IOSR Journal of Research & Method in Education (IOSR-JRME)
e-ISSN: 2320–7388,p-ISSN: 2320–737X Volume 7, Issue 4 Ver. IV (Jul - Aug 2017), PP 10-18
www.iosrjournals.org

Development of Student Worksheet Geometry Based Metacognitive Strategy Through Creative Thinking Ability

Tetty Khairani Nasution[1], Bornok Sinaga[2]
[1](Postgraduate, State University of Medan (UNIMED), Indonesia)
[2](Proffesor, State University of Medan (UNIMED), Indonesia)
Corresponding Author: * Tetty Khairani Nasution[1]

Abstract : *This research aims to describe the validity and effectiveness of product development the student worksheet (SWS) geometry based metacognitive strategy. This type of research is the development of a modified model 4-D by Thiagarajan, Semmel and Semmel through the define, design, develop and disseminate stages. The disseminate stage not discussed in depth only limited extent in school research. The subject of research is the students of grade X-4 SMA N 5 on trial 1 as many as 30 students and students of grade X-MIA-3 MAN 1 on trial 2 as many as 28 students. The result of this research showed that on trial 1 SWS is valid criteria. SWS had effective on trial 1 and 2 are reviewed based on the student's active activity being at the time tolerance interval with the greatest persentage being the activity of disclosing the reasons. Teacher Competence Value (TCV) trials 1 and 2 each with criteria quite well. The positive response of the students againts the components and processes of learning in trial 1 and 2 meet the criteria effectively. The student's creative thinking ability is reviewed from the each indicator fluency, flexibility, originality and elaboration.*

Keywords - *Development, student worksheet based metacognitive strategy, creative thinking ability.*

Date of Submission: 02-08-2017 Date of acceptance: 14-08-2017

I. INTRODUCTION

Binkley, et al., (Abidin [1]) states that creativity and metacognition must belong to the 21st century. Trilling and Fadel mentions the need for revitalization of roles and functions of learning. Permendiknas No 23 of 2006 on SKL that mathematics need to equip students with creative ability. According to constructivist theory students must build their own knowledge. This is because every individual has the creative potential to be developed. The environment is expected to train creativity either implicitly or explicitly in learning.

Creativity is very important in learning mathematics. Munandar [2] creativity is very meaningful in life and need to be nurtured early on through proper education. Creativity is the ability to find alternatives to varied answers to a solution. Creativity focuses on quantity, usability, and diversity of answers. Laurence (Wijaya, [3]) that creativity is a skill that can be learned. Further Rose and Malcom [4] the key to creativity is obtaining detailed background knowledge on the subject. Because almost all new ideas are a recombination of existing ideas.

In line with that Hevy [5] creative thinking is very important in today's global era, is needed when the complex level of problems from all categories of life. In creative thinking there are two basic components that are needed to include a balance between logic and intuition. Munandar, Hevy and Kusumah [6] mentioned there are 4 indicators in creative thinking include fluency (ability to express ideas); flexibility (the ability to generate ideas or alternative solutions); originality (ability to produce original product, modification of old object into new object) and elaboration (developing idea, detailing object). While Kusumah added an indicator of sensitivity (the ability to generate problems in response to problems encountered). Adams and Hamm (Wijaya) states that the creative thinking ability is a natural potential that is owned by humans and can be improved through awareness and practices. The focus of creative thinking lies in the product of originality for oneself, not the invention of ideas that no one has ever known before. It can also be a combination of ideas into something more interesting.

Preliminary observations are based on consideration of school ranking factors. School ratings are closely related to students' ability to understand the material, and the application of mathematical concepts. The application of mathematical concepts is essential for developing the creative potential of the individual. This is because each individual has a unique creativity. The goal is to anticipate possible student responses. Anticipation is didactic and pedagogical. Stimulates the ability to think through imaginative tests aims to see how far the students' abilities. Test geometric material questions refer to each of the 4 indicators.

