Practicality of ADOICARE Mathematics Learning Model in Developing Mathematical Creativity for Junior High School Students

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Abstract. Advance organizer, Progressive Differentiation, Progressive Ordinate, integrative reconciliation, Creativity Deflopmen, Reflection, and Extention are mathematics learning syntax, hereinafter referred to as the ADOICARE learning model. This is the result of 3 years of research and development. Plomp's theory (1997) became a reference for development. The ADOICARE model draft that has been validated by experts was tested on 9 mathematics teachers of class VIII SMP in Gowa Regency, South Sulawesi, which were divided into 3 groups. Each group teaches ADOICARE-based learning tools to 3 parallel classes. Data collection was carried out during the implementation process using observation sheets of learning implementation, student activities and student response questionnaires. The collected data were analyzed descriptively. Practicality criteria refer to Nieveen's (1999) theory. The results showed that the ADOICARE model-based mathematics learning tool was practically applied in the field.

Keywords: practicality, ADOICARE, mathematics learning

INTRODUCTION

Motivations for the creation of the ADOICARE learning model are: (1) concern about: low mathematical creativity and the positive character of students, which is marked by the spread of brawls between students (results of initial studies), (2) creativity is very important for every individual[1], (3) creativity can be developed through continuous practice[2–4]. Furthermore, an initial study was carried out: Curriculum 2013, learning theory, creativity theory, development research theory, and character theory.

The essence of learning theory to support the ADOICARE Model

Cognitive Understanding. The basic concepts of thinking about cognitivists include: (1) the individual as an active information processor,[5,6]; (2) individual behavior is determined by the perception and experience of the information encountered, as well as how much the individual is involved in processing (transforming) the information; (3) learning is a product of the interaction between

ISBN: 978-623-7496-62-5

what individuals know, the information they encounter, and what they do when they learn.[7](4) knowledge resulting from the formation and storage of an information package, or schema, which consists of the mental construction of our ideas. This view explains that information can be well absorbed by students if in learning they pay attention to: (1) the network linkages of packets in the brain about what is explained, (2) what connection is explained with the knowledge they have, (3) the correspondence between what is said with something that is understood. Learning in this view focuses on a process of experiencing, repairing / strengthening networks and expanding cognitive structures. Contructivistic understanding. The essential thing from the viewpoint of constructivism is that knowledge is not accepted passively, knowledge should not be simply transferred, but interpreted, built actively by individuals. Humans construct their knowledge through their interactions with phenomena and objects in their environment. Learning begins with giving problems, then provides opportunities for learners to discover for themselves, teaches students to be aware and use their own learning strategies, so that students can find parts of the basic skills required[8]. Piaget's theory. In learning, it emphasizes: (1) focusing on the child's thinking or mental processes, not just what the child uses to arrive at the answer. Appropriate learning experiences are developed with attention to the cognitive stages of students, (2) prioritizing the role of students in taking their own initiative and active involvement in learning activities. Presentation of knowledge is not emphasized, but children are encouraged to discover their own knowledge through spontaneous interactions with their environment, (3) understand that there are individual differences in terms of developmental progress[9].

Vygotsky's Theory. Slavin and Wertsch stated that in learning, Vygotsky's theory emphasizes: (1) The area of the closest development, abbreviated as ZPD (zone of proximal development) [9,10]. ZPD is the area between the level of actual development and the level of potential development of a person. The actual level of development is the level of a person's current learning development that he or she has obtained with one's own abilities, while the level of potential development is the level of one's current learning development that can only be developed through the guidance of "adults" or by collaborating with peers.[11], (1) cognitive apprenticeship. What is meant by cognitive holding here is a process in which someone who is learning step by step gains expertise through his interaction with people who are more familiar with the problems being studied, (3) Scaffolding. According to Vygotsky scaffolding is the provision of a number of assistance to a student during the early stages of learning and then reduces the assistance and gives the student the opportunity to take over greater responsibility as soon as he can do it. Ausubel Theory.This theory emphasizes meaningful learning and the importance of repetition before learning begins. According to Ausubel, learning can be classified into two dimensions. The first dimension relates to the way information or subject matter is presented to students through acceptance or discovery. The second dimension concerns how students can relate the information to existing cognitive structures,

ISBN: 978-623-7496-62-5

which include facts, concepts, and generalizations that have been learned and remembered by students. At the first level of learning, information can be communicated to students either in the form of acceptance learning which presents the information in its final form, or in the form of discovery learning which requires students to find some or all of the material to be taught themselves. At the second level, students connect or link the information to the knowledge they already have, in this case meaningful learning occurs. However, the student can also just try to memorize the new information, without relating it to the existing concepts in the cognitive structure, in this case rote learning occurs. According to Ausubel & Robinson in meaningful learning new information is assimilated to existing subsumes. Ausubel distinguishes between learning to accept and learning to discover. In learning to accept students only accept, so they tend to memorize, while in learning to find, the concept is discovered by students. students do not take lessons for granted. In addition, there is a difference between learning to memorize and meaningful learning, in learning to memorize the material that they have obtained, while in meaningful learning the material that has been obtained is developed in other circumstances so that learning is more understandable.

