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DESIGN OF MATHEMATIC LEARNING BASED ON COGNITIVE STYLE

Warli (warli_matpend@yahoo.com)
Mu'jizatin Fadiana (lkituban@gmail.com)

Departement of Mathematics Education, University of PGRI Ronggolawe, Tuban

Abstract

Cognitive style is an individual characteristic in terms of feeling, remembering, organizing, processing, and solving the problems. This paper aims to describe the design mathematic learning based on particular cognitive style reflective vs impulsive. Cognitive styles tend to be fixed on the child, so that the learning is more effective when the learning designed based on cognitive styles. To design the learning will be used method development of Plomp (1997), which consists of five phases, namely: (1) the initial assessment phase, (2) the design phase, (3) the realization /construction phase, (4) test, evaluation and revision phase, and (5) the implementation phase. The result showed that the syntax of the mathematic learning based cognitive styles as follows: (a) introduction, (b) present information, (c) Organize students in groups based on cognitive styles, (d) lead the discussion and presentation, (e) problem-solving exercises, and (f) close/evaluation. Furthermore, to assess the quality of mathematics learning design based on cognitive style used criteria of Nieveen (1999), among others *the validity, practicality, and effectiveness.*

Key words: learning, cognitive style, reflective, impulsive, and problem solving.

INTRODUCTION

Design the innovative learning mathematics becomes an integral task for a mathematic teachers. Many aspects that form the basis for designing innovative learning, from events before learning, during the learning and after learning to produce effective and efficient learning. Suryadi & Turmudi (2011) thought process that teachers are divided in three phases *ie* before learning, during the learning, and after learning. The results of the analysis of the process has the potential to generate innovative didactic design, and all three processes can be formulated as a series of steps to produce a new didactic design. When learning takes place is the most widely used source of basic in design learning.

Student as learning objects, has a lot of diversity in the intelligence, cognitive style, interests, and talents. It is also to be considered in designing an effective and an efficient learning. According to Teng Fatt (2000) ideally, the way teachers teach should match the way students learn. The concern of teachers should be the students' style of learning. Teacher can adapt their teaching styles to suit the learning styles of students. The aim is to understand from the heterogeneous of student learning styles the group learning style so that teachers can adapt their teaching style and materials to suit the students' group learning style. However, design the learning based on the way students learn is rarely done by teachers. This is in line with Suryadi & Turmudi (2011) says that the lesson plans are usually less considering the diversity of the student response to the situation that developed didactic. As a result, most likely developed didactic does not match the diversity learning trajectory of each student's learning.

This paper aims to describe the design of the learning based on the cognitive styles of learners. Why cognitive styles are considered important variables to be accommodated in learning. Some of the reasons include: According Thornell (1976) The sensitivity of the teacher in dealing with individual students differences in cognitive style in his classroom may be a significant influence in facilitating learning. Following the identification of relative individual defferences in cognitive style of students in a classroom, the teacher can provide a multiplicity of strategies and techniques to determine which seem to be most feasible, in terms of class time and effectiveness, for analytic and global children. Line with this matter, Joyce, Weil & Calhoun (2009) says that learning style is very important, because it is a style of expression that education is closely related to the uniqueness of each individual. These individual differences should be appreciated, because style is an expression of the uniqueness of individual personality. Similarly Hayes & Allinson (Riding & Sadler-Smith, 1997) argued that cognitive style my be an important factor in determining how individuals operate at each stage of the learning cycle. Additionally, according Riding & Rayner (2005: 161) cognitive style appears to be a comparatively major influence on learning performance both at the specific level of interacting with material structure or presentation mode, through to the level of overall attainment at public examination. Since style is unrelated to intelligence, it represents an under-researched area in connection with learning and instruction. Furthermore Riding & Rayner (2005: 161) explains that one way of improving learning performance is to adapt the mode of presentation to suit the individual student. This is particularly so for student of lower ability for whom style presentation matching is likely to be more crucial because of their limited processing capacity.

The advantages of learning based on the cognitive styles of learners, learning can be more effective and efficient, because according to the learning style of the learner possessed. Additionally, according to Joyce, Weil & Calhoun (2009) by utilizing cognitive style, teaching model can avoid two mistakes. First, the assumption that the teaching model is a model that has a suitable and fitting as well as patents for use, so the model must be applied in order to get the best results. Second, the assumption that each student has a learning style that does not fit in may be changed or repaired. Both of these errors are equally would lead to a very bad dilemma. Therefore, if the model is not appropriate instruction used by teachers who also have a rigid teaching style, then this will cause a destructive collision unavoidable. Another advantage, according Riding & Sadler-Smith (1997) It is possible to suggest a variety of ways of designing training which (i) matches the mode of presentation of imformation to each aspect of the Verbaliser-Imager dimension or provide a balanced mode of presentation, and (ii) compensates for the deficiencies of each aspect of the Wholist-Analytic dimension.