The results of the test analysis show that students have difficulties in flexibility indicators to make mathematical models, originality combines ideas and elaboration in making conclusions. The cause of the

students has not been optimal in creative thinking that is the fear of failure, the difficulties in the image aspect and the solution with different variation. The reason for the difficulties is also because students have not written alternative solutions. When learning teachers have not focused on empowering the creative potential of students. It is also mentioned Guilford (Munandar) that educational emphasis is more on memorizing and looking for the right answer to the questions given. So the process of creative thinking is rarely trained. Further observations are reviewed on teaching materials and the learning process tends to be limited to partial cognitive strategies. Oriented to the achievement of certain cognitive goals. Geared to remember and master the material so that students become smart theoretically. Mathematical exercises that are algorithmic, mechanistic, and routine. Activities and problems solved by students do not include indicators of creative thinking. Teachers have not provided instructional materials in the form of activity sheets that focus on create or creative thinking.

II. LITERATURE

2.1 *Creative Thinking Ability*

Rose and Malcom creative always demands a lot of hard work and requires careful preparation. The key to creativity is to acquire knowledge into a detailed background of the subject. The reason creativity is a recombination of existing ideas. Creativity is conferred on individuals who can manipulate and manipulate facts and then combine them in new ways. Creativity demands courage, because it will pose a risk and it's hard to get away from conventional thinking. Sternberg (Rose and Malcom) creativity through three stages includes (1) insight: can separate important clues, (2) combinations: combine ideas in a new way, (3) compare old ones with new, it takes time and patience. Conclusion Sternberg mentions that to be creative even also requires perseverance. This is in line with Munandar's opinion) that creativity is the result of interaction between individuals and their environment. Creativity is concerned with cognitive and affective factors. Cognitive has *aptitude* (affective) while affective has *non-aptitude* features. The implications of creative ability can be improved through education.

Abidin mentioned that some of the skills of one of them are important creative thinking skills. The creative thinking ability to must be mastered by students in this century. This is the basis of the concept of multi literation learning. Thinking ability is a complex set of skills that can be trained from an early age through the process of thinking. Every individual's thinking process is different. According to Abidin creative thinking viewed from various concepts. If creative thinking is viewed from the cognitive then creative thinking is a technique of idea creation widely, innovation from the past, adopting new ideas. If creative thinking is viewed from the psychomotor then creative thinking is a skill to create new ideas and valuable (either in the form of additional concepts and radical concepts). Ability to explain, refine, analyze and evaluate own ideas in order to increase creative effort. If creative thinking is viewed from an attitude then it is open to new ideas.

Munandar that creative is the result of learning that is revealed verbally in the creative thinking ability and creative attitude. The creative thinking ability can be interpreted as the level of the child's ability to think as much as possible, as varied as possible and relevant, the answer to a problem, flexible, original and elaborated, based on available data and information. Fisher et al, (Abidin) basic components and an indicator in creative thinking that is newness and usefulness. Newness if it contains an element that is different from the opinion that Fisher usually expressed, although never put forth by others. Elements of usefulness if adding personal quality that is useful for audiences. Munandar explains that the optimal development of creative thinking ability is closely related to the way of teaching. Teachers have confidence in the child's ability to think and dare to come up with new ideas, and when children are given the opportunity to work according to their interests, so creative abilities can grow. Preisseisen (Yamin [7]) that metacognitive strategies include 4 types of skills including: problem solving skills, decision making skills, critical thinking skills and creative thinking skills.

2.2 *Metacognitive Strategy*

According to Adams and Hamm (Wijaya) the creative thinking ability can be improved through awareness and practice. The main control of thinking activity is awareness. The awareness of thinking is relevant to metacognitive terms. Metacognitive as a learning strategy is needed to systematically manage knowledge. Lester [8] metacognition that includes awareness of cognitive processes and regulation is an important part of the solution. Metacognitive strategies can direct students' activities to understand the thinking process they experience. Metacognition introduced by Flavell in 1976 (Sastrawati [9]) is the awareness of one's thinking, about his own thought process. Metacognitive is related to the student's awareness of his ability to develop various ways that may be pursued. Metacognitive contains 3 components namely: planning, monitoring and evaluation.