ADOICARE Learning Conceptual Framework

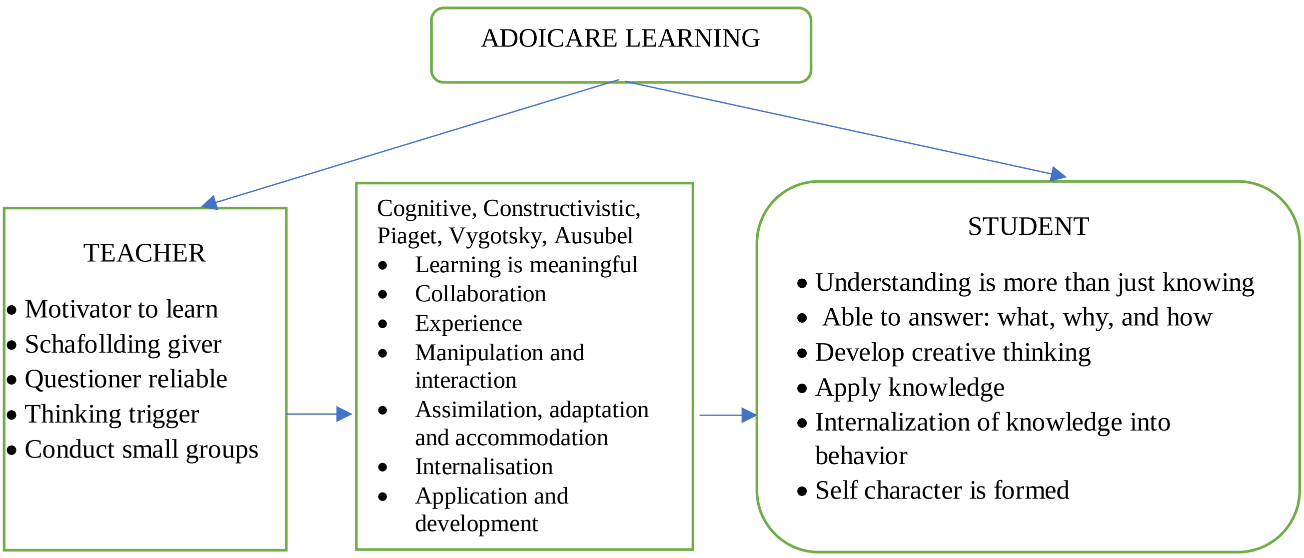

Figure 1.1. ADOICARE Learning Conceptual Framework

Mathematical Creativity

Mathematical creativity is defined differently by experts and adopts a general definition of creativity. In general, experts have the view that creative mathematical thinking is different from mathematical creativity. Creative thinking in mathematics is a mental activity that occurs in the human mind, namely: understanding / finding problems, formulating problems, developing knowledge that is already possessed

ISBN: 978-623-7496-62-5

from learning experiences, synthesizing knowledge with problems, viewing information from different points of view, predicting from limited information , formulating hypotheses based on observed phenomena and testing Carin & Sund's hypothesis[12], Costa[13], Fisher[14], De Bono [15]. Mathematical creativity is a product of mathematical thinking with fluent, flexible and original indicators.[16]. Fluent refers to the ability of students to come up with different ways / answers using the same concept[17]. Flexible is reflected in the student's ability to suggest different ways / answers using different concepts[18]. The original is the student's ability to suggest ways / answers that are unusual and new to students[19–21].

METHOD

This development research uses Plom's (2007) development theory at the implementation stage. The research steps were: (1) training and assisting teachers in preparing ADOICARE-based learning tools, (2) implementing learning tools, (3) collecting data, (4) analyzing data, and (5) drawing conclusions. 9 mathematics teachers of class VIII SMP in Gowa Regency, South Sulawesi were participants in this study. The 9 teachers were divided into 3 groups. The members of each group come from a different school. Each group teaches a parallel class with the same material. The data was collected during the learning process in 5 meetings using observation sheets (scale 1 to 5). Observations are focused on the implementation of (a) the ADOICARE learning syntax, (b) implementation of the social system, and (c) implementation of the principle of management reaction with a support system provided for the intended operation (IO). The collected data were analyzed using the formula: IO =, where: IO = total mean for all aspects, = average aspect = i, and n = number of aspects. ADOICARE learning model is said to be practical, if.$\leftrightarrow \frac{\sum_{i=1}^{n} A_i}{n} A_i 4 \leq IO < 5$

