The Development of Model Advance Organizer Based Mind Mapping for Student at Senior High School

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Abstract This research aims to develop a valid mind mapping based advance organizer learning model (PAO PaPi Model) for senior high school students. The research question is whether the development of PAO PaPi mode is valid in terms of theoretical basis and learning model components. The research subjects were 33 students in Senior High School 20 Pangkep, Indonesia. The development procedure of PAO Papi Model was carried out by referring to the development model of Plomp [1] which consists of five stages, namely: (1) investigation, (2) design, (3) realization / construction, (4) testing, evaluation and revision, and (5) implementation. The research product is the PAO PaPi Model. The component model developed refers to Joyce, et al. [2]. Characteristics of the developed model refer to Arend (2012), and product quality criteria refer to Nieeven (2007). Validation data analysis refers to Nurdin (2007) and Asdar (2013). The instrument reliability percentage used the concept of percentage of agreements by Grinnell (1988) in Nurdin (2007). The results showed that the PAO PaPi model was valid in terms of the supporting theories and components of the model.

Keywords Advance Organizer Learning Model, Mind Mapping

1. Introduction

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to become spiritual, religious, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state. Law No. 20 Year 2003.

Education plays an important role in preparing qualified human resources who are able to face future challenges and compete in the development of science and technology. Education is the most important thing which becomes a benchmark for the development of a nation so that it is not being left behind other nations.

The 2013 curriculum has been applied to primary and secondary education. *Permendikbud* No. 24 Year 2016 concerning Core Competencies and Basic Competencies formulates the application of the 2013 curriculum in the learning process using an integrative thematic approach.

A learning model has some characteristics as follows; (1) it is based on educational theory and learning theory from the experts, (2) it has a certain educational value or purpose, (3) it can be used as a guide for improving learning activities in the classroom, (4) it has parts of the model called sequence of learning steps or syntax, principles of reaction, social systems, and support systems, (5) it has an impact as a result of applied learning models, namely the impact of learning in the form of long-term learning outcomes, and (6) it develops teaching preparations or instructional design with guidelines for the chosen learning model (Joyce et al, 2011) [2].

Learning models that are often used in schools include; direct instruction, cooperative learning models, problem based instruction, and contextual teaching and learning models. The four learning models apparently have not been

able to encourage students to promote meaningful learning and maximum learning outcomes according to the expected goals.

The preliminary research was conducted by researchers in four high schools in Pangkep Regency (Senior High School 1, Senior High School 11, Senior High School 20 and Senior High School DDI Sibatua). The results of this preliminary research reveal the Mathematics learning outcomes of Class XI students in odd semester 2018/2019 academic year which was held in the first week of January 2019. It was found that there were students who scored below the minimum standard of completeness that was set at 75, and there were only a few students who scored ≥ 75 (complete), with an average grade of all four schools are still lower than expected grades. The results show that the students' level of meaningful learning still needs to be improved because students have not been fully able to store their knowledge in a long term period and may still have difficulties to solve problems that are not exactly the same as the sample problems given by teachers, thus the learning outcomes are not optimal.

The interview with several students indicated that there are students who study once a week at home, and students who study one to three times a week (interview on 3 to 10 January 2019). It is identified that there are still students get lower than minimum completeness criteria (KKM) due to lack of spending time to study after school. That is because their motivation to learn is still lacking as one of the impacts of their in-active involvement in the learning process. Meanwhile, based on the results of interviews conducted by researchers of 92 students from the four high schools, it was also revealed that most of the students' free time after school was spent on playing (games, facebook, twitter and others) at home and at the internet cafe.

To optimize the advanced organizer learning model, it is necessary to combine with mind mapping model. This model could create an interesting and fun learning atmosphere as well as motivate students to learn the material in order to develop meaningful learning. Mind mapping is one technique to concise the learning material and predict the learning process' problem onto map or figure in order to be easier to understand.

Senior High School 20 Pangkep is one of the schools where researchers conduct preliminary observations to obtain information related to learning models that are often used in the learning process, the level of meaningful learning, and mathematical learning outcomes. From the results of the preliminary study, it is identified that the teachers had implemented the 2013 Curriculum at school, and the students had achieved the minimum standard of the assessment. However, during the observation and interview process, a math teacher commented that learning at school is still not meaningful because of the tendency of learning that is still oriented towards cognitive values. In addition, learning is still focused on the teacher's book and student's book which sometimes does not suit the students' real life. This is the reason why the researchers chose

Senior High School 20 Pangkep as one of the research target school. One of the learning models that can be developed to increase the meaningful learning and mathematics learning outcomes is Mind Mapping based Advance Organizer learning model. Through this learning model, Students are expected to construct the ideas based on the topic given and correlate these ideas in order to adapt and create new concept.

