the teacher to students at all times so that the fun learning process can be maintained.
- Meeting V: The results of the discussion between teachers, observers, practitioners, and researchers to be reflective that the implementation of the learning process for each phase of learning must really maintain the learning phase goes well, and prizes need to be given to each group member so that students are more excited work in groups.
- Meeting VI; the learning process for each phase of group activities, there needs to be a variety of problem presentation forms that increase students' attention to discuss them.

2) The using of teacher work guidelines according to practitioners: The results of practicality about the teacher work manual filled by twelve practitioners, illustrate that the eight aspects of assessment get a range of practical and very practical values. The Practicality of Teacher's Work Guide book by teachers or practitioners with a mean of 82.47% with very practical categories. The results of the analysis provide for the aspect of physical form assessment is still in the practical category with a mean of 73.40%, while for the aspect of valuation in terms of benefits, the maximum mean is 90% with a very practical category. Likewise, for other aspects of assessment, such as aspects of instructions, goals, syntax, material, worksheets, languages all in a very practical range.

Based on the results of the analysis, this illustrates that the Teacher's Work Guide book has been assessed and considered feasible to be used in general research, and in particular can be used in the learning process and provide benefits for teachers.

3) The using of student work guidelines book according to students: The results of the study on the practicality aspects of the Student Work Guidelines illustrate that the eight assessment aspects for trial 1 which have been filled in by students in Islamic School 1 class are 80.415% with very practical categories, while the practicality according to students based on the results of trial 2 is 71, 33% in the practical category.

The results of this analysis illustrate that the eight assessment aspects obtain practicality percentage values in the practical and very practical categories, and have met the criteria previously proposed. It can be concluded that constructivism-based TCA learning model is feasible to be used in the next learning process.

B. The Implementation of Constructivism-Based TCA Learning Model

The Following results of the observations will be presented for each trial I and trial II as follows. (a) Test Results I at Islamic School 1 (i) Components of the Learning Syntax Model The results of the observation of the syntax model component for each meeting in the I-trial at Islamic School 1, obtained the mean percentage of the implementation of syntax constructivism-based TCA learning model from observers, namely at the first meeting of 69.1% (practical), meeting II at 75.3% (practical) , III meeting was 80.8% (very practical), IV meeting was 94.6% (very practical) and V meeting was 95.3% (very practical). The mean for each meeting is 83% with a very practical category. (ii) Social System Components The observation result of the social system model component for each meeting in trial 1 in Islamic School 1 in Jambi City, obtained the mean percentage of the implementation of the social system of constructivism-based TCA learning model from observers, namely at the first meeting of 61% (practical), the second meeting was 75.5% (practical), meeting III is 85.3% (very practical), IV meeting is 85% (very practical), meeting V is 95.1% (very practical). The mean for each meeting is 80.38% with a very practical category. (iii) Components of the Reaction Principle Model The results of observation of the principal component of the model for each meeting in the first tryout at Islamic School 1, obtained the mean percentage of the implementation of the reaction principle TCA-based constructivism learning model from observers, namely at the first meeting of 60% (practical), meeting II at 75% (practical),

meeting III was 84% (very practical), meeting IV was 96% (very practical), meeting V was 96% (very practical). The mean for each meeting is 82.2% with a very practical category. Based on the results of observations and feasibility analysis, constructivism-based TCA learning model in the I-test class in 1 Islamic school in Jambi, although all components of implementation, constructivism-based TCA learning models are already practical and very practical at each meeting, but there are still things that must be repaired and noted, so that there is an increase in assessment for each meeting in the I-trial. So that a trial-II class is needed to correct things that are lacking in the trial-I process, to get a practical product with a better value than the trial-I class by deliberating all these deficiencies with the teacher, observer. (b) Trial-II in Islamic school 2 (i) Components of the Learning Syntax model For each meeting in the trial-II observation results of the syntax model component in Islamic School 2, obtained the mean percentage of the implementation of syntax of constructivism-based TCA learning model from observers, namely at the first meeting of 75.5 (very practical), meeting II at 90.1 (very practical), III meeting was 85.6 (very practical), IV meeting was 90.8 (very practical), V meeting was 96.5 (very practical), and the VI meeting was 97% (very practical). The mean for each meeting is 89.25% with a very practical category. (ii) Social System Components Observation results of the social system model components for each meeting in trial 2 in Islamic School 2, then obtained the mean percentage of the implementation of the social system of constructivism-based TCA learning model from observers, namely at the first meeting of 67% (practical), meeting II amounted to 83.33 % (very practical), III meeting 95% (very practical), IV meeting 81% (very practical), V meeting 94% (very practical), and VI meeting 95.7% (very practical). The mean for each meeting is 86% with a very practical category. (iii) Components of the Reaction Principle Model For each meeting in experiment II, the observation component of the principal model of reaction in Islamic School 2, obtained the mean percentage of the implementation of the reaction principle TCA-based constructivism learning model from observers, namely at the first meeting of 65% (practical), meeting II at 82% (Very practical), meeting III was 85% (very practical), IV meeting was 95% (very practical), meeting V was 90% (very practical), and meeting VI was 92% (very practical). The mean for each meeting is 84.4% with a very practical category. Based on the results of observations and feasibility analysis, constructivism-based TCA learning model in the II-trial class at Islamic School 2 in the six meetings, although all components of implementation, constructivism-based TCA learning model was classified as very practical at each meeting, but there were still must be corrected and noted, so that there is an increase in assessment for each meeting in the trial-II. So that a trial-III class is needed to correct things that are lacking in the trial-II process, to get a practical product with a better value than the trial-II class by deliberating these deficiencies with the teacher, observer, and enter from students.

IV. Conclusion

The results of the analysis based on the Plomp model after practicing constructivism-based TCA models using guidebooks for teachers and students show that the TCA model is very practical for classroom learning. This can be done with mathematical problems. Students look enthusiastic in doing the exercises, then they take turns presenting the results of group discussions in front of the class. For teachers, this TCA learning model is very helpful for teachers in guiding students because this TCA model provides students the opportunity to solve problems with existing abilities in students. Students can work together by learning to do the exercises. The teacher can guide students freely because of the TCA model because it provides an opportunity for students to find solutions and use solutions for other problems.

Constructivism-based TCA Learning Model is very effective in the classroom and outside the classroom. This can be seen from the increasing student learning activities. The teacher and student handbook is also very effective to use and can save time in learning because it shows important things to be discussed by students. The material is concise, uncomplicated and in accordance with the daily lives of students.

Acknowledgment

I would like to thanks to the Director of the postgraduate program of Sulthan Thaha Saifuddin State Islamic University and Project Implementation Unit who facilitates this research project.

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