Metacognitive by Joyce and Calhoun (Yamin) is closely related to constructivist in building student knowledge. Metacognitive strategy can awaken the students in learning and understanding the context studied. This strategy leads students to the thinking process model. There thing need do students includes make focus, emphasizing demonstration values, talking in conversational language, making simple and clear steps, helping

the students remember. According to Yamin the process of metacognitive learning strategies are: preparation; presentation; closing.

Meichenbaum, et al., (Yamin) suggests that metacognition is "the awareness of the person of his own machine of knowledge and of how the machine works." Borich (Yamin) mentions that metacognition is a self directed strategy. Kellough (Yamin) conditions students through metacognitive strategies. Through planning, monitoring, evaluating the progress of thinking and learning. Woolfolk (Yamin) planning in metacognition strategies includes decisions about how much time is needed, strategies used, how to start, and rules that are followed for a task. Further monitoring in metacognitive strategies includes: how to understand, understand the problems and strategies used. Woolfolk also argued that the evaluation includes making conclusions about the process and the outcomes of learning and thinking. Furthermore, according to Anwari [10] metacognitive can increase understanding, complex learning from familiar problems, designing notes, discussions, and scaffolding in learning. One of the important metacognitive reasons in learning can make learning more meaningful. Gain a deep understanding of the problem.

Therefore, the advantages of metacognitive strategies that can help students to solve problems through the design of completion effectively. Teachers guide to positive thinking. It directs students' cognition capable of controlling the ongoing thinking process on their own. Students are more inclined to discuss problem solving. Besides, the weakness is difficult in managing the right time. Difficulty in making activities according to learning style. Difficulty in making discussion groups.

2.3 *Development Student Worksheet*

Teaching materials are an important learning element to be noticed by teachers. Hamdani [11], Majid [12] and Ibrahim [13] teaching materials mathematics is a set of information materials, tools or texts that teachers need in teaching and learning activities. There are a number of reasons why teachers need to develop SWS, namely: the availability of materials according to curriculum demands, target characteristics. There are various categories of teaching materials, Majid and Hamdani explain that based on the technology used, teaching materials are grouped into several categories: printed materials: handout, book, module, students worksheet, brochure, leaflet, wall chart, photo, model. Audio teaching materials: cassette, radio and audio compact disc, CD. Audio visual teaching materials: video compact disk, movie, VCD. Visual teaching materials: photos and pictures. Interactive multimedia teaching materials: CAI (Computer Assisted Instruction), compact disk (CD), and web based learning materials. SWS (student worksheet) is a sheet containing tasks that must be done by students (Majid). The existence of SWS aims to provide ease of teachers in accommodating different levels of students' abilities. SWS to be developed in accordance with the metacognitive component. The test used to determine the ability of students (Trianto [14]).

According to Akker (Rangkuti [15]) and Nieveen [16] say that a learning material are validity, practical and effective. Further the researcher modify from Nieveen development procedure refers to teaching materials are said to be good if includes the validity and effective criteria. The validity criteria of teaching materials is linked to theoretical and consitarian rational (Akker, [17]). General validation criteria are format, language, illustrations, content and learning objectives. The effective criteria are students' classical ability in using SWS, active activities of students using SWS, teacher competence to manage the learning process using SWS; achievement of students' positive responses during learning.

III. RESEARCH METHODOLOGY

Rangkuti mentions the importance of development research systematically and objectively. Subjects are students of grade X 4 SMA N 5 Padangsidimpuan and students of grade X MIA 3 MAN 1 Medan. Instrument for measuring the level of validity SWS is validation sheet. Instruments for measuring effectiveness are observation sheets (active activities of student, teacher competences to manage the learning process) and student response questionnaires. Furthermore, the data are analyzed descriptively for conclusion. Data from a team of experts or practitioners are analyzed to answer whether the developed SWS include the validity criteria. Field trial data to answer whether the developed SWS include the effective criteria.