Based on the background above, the researchers conducted a study of mind mapping based advance organizer learning model to improve the quality of mathematic teaching.

In the model, the syntax, principle of reaction, social system, support system, instructional impact and other impact are considered. The research objective is to find out the validation of development of mind mapping based advance organizer learning model to improve the meaningful learning of high school students.

2. Literature Review

Meaningful Learning and Learning Outcome

Learning is the process of behavior in terms of knowledge, attitudes, and skills. This change is permanent in behavior that occurs as a result of practice or experience. The behaviour process cannot be separated by individual of the students and environment. This means that learning process of the students are much influenced by development phase and environment learning is something done by students, not made by students (Slavin, 2015: 78)[3].

Meaningful learning is fun learning that will have an advantage in capturing all the information intact so that the final consequences increase students' abilities. Meaningful learning is a process of relating new information to relevant concepts contained in a person's cognitive structure. Thus, for meaningful learning to occur, the teacher must always try to find out the students' interest and knowledge capabilities and help them harmoniously integrate these concepts with new knowledge to be taught. Learning will be "more meaningful if the child experiences directly what he learned by activating more senses than just listening to the person / teacher's explanation" (Yalcin, S.A, 2009: 100)[4].

Learning outcomes are the learning mastery that refer to changes in cognitive abilities that include dimensions of knowledge and dimensions of cognitive processes achieved by students as a result of the learning process taken during a certain period based on the learning objectives set (Anderson and Krathwohl, 2009: 124)[5].

Mind Mapping Based Advance Organizer Learning Model (PAO PaPi)

Learning model is an important element in teaching and

learning activities to achieve learning objectives. The learning model is used by the teacher as a guide to plan the learning process. Joyce & Weil (in Rusman, 2012: 133) argues that "the learning model is a plan or pattern that can be used to shape the curriculum (long-term learning plans), design learning materials, and guide learning in class or other" (Uzzaman, T, et al, 2015: 45).

The Advanced Organizer Model is a learning model designed to clarify students' cognitive structures. It structure is a factor that determines whether new material will be meaningful and the extent to which these materials can be obtained and maintained. Before delivering new material successfully, teachers must improve the stability and clarity of students' cognitive structures. The teacher understand the student's initial knowledge in relation with the material to be taught so that the students' response become better and improve the quality of the learning process (Rahayu, S. 2012: 32). Advanced organizer is used to overcome student difficulties, namely directing and helping students recall material related to the material to be learned, and helping students to instill new knowledge (Simanjuntak, et al, 2013: 314). On the other hand, Mind Mapping is a graphic technique that is very powerful and a universal key to unlocking the potential of the whole brain because it uses all the skills found in the neo-cortex of the brain or better known as the left brain and right brain (Panggabean, et al, 2012: 15).

Based on these assumptions, students make modifications by developing a mind mapping based advance organizer in order to find out and recall information related to the material which assists them in instilling new knowledge. Students are also given time to think, to answer, and to help one another in social groups. Through this learning model, it is expected that students' difficulties in learning mathematical concepts can be overcome. If students find difficulties in learning and understanding a subject matter, their learning outcomes will be low. Learning outcomes will be good if students' difficulties in learning a subject matter can be solved. This can be seen from the completeness of students in solving the problems given.

3. Research Methods

The type of research used is research & development. The development procedure of PAO PaPi Model PAO was carried out by referring to Plomp's development model which consists of five stages, namely (1) initial investigation, (2) design, (3) realization / construction, (4) testing, evaluation and revision, and (5) implementation.