FINDINGS AND DISCUSSSION

Findings

The process of analyzing data to determine whether the ADOICARE Learning Model is practical or not is: (1) recapitulating the results of observations of the implementation of learning into a table including: Aspect I (Ai), Indicator I (Ii), and the value of the jth meeting of indicators to -i (Pji) for 5 meetings, (2) determining the average value of the observed results for 5 meetings, (3) determining the mean value for each aspect of the observation: Syntax, social system, and reaction principles for 5 meetings, (4)) tabulating points (3) into a table for 5 meetings, and for each group of parallel classroom teachers as shown in tables 3.1, 3.2., and 3.3, and (5) determining the intended operational (OI)

ISBN: 978-623-7496-62-5

Table 3.1. Mean intended operational (OI) value for Group A 5 Meeting↔

No.	Parallel Kls	Average Value of Aspects Observed in 5 Meetings			IO
		Syntax	Social System	Principle of Reaction	
1.	A1	4.25	4.45	3.96	4.22
2.	A2	4.16	4.05	3.98	4.06
3.	A3	4.32	4.16	3.88	4.12

Table 3.1. It shows that group A for parallel classes A1, A2, and A3 in the syntax and social system aspects is in the high category. The principle aspects of the reaction are in the moderate category and tend to be high. Mean intended operational (OI) values for each parallel class and for each aspect in group A are at intervals. Referring to the predetermined criteria, it is concluded that practical ADOICARE-based learning is carried out in the field.↔ $4 \leq IO < 5$

Table 3.2. Mean intended operational (OI) value for Group B 5 Meeting↔

No.	Parallel Kls	Average Value of Aspects Observed in 5 Meetings			IO
		Syntax	Social System	Principle of Reaction	
1.	B1	4.12	4.14	4.15	4.13
2.	B2	4.20	4.10	4.02	4.10
3.	B3	4.05	4.16	3.98	4.06

Table 3.2. It shows that group B for parallel classes B1, B2, and B3 on the aspects of syntax and social systems is in the high category. The principle aspects of the reaction are moderate and tend to be high. Mean intended operational (OI) values for each parallel class and for each aspect in group B are at intervals. Referring to the predetermined criteria, it is concluded that practical ADOICARE-based learning is carried out in the field.↔ $4 \leq IO < 5$

Table 3.3. Mean intended operational (OI) value for Group C 5 Meeting↔

No.	Parallel Kls	Average Value of Aspects Observed in 5 Meetings			IO
		Syntax	Social System	Principle of Reaction	
1.	C1	4.20	4.40	3.92	4.17
2.	C2	4.05	4.45	3.88	4.12
3.	C3	4.15	4.25	4.02	4.14

Table 3.3. It shows that group C for parallel classes C1, C2, and C3 on the aspects of syntax and social systems is in the high category. The principle aspects of the reaction are moderate and tend to be high. Mean intended operational (OI) values for each parallel class and for each aspect in group C are at intervals. Referring

ISBN: 978-623-7496-62-5

to the predetermined criteria, it is concluded that practical ADOICARE-based learning is carried out in the field.$\leftrightarrow 4 \leq IO < 5$

Discusssion

This study aims to determine the extent of the implementation of mathematics learning based on the ADOICARE learning model compiled by the teacher. The contribution of this research is to improve the ability of mathematics teachers to innovate learning to develop mathematical creativity and positive character of students. One of the most important student competencies in the 21st century is higher order thinking skills (creative, critical and problem solving) and students' positive character. The role of teachers to develop creative thinking skills and cultivate the positive character of students in the 21st century is very essential and a necessity (NACCCE, Jeffrey & Craft, Jeffrey & Craft (in[22]). For this reason, one of the activities in this research is to train and assist teachers in collaborating to develop ADOICARE-based learning tools and implement collaborative learning tools. The results showed that the 9 teachers could carry out ADOICARE-based mathematics learning well. This shows that: (a) the teacher has performed its role well as: learning motivator, schafolling giver, reliable asker, thinking trigger, and small group conductor, (b) the teacher has been able to implement Ausubel's meaningful learning principles and basic principles of understanding constructivism. This theory is the basis for the creation of the ADOICARE mathematics learning model which consists of 7 syntax, namely: (1) Advance organizer. This activity facilitates students to improve the ability to connect between the knowledge they already have and the knowledge to be studied, (2) Progressive Differentiation. This activity facilitates students to represent their knowledge in another form and practice creativity, (3) Progressive Ordinate. This activity trains students to build their own knowledge through collaboration, (4) integrative reconciliation. This activity trains students to internalize and develop their knowledge in a higher realm, (5) Creativity deflection. This activity trains students to come up with new ideas in finding solutions to the problems at hand, (6) Reflection. This activity trains students' metacognition skills, communicates ideas, and forms an honest character, and realizes their weaknesses. and (8) Extention. This activity trains students to overcome cognitive conflicts and misconceptions. These 8 principles facilitate students: understanding mathematical concepts more than just knowing, being able to answer: what, why, and, how, developing creative thinking, applying knowledge, internalizing knowledge to behavior, forming self-character. This activity will improve students' learning skills that are needed in the 21st century.

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