The indicator of success teaching materials includes validity and effective criteria. SWS validity criteria if value $4 \leq Va < 5$. Effective criteria using SWS includes the active activity of student in using SWS is effective if the average activity in time management, and the teacher competence in using SWS is effective if the average teacher competence value (TCV) for all meetings reaches a minimum criterion is quite good (TCV > 3.00), and achievement of positive responses of students ≥ 75% of the many categories (modified Sinaga [18]). Student's creative thinking ability is complete if the value obtained by students exceeds 2.18 (C + value) and at least 75% complete percentage of classical. The reason for determining minimum score is caused as high order thinking.

The Thiagarajan development model [19] focuses on only 3 stages of the four stages: define, design, develop and disseminate. The following is a brief description of the step: define stage consists of: front end analysis, learner analysis), task analysis, concepts analysis, specifying instructional objectives. Next design

stage consists of: constructing criterion-referenced test, media selection, format selection, initial design. Develop stage consists of: expert appraisal, developmental testing. Disseminate stage only in the trial school that has been done not explained in depth.

IV. RESULT

4.1 Define Stage

Based on direct observation in grade X that the implementation of learning based on the curriculum has not been completely consistent. Educators teach by direct learning. Materials and examples of problems in explain teachers. Students are more focused on summarize the material that is considered important and directed to seek information related to the lesson. Student completed exercises tend to go through routine procedures do not reflect flexible answers and elaboration. Students learn not through the awareness of thinking in completing the task. Characteristics of the grade X students associated with cognitive development according to Piaget, are at the stage of formal operational development. Learning begins with the facts then abstract thinking that is expected to help the students' thinking process. Identify major academic skills through concept maps that describe the concept of distance and angle between points, lines and planes through demonstrations using props or other media. Indicators and learning objectives are tailored to the 2013 curriculum consist of student active, independent students and able to think creatively in: fluency sketching the image of position of point, line and plane, distance of point, line and plane and angle between line and plane; flexible to write mathematical models of varied answers; original in expressing or combining several ideas concerning the position of point, line and plane, the distance and the angle between the line and the plane and its relation; elaboration the conclusions through appropriate and relevant problem solving. Furthermore students appreciate the usefulness of mathematics in life.

4.2 Design Stage

At this stage SWS designing and research instrument as Draft 1. SWS based metacognitive strategy that is designed to contain four indicators (fluency, flexibility, originality, and elaboration). SWS presents thought awareness questions to be considered in the minds of students. Metacognitive questions become controls in own students for creative thinking. Students explore through open ended problems. SWS based metacognitive strategy consists of three components consist of planning (the process of design begins from facts), monitoring (process related to alternative solutions), and evaluating (process of assessing the writing of the evaluation in the form of a summary of the problems presented). SWS developed three topics for each meeting in plan teaching.

Pigure 1: Design SWS geometry based metacognitive strategy

4.3 Develop Stage

4.3.1 Results of Validation Experts

Validation procedure by 5 expert validators and competent practitioners. The objective is to produce a feasible SWS. Expert judiciary through consideration has followed the training Curriculum 2013, P4TK training

and at least 10-15 years in education. The average value of total validity of SWS is 4.03 with valid category. Revisions are emphasized on adjusting images with material, listing instructions, selecting relevant metacognitive questions, language and word choice.

4.3.2 Field Trial

Field trials were conducted each three times, namely trial 1 and trial 2. Field trials to obtain active activities of student data, teacher competence to manage learning process, and student response. The SWS geometry has met the criteria of validity. The next step revises the SWS according to the suggestion from the validator as draft II for trial 1. Trial 1 as many as 30 students of grade X-4 SMA N 5 on March 15 until April 8 2017. The revision result of the improvement of trial 1 as a draft III for the trial 2. While the trial 2 as many as 28 students of grade X MIA-3 MAN 1 on April 10 until May 15 2017.

The researcher acts as an educator in teaching with two observers observing active activities of student and teacher competence. Students with paired learning characteristics and heterogeneous academic ability. The observations focused on the three selected groups. This is done with the consideration of more focused observation results so as to be more accurate. The weakness of trial 1 in analysis for improvement in trial 2. Characteristics of students tailored to match couples and learning styles.