The research product is the Mind Mapping based Advance Organizer Learning Model (PAO PaPi Model). The model component developed refers to Joyce, et al. (1992). Characteristics of the developed model refer to Arend (2012), and product quality criteria refer to Nieeven (2007). Data collection techniques were carried out using

the validity assessment instrument of PAO PaPi Model. Validation of the PAO PaPi Model I prototype was carried out by expert and practitioner validators. The expert and practitioner validators were handed over the PAO Papi Model instrument which had been declared valid along with the PAO PaPi Model book. If the validation results show that the PAO PaPi Model is invalid, then a model revision is made based on the validator's suggestion. Validation data analysis (Va) refers to Nurdin (2007) and Hobri (2009). The overall relevance of the two experts is Gregory's content validity, which is a content validity coefficient. The content validity coefficient can be calculated using the following formula:

$$\text{Content Validity} = \frac{D}{A+B+C+D}$$

Description:

A = Cell that shows both assessors / experts states that it is irrelevant

B and C = Cells that show differences in views between assessors / experts.

D= Cells that show valid agreement between the two assessors

Following is a model of interagency agreement for content validity:

Validator II		Validator I	
		Irrelevant Score (1-2)	Relevant Score (3-4)
Irrelevant score (1-2)		A	B
Relevant Score (3-4)		C	D

Figure 1. Model of agreement between two experts/validators (in Asdar, 2013: 75)

To measure the validity of the mind mapping based advanced organizer learning model, Two validators assess that measurement of the instruments are in valid category, If the result of the content validity coefficient is higher (V> 75%), then it can be stated that the measurement results is valid. The instrument's reliability percentage used the percentage agreement concept by Grinnell (1988) as cited in Nurdin (2009:145)

4. Results and Discussion

Results

PAO PaPi model is a learning model developed based on Ausebel theory with a cognitive approach and supported by the use of media in every meeting. The PAO PaPi model developed consists of six phases, namely conveying objectives and motivating, presenting learning material / main material, organizing students into groups, presentation of learning materials, and strengthening cognitive organization. Then the six phases in the PAO

PaPi model syntax can be seen in the following explanation. Phase-1 is Conveying objectives and Motivating which includes (1) The teacher gives motivation to learn seriously and confidently, (2) The teacher gives apperception of expectations, empathy, and self-confidence, (3) The teacher conveys the learning objectives.

Phase-2 is the Presentation of Advance Organizer as follows: (1) clarifying learning objectives, namely by gaining students' attention and directing students towards learning objectives. (2) presenting organizers on the material of number patterns and sequence by distributing students' worksheet (LKPD) to each student, (3) the teacher provides the opportunity for students to identify the characteristics of the concept of Number Patterns, in accordance with the steps contained in LKPD, (4) The teacher gives examples of number patterns and sequence, and (5) the teacher encourages students' abilities and experiences by making guided discoveries using LKPD media.

Phase-3 is the teacher organizing students into groups as follows: (1) the teacher assigns students the role of the subject matter, and (2) the teacher forms several groups by applying mind mapping strategies in student books. Phase-4 is the teacher presents the lesson material by: (1) developing mind mapping based advance organizer framework into the number patterns and sequences material that can be logically understood by students, especially about the relationship of the elements contained therein, (2) The teacher explains the learning material clearly and completely on a subject that is accompanied by relevant examples in the order of the material clearly, (3) Then the teacher directs students to work on student work exercises that are made in accordance with students' cognitive reinforcement designed according to students' mind mapping.

Phase-5 is that the teacher strengthens cognitive organizations by: (1) using the principles of integrative reconciliation. This activity brings together new learning material with the cognitive structure of students by means of the teacher reminding students of ideas (general picture); the teacher asks a summary of the attributes of the new subject matter; students repeat the definition correctly through mind mapping, (2) increase learning activities, students connecting the material with their background experience or knowledge and provide examples of concepts related to the material, and (3) enhance a critical approach to the subject, teacher asking students about their opinions related to the subject matter. Phase-6 is the teacher evaluates and gives rewards by: (1) evaluating the learning process that has been carried out in the classroom, and (2) giving rewards to students who have the highest level of activity and motivation during the learning process.

PAO PaPi Model Social System organizing students in learning through roles, students can improve their ability to recognize themselves and the feelings of others, they can acquire new behaviors to handle previously difficult situations, and they can improve their problem solving skills. In addition, it also includes a series of interesting activities because students enjoy acting, and acting is a way to develop instructional content. Applying patterns to the role of students in solving problems, students form groups according to the teacher's instructions.

Then the teacher proposes a problem and each group discusses to solve the problem. The students explore to ask their friends or the teacher. When there are groups that experience doubts or difficulties, it is better to ask the teacher. Then the teacher gives direction, assistance and guidance and prepares learning facilities.