Table 1: Average percentage active activities of student on trial 1 and 2

Times/ meetings	Average percentage active activities of student on trial 1					Average percentage active activities of student on trial 2				
	a	b	c	d	e	a	b	C	d	e
I (2x45')	25,00	16,21	26,85	27,40	4,63	25,47	20,74	26,85	29,17	2,77
II (2x45')	26,39	16,2	26,86	26,85	3,70	25,00	15,74	27,31	29,16	2,77
III (2x45')	26,39	16,67	26,39	27,78	2,77	25,47	15,74	28,24	29,63	0,92
Average percentage	25,93	16,36	26,70	27,34	3,70	25,31	17,40	27,47	29,32	2,15

Table 1 shows that the active activities of student categories for each trial include (a) planning activities, (b) monitoring activities, (c) evaluating activities, (d) activity disclosing reasons, (e) irrelevant activities. Percentage of students frequency in planning activity: listening / explaining the teacher / friend's explanation of the idea of solving in the SWS at meeting I, trial 1 for 25.00% from 90 minutes with observation time unit every 5 minutes. This percentage is derived from the result for the average frequency of activity of 6 students for each category. While the planning activity at the meeting I, trial 2 for 25.47% of 90 minutes also for observation every 5 minutes. Students during the learning process can already do things that have been set so that things that are not relevant to the learning is also not seen significantly. Therefore, the active activities of student on the category for each meeting is at intervals of tolerances.

Table 2: The Teacher Competence Value (TCV)

No.	Categories	Average value trial 1	Average value trial 2
I	Metacognitive Strategy: opening, content (*planning, monitoring, evaluating)*, closing	3,30	3,33
II.	Time management	3,00	3,00
III.	Scaffolding	2,75	2,83
IV.	Manage Classroom	3,02	3,04
Average TCV		3,16	3,19

Table 2 shows that the value of teacher competence in managing learning includes 4 categories consist of average teacher competence trial 1 in the metacognitive strategy of every categories of observation, that is 3.50 for opening activity; 3.34 for content activity; 3.00 for closing activity. The teacher competence value (TCV) trial 1 and trial 2 for each 3.16 and 3.19 with criteria quite well.

Table 3: Student's response to component and learning process

No	Categories	Frequency and Percentage trial 1	Frequency and Percentage trial 2

1	Are you comfortable with SWS and learning process?	comfortable 29 students (96,66%)	no 1 student (3,33%)	comfortable 27 students (96,42%)	no 1 student (3,57)
2	There is SWS. Is it novelty for you?	novelty 29 students (96,66%)	no 1 student (3,33)	novelty 27 students (96,42%)	no 1 student (3,57)
3	Are you clear in understanding language on SWS?	clarity 27 students (90,00%)	no 3 students (10,00%)	clarity 27students (96,42%)	no 1 student (3,57%)
4	Are you interest to read SWS?	interest 28 students (93,33%)	no 2 students (6,66%)	interest 28 students (100%)	no 0 student (0%)

Table 3 shows that the percentage of many students for categories of comfortable, novelty, clarity and interest. Student response data on process and learning component is obtained from questionnaire. Trials 1 and 2 for each categories received a positive response from the students.

Table 4: Students' creative thinking ability in solving SWS problems

No	Value Interval (VI)	Predicate	Trial 1		Trial 2	
			Total of student	%	Total of student	%
1	$0,00 < VI \leq 1,00$	D	0	0%	0	0%
2	$1,00 < VI \leq 1,33$	D+	0	0%	0	0%
3	$1,33 < VI \leq 1,66$	C-	1	3,33%	0	0%
4	$1,66 < VI \leq 2,00$	C	5	16,66%	3	10,71%
5	$2,00 < VI \leq 2,33$	C+	7	23,33%	4	14,28%
6	$2,33 < VI \leq 2,66$	B-	10	33,33%	6	21,42%
7	$2,66 < VI \leq 3,00$	B	5	16,66%	7	25%
8	$3,00 < VI \leq 3,33$	B+	2	6,66%	5	17,85%
9	$3,33 < VI \leq 3,66$	A-	0	0%	3	10,71%
10	$3,66 < VI \leq 4,00$	A	0	0%	0	0%

Table 4 shows that students' creative thinking ability is derived from the smallest average score of 2.18 in the category (C +). So that the students who finished on trial 1 as many as 24 students (80.00%) and on trial 2 as many as 25 students (89.28%). For each trial there were no students on predicate D, D + and A. Scoring technique of indicator in problem focused on fluency range (4 score), flexibility (2 score), originality (2 score) and elaboration (2 score). The fluency indicator scores more because the aspect of drawing sketches requires students to make at least 2 sketches. Based on the established criteria, it is concluded that the students' response has met the effective criteria.

The results of the analysis on trial 1 and 2 can be concluded that the SWS has met the effective criteria. Because the criteria of effectiveness regarding the achievement of active activities of student are at the time of interval tolerance, the teacher competence to manage learning with good enough criteria and positive responses of students. So the SWS obtained after trial 2 are defined as SWS that have met the validity and effective criteria.

4.4 Disseminate Stage

The developed SWS has been validity and effective criteria at the end of the trial 2 as SWS geometry based metacognitive strategy final. SWS development procedures only until the development stage reaches the final stage. The disseminate of the final SWS is not carried out in depth. The disseminate is limited only of grade X students of partner schools and geometry materials to be used in the next semester.

V. DISCUSSION

SWS that have been prepared through the stages of define and design in the form of prototype first tested its validity. The validity aspect of the format, content, and language then assessed by the expert team can satisfy what is measured. Sugiyono [20] states that to obtain what data is measured used valid measuring

instrument. Then the validation must be followed up with the revision. Validity means the instrument can be used to measure what should be measured.

The success of a learning is determined by the activity or learning process that takes place. Active activities of student in the learning process is the involvement of students both physically, mentally, emotionally and intellectually. Viewed from the students, that the student's attention to complete each task given in accordance with the time specified. The activity of teachers is the involvement of teacher in directing and leading the learning process. The teacher competence to manage learning on trial I and trial 2 in the category is good enough. Oprea [21] teacher create opportunities to engage creative and interactive students. The teaching style of teachers plays an important role in shaping student habits through activity. In addition Kuo [22] mentioned the need to show activities and challenges to develop effective learning strategies. One of them is the creative thinking strategy proposed to solve the problem. Refers to the ability to investigate a range of problems through the search for ideas. Creative thinking is the process of going beyond the principles learned and creating new methods for solving problems.

Navarrete [23] in a case study that student-centered learning activities can provide a rich experience and fun learning through a process of creative thinking. While the creative process according to Navarrete as individual creative actions that can be performed in everyday life. In particular, the creative process can be found in each individual as "the capacity to build the original interpretation". In addition, it gives students the opportunity to creative thinking suggested it is important to the fulfillment of personal ability. While Laisema [24] and Chiu [25] encourages students to self reliance through awareness and creativity improved with regard to fluency and originality. The most important things that should be considered by teachers is to let students experience the disguise before giving the scaffolding (Sitorus [26]). So the teachers competence in contributing to situation that provides much needed support to carry out the learning process. Students need help teachers in the process of clarifying facts, concepts, or procedure relating to the subject matter being taught.

If attributed student activity to Vigosky theory states that one's way of thinking must be understood from its interaction. The improvement of one's mental function derives from his social life or group, and not from the individual himself. Social interaction in learning activities with friends in pairs has a great influence in children's thinking. Through this interaction, students can compare the thoughts and knowledge that they have formed with others. Another aspect of Jhon Dewey states that learning based on open ended problems is the interaction between stimulus and response, a relationship between learning and the environment. The environment provides input to students in the form of help and problems, while the brain's nervous system functions to effectively interpret the aid so that problems can be investigated with good solutions. Guilford (Sitorus) creativity is the action of the conscious and unconscious conscious process. Creativity in the right hemisphere tends to think wide, the thought process spreads with emphasis on conformity. With the process and learning activities are expected to provide students as an active and creative learner.