In the interaction of roles between students and students, groups and groups, and between students and teachers, each needs to understand the importance of building self-efficacy, for example: (1) empathy, (2) collaboration, (3) experience, (4) oral and written communication to produce mutually agreed-upon problem solving.

In PAO PaPi model the teacher holds control of the learning structure. This is needed in an effort to connect learning material with PAO PaPi model and help students to distinguish between new material and previous material. The success of mastering this material depends on the criticism and desire of students to integrate the material and how the teacher presents the PAO PaPi model. This social system looks very striking in the third stage with a more ideal learning situation because it is more interactive with many students taking the initiative to ask questions.

PAO PaPi Model principle of reaction is based on the meaningful learning theory proposed by Ausebel where learning is carried out by the teacher to function as a facilitator and mediator in teaching students. The teacher's behavior in responding to students' thought results in the form of questions, the difficulties experienced in solving problems must direct, guide, motivate and inspire student learning.

In PAO PaPi model, the teacher shows his response to student reactions directed through achieving the goal of classifying the meaning of new material, differentiating and harmonizing with existing knowledge, then personally associated with student knowledge to enhance a critical approach to knowledge. Ideally, students will start their own questions in response to the information they have obtained.

Additionally, to implement PAO Papi model effectively, the teacher is required to make a learning plan that is based on the learning theory that is found by Ausebel, which is a meaningful learning theory. In this case, a model book was developed which contained supporting theories for implementing learning, the components of the PAO PaPi model, implementation instructions and all learning tools used such as lesson plans, teacher books, student books, student worksheets, resources learning, and props needed. Supporting facilities needed by PAO PaPi Model are well-organized material that is material that is

interconnected with previous material. The effectiveness of PAO PaPi Model depends on an exact integral relationship between the concepts being organized and the content. This model provides instructions for reorganizing learning material.

For expected instructional and other impacts, the instructional impact of this model is the ideas that have been studied are used as an organizer and presented clearly as well as in presenting subject matter. So students are able to use their cognitive structures to support new material. The impact of this model is that students indirectly gain the ability to learn from reading, and other media used in the presentation of learning. This will raise awareness of relevant knowledge and critical attitude in learning.

Based on the description above, about the learning components of the PAO PaPi model, the following is presented in Figure 2 below.
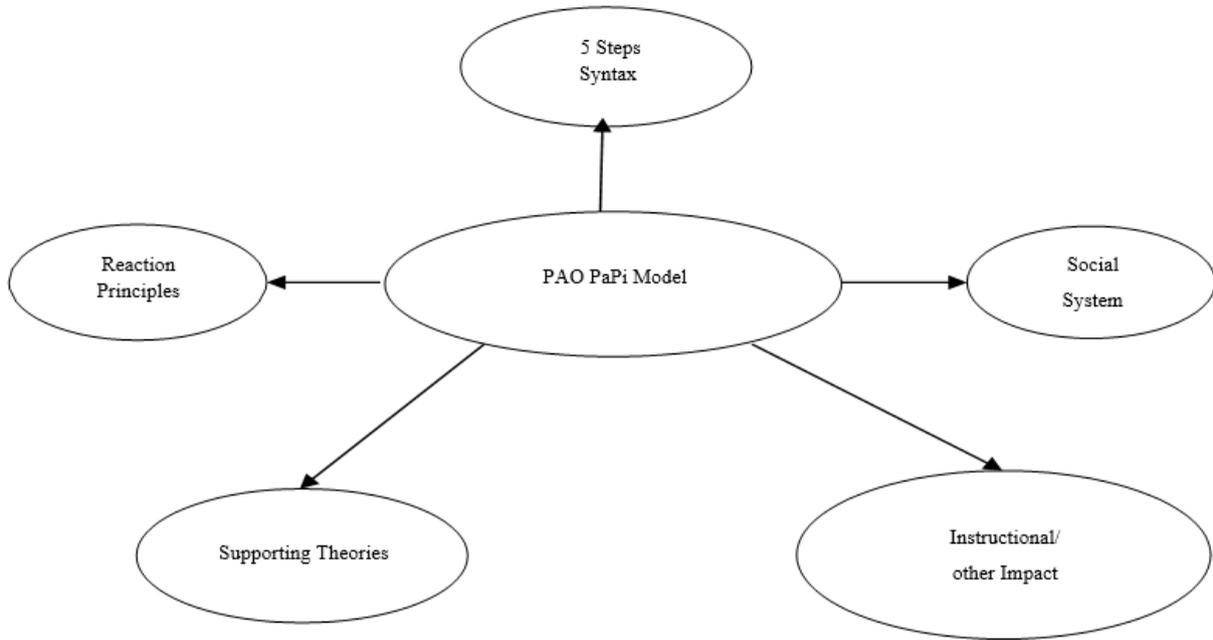