Kashefi [27] pointed out that for students who use the thinking skills required students' creative thinking in mathematics. Characterized by different ways of thinking, knowledge, and information processing. Student creative thinking is a dynamic process that broadens understanding with complex activities. Daly [28] performs creative activities in a discipline through perception. Student perceptions of the creative learning experience in higher education today. A creative skills development facility is required. This is to identify the relationship between the learning experience and the students' creative performance outcomes. SWS based metacognitive strategies are effective in learning mathematics. This is in line with Stephan [29] in mathematical research which recommends that for teachers and students be able to apply metacognitive strategies in mathematics learning, especially those used to improve past learning patterns. Basic metacognitive strategies applied by teachers are one of deep thinking.

The students' creative thinking ability in learning is not enough for only three meetings, but also requires perseverance. In line with this Sannomiya [30] mentions that the process of solving requires different convergent (creative) thinking. The move should consider the various possible causes. Creative is very difficult for most students because of inadequate in pushing ability and level required. In other words, creativity is a remarkable talent. The belief that creativity is an innate and stable character can cause a negative outlook. It is impossible for yourself to produce original creative ideas. But by trying to solve problems from various perspectives. Then students need to believe that creative thinking can be enhanced through training that has an effect on creativity.

Metacognitive related individual awareness in particular takes relatively long time for students. So teachers have difficulty in directing the awareness of individual thinking. Teachers provide guidance to some students who quickly grasp the learning. Consequently there are some students who should be guided but not

getting it. At the time of monitoring the researcher as a teacher should always try to remind the consciousness of thinking. In the beginning, students are still not fluency with sketches, this is due to students' habits on routine problem solving. To overcome this, researchers provide guidance to students who are good at elaboration completion and motivating other students to actively provide elaborates of the settlement in accordance with the material being studied.

VI. CONCLUSION

The development of SWS geometry based metacognitive strategies on 4-D models meets validity and effective criteria. SWS developed with a validation score of 4.03 satisfies the validity criteria of five validators. The developed SWS has also met the effective criteria in terms of active activities of student in the criteria of the ideal time tolerance interval, the largest percentage of time on trial 1 and trial 2 is activity disclosing the reason through discussion to friends or teachers, the teacher competence value to manage learning process on trial 1 and trial 2 with good enough category, and positive response of student ≥ 75% to component and learning process at trial 1 and 2. So that SWS developed have fulfilled criteria.

ACKNOWLEDGEMENTS

Based on the results of the research, the discussions and conclusions that have been presented can be suggested that the ability of creative thinking is recommended that should be focus on indicators originality and elaboration, because these indicators require in depth study.

REFERENCES

[1]. Abidin, Y. (2016). *Revitalizing Assessment of Learning in the Context of Multiliteration Education of the 21st Century*. Bandung: Refika Aditama.
[2]. Munandar, U. (2012). *Development of Gifted Children Creativity*. Jakarta: PT Rineka Cipta.
[3]. Wijaya, A. (2012). *Realistic Mathematics Education: An Alternative Approach to Mathematics Learning*. Yogyakarta: Graha Ilmu.
[4]. Rose, C and Malcom J. N. (2015). *Revolusi Belajar: Accelerated Learning for The 21st Century/* Penerjemah.Dedy Ahimsa; ed. Ruwanto. Bandung: Nuansa Cendikia.
[5]. Hevy, R. M. (2014). ICMSE, [Online] *http://icmseunnes.com/wp-content/uploads/2015/10/21.pdf*, accessed on August 1, 2016.
[6]. Kusumah, Y. S. (2015). *Innovation of Mathematics Learning in Curriculum Implementation 2013*. Paper Presented in National Seminar organized by Indonesian Mathematics Professional Association. UNIMED, 21 November.
[7]. Yamin, M. (2013). *Strategies and Methods in the Learning Model*. Jakarta: Press Group.
[8]. Lester, F. (1975). Developmental Aspects of Children's Ability to Understand Mathematical Proof. *Journal for Research in Mathematics Education*.
[9]. Sastrawati, E., (2011). Problem Based Learning, Metacognition Strategies, and High-Order Thinking Skills of Students. *Jurnal Tekno-Pedagogi.* Vol.1. No.2. Hal: 1-14. ISSN 2088-205 X.
[10]. Anwari, I. et al. (2015). *Implementation of Authentic and Assessment through STEM Education Approach to Improve Student's Metacognitive Skills*. Vol 1, no 3. *K-12 STEM Education.*
[11]. Hamdani. (2011). *Teaching and Learning Strategies*. Bandung: Pustaka Setia.
[12]. Majid, A. (2011). *Lesson Planning: Developing Teacher Competency Standards*. Bandung: Remaja Rosdakarya.
[13]. Ibrahim. (2011). Development of School Based Mathematics Teaching Material Problems Open to Facilitate Achievement of Critical and Creative Thinking Skills Mathematically Students. Jakarta.
[14]. Trianto. (2011). *Designing Innovative-Progressive Learning Model*. Jakarta: Kencana.
[15]. Rangkuti, A. N. (2014). *Educational Research Methods: Quantitative Approach, Qualitative, PTK, and Research Development*. Bandung: Citapustaka Media.
[16]. Nieveen, N. (2007). An Introduction to Education Design Research. China. (www.slo.nl/organisatie/international/publications, accessed on October 10, 2016).
[17]. Akker, J.V.D.(1999). *Design Approaches and Tools in Education and Training*. Kluwer Academic Publisher.
[18]. Sinaga, B. (2008). Development of Mathematical Learning Model Based on Batak Culture-Based Problems (PBMB3). *Research Report*. FMIPA Unimed, Medan.
[19]. Thiagarajan. (1974). *Instructional Development for Training Teachers of Exceptional Children: a sourcebook,* Washington Indiana Univ., Bloomington.
[20]. Sugiyono. (2015). *Metode Research and Development/ R&D*. Bandung: Alfabeta.
[21]. Oprea, C. L., (2014). Interactive and creative learning of the adults. *Procedia: Social and Behavioral Sciences*, 142, 493 – 498.
[22]. Kuo,F. R., Nian S. C., & Gwo J. H. (2014). A creative thinking approach to enhancing the web-based problem solving performance of university students. *Journal Computers & Education*, 72, 220–230.
[23]. Navarrete, C. C., (2013). Creative thinking in digital game design and development: A case study. *Journal Computers & Education*, 69, 320–331.
[24]. Laisema, S., & Panita W., (2014). Design of Collaborative Learning with Creative Problem-Solving Process Learning Activities in a Ubiquitous Learning Environment to Develop Creative Thinking Skills. *Procedia: Social and Behavioral Sciences*, 116, 3921 – 3926.
[25]. Chiu, Fa C., (2015). Improving your creative potential without awareness:Overinclusive thinking training. *Journal Science Direct Thinking Skills and Creativity*, 15, 1–12.
[26]. Sitorus, J. & Masrayati,. (2016). Students' Creative Thinking Process Stages: Implementation of Realistic Mathematics Education. *Journal Thinking Skills and Creativity*, 22, 111–120.
[27]. Kashefi, H., Zaleha I., & Yudariah M. Y., (2012). Supporting Engineering Students' Thinking and Creative Problem Solving through Blended Learning. International Conference on Teaching and Learning in Higher Education (ICTLHE 2012) in conjunction with RCEE & RHED 2012, *Procedia - Social and Behavioral Sciences*, 56, 117 – 125.

[28]. Daly, S. R., et al. (2016). College students' views of creative process instruction across disciplines. *Journal Thinking Skills and Creativity*, 22 1–13.
[29]. Stephan, D.T and G. Kotze. (2009). *Metacognitive Strategies in the Teaching and Learning of Mathematics*. Pythagoras. University of the Free State at December.
[30]. Sannomiya, Machiko & Yosuke Yamaguchi. (2016). Creativity Training in Causal Inference Using the Idea post-Exposure Paradigm: Effects on Idea Generation in Junior High School Students. *Journal Thinking Skills and Creativity*, 22, 152–158.

Tetty Khairani Nasution. "Development of Student Work Sheet Geometry Based Metacognitive Strategy Through Creative Thingking Ability." IOSR Journal of Research & Method in Education (IOSR-JRME) , vol. 7, no. 4, 2017, pp. 10–18.