Figure 2.   PAO PaPi Component Scheme

Table 1.   Results of the Detailed Assessment / Validation of the PAO PaPi Model

No	Assessment Aspects	Two Experts' Agreement			
		A	B	C	D
1	Supporting Theories	1			6
2	Syntax				5
3	Social system	1			3
4	Reaction Principle				4
5	Supporting system				5
6	Instructional and other impact			1	6
7	Learning Implementation	2			4

The analysis results in the table above can be explained as follows:

		Validator I	
		Irrelevant Score (1 –2)	Relevant Score (3 – 4)
Validator II	**Irrelevant Score (1 – 2)**	4	0
	Relevant Score (3 – 4)	1	33

Figure 3.   Results of agreement between the two experts on the PAO PAO Model

From the assessment given by the two validators above, the validity level can be calculated based on Gregory's content validity formula as follows:

Discussion

$$\text{Content Validity} = \frac{D}{A + B + C + D} = \frac{33}{38} = 0,868$$

Based on the validity test results, it can be concluded that the PAO PaPi Model Prototype-1 has all met the validity criteria, although not simultaneously achieved. In the initial testing process, it turns out that the PAO PaPi Model is declared valid in terms of all aspects / components of the model. However, the supporting theory component has not been declared valid. As a result, the revision of the model text / book was carried out by looking back at the theories supporting the Model. This has an impact on the process of developing devices and instruments to be used. This revision is not immediately possible, but it requires a lot of time to find and establish strong supporting theories. So it can be concluded that the validity obtained is 0.868 or V = 86.8%. This means that the results of the assessment of the two validators have "strong relevance" with a content validity coefficient of more than 75% or V > 75%, so it can be said that the results of measurements or interventions carried out are valid.

The average value of PAO PaPi Model validity for aspects of supporting theories is 0.857 or V = 85.7%. Based on the validity criteria of the PAO PaPi model, this value is only included in the category of "strong relevance" with a content validity coefficient of more than 75% or V > 75%, so that the aspects of the theories supporting the PAP PaPi model have not yet met these criteria. In other words, according to the validators, the theories included in the PAO PaPi model book have not yet seen its strengths as supporters of the PAO PaPi model. The average validity of the PAO PaPi Model for syntax, social system, and principles of reaction was 86.5%; 88.7; and 85.6. Based on the criteria (ii) validity of the PAO PaPi Model, the three values are included in the category of "strong relevance" with a content validity coefficient of more than 75% or V > 75%. Thus, the elements in each of these aspects are related to one another. Based on point 2) above, the PAO PaPi model cannot be declared strongly supported by theories. Therefore, the manuscript (the PAO PaPi model book) especially about supporting theories needs to be re-examined by paying attention to the validators' suggestions and comments. This is necessary to revise the text on aspects of supporting theories.

The new things in the study after learning process using the model PAO PaPi found that there is a positive change in the students of SMA Negeri 20 Pangkep in achieving the meaningful learning presented in the three aspects namely retention test, transfer tests and learning outcomes. The overall result of students' mastery learning scored 6.5 and above reached 30 out of 32 students around 86.5% in the second Test. This shows that the degree of meaningful learning at students of SMA Negeri 20 Pangkep changed positively before testing the product that has been developed due to the initial observation that the teacher only measured in terms of learning results, regardless of how long the students remember the lesson and how able students to answer the question that has been modified by the teacher of the same previous question.

5. Conclusions and Suggestions

Based on the results of data analysis and discussion of the validity of PAO PaPi Model, it can be concluded that the mind mapping advanced organizer learning model (PAO PaPi Model) is valid, because the results of the experts' validation of the model, both the theoretical basis and the components all models are valid. It is recommended that the PAO PaPi Model can be used as a learning model that can be applied by teachers at the level of basic education, especially at the level of high school education, so that motivation, cognitive abilities, and awareness of the meaningfulness of student learning can be improved.

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