Based on the above description, it is necessary to design a model of learning which accommodates students' cognitive styles. Riding & Rayner (2005: 161) explains that research is needed to consider the practical application of individual differences in style to the type of teaching and instructional presentation a student receives. A pedagogy which incorporates style led differentiation will achieve authentic accommodation of individual differences in the classroom. Further studies are necessary to facilitate such approaches in teaching and training. This research question is how to design a mathematical model of learning based on students' cognitive styles? The purpose of this study is to describe the design of mathematical learning model based on cognitive styles. Cognitive style in this study is limited to cognitive style put forward by Jerome Kagan, namely Reflective vs Impulsive. Kagan and Kogan (1970) defines reflective-impulsive is the degree/level of accuracy in describing the subject of the alleged settlement problems containing uncertainty answers. When the aspect of time (variable level) is divided into two, namely fast and slow, then the aspect of uncertainty (variable uncertainty) is divided into carefully/accurately (answer frequency slightly) and not accurate/not accurate (frequency answered a lot), then the students can be grouped into 4 (four) groups, namely:

group of students quickly and carefully, slowly and carefully (reflective), fast and inaccurate (impulsive), and the slow and careful. So, a child who has the characteristic quick in answering the problem, but no/less accurate, so the answers tend to be wrong, the child is called impulsive cognitive style. Child who has the characteristic slow in answering the the problem, but carefully/accurately, so that tends to be the correct answers, the child is called a reflective cognitive style. (Warli, 2010b).

RESEARCH METHOD

This research aims to develop a model of mathematical learning based on cognitive styles, so this kind of research including research development. The design research used is the design development by Plomp (1997). To develop a model of mathematical learning based on cognitive styles many aspects that need to be met, so that the models are designed in accordance with the model of good teaching. Joyce, Weil, & Showers (1992 : 14) suggests five essential elements as a description of a learning model, namely (1) syntax, which is a sequence of events is usually called phase; (2) the social system, the role of teachers and students as well as types of rules are required, (3) the principles of reaction, ie, to give an idea to the teachers on how to view or respond to student questions, (4) support system, which is the condition required by the model, and (5) the impact of instructional and accompaniment; The impact of the instructional learning outcomes are achieved by directing the students directly on the desired objectives, while the impact of other learning outcomes accompaniment is produced by a process of learning, as a result of the creation of a learning environment that is experienced by students directly without the direct guidance of a teacher.

As mentioned above, to develop a learning model with the five elements mentioned above, the development of the model will be used Plomp (1997) which consists of 5 stages, namely:

1. Initial Assessment Phase. This stage is the analysis phase needs or problems. This stage includes: (a) identifying information, (b) the analysis of information, (c) defining the problem, (d) plan follow-up activities.
2. Design Phase. Activity at this stage is to design completion problems identified in the first phase.
3. Realization/Construction Phase. At this stage the prototype made as the main design of the learning model will be developed.
4. Stage Test, Evaluation, and Revision. This stage aims to consider the quality of the design developed, and make decisions through careful consideration. The evaluation includes a process to collect and analyze information systematically. This is done to assess the quality of the selected solution. Subsequently revised and then back to the activities of designing, and so on. This is a cycle that occurs feedback cycle and stopped after obtain the desired solution.
5. Implementation Phase. At this stage after the solutions have been obtained through evaluation. The breakdown is considered to meet the problems encountered. Because the chosen solution can be implemented or applied in real situations.

Furthermore, to assess the quality of mathematical learning model of based on cognitive styles used criteria Nieveen (1999), which meets the validity, practibility, and effectiveness. However, in this article was at the stage of realization/construction, was the next phase includes assessing the quality of the learning model is still trials in SMP N 5 Tuban, East Java

RESULT AND DISCUSSION

After the stages proposed by Plomp, and with regard to the components of the learning model proposed by Joyce, Weil, & Shower, the result can be described as follows.

1. The Initial Assessment Phase,

Differences cognitive styles of students, causing diversity in mathematics ability. Research on children's reflective thinking processes and impulsive children in solving geometry problems concluded that: Students impulsive problem-solving process is done in a holistic manner. Students who are less impulsive careful at this stage of work (a little trial and error), direct work, so the answers obtained a lot, but it tended to one (Warli, 2009). Research on children's mathematical skills of reflective and impulsive children concludes that: There is a significant difference between the mathematical skills of students cognitive style reflective and impulsive cognitive style of students. Students who demonstrate reflective cognitive style better math skills than students impulsive (Warli, 2010a). And other research conducted by the Warli (2010b) on the profile of student creativity reflective cognitive style and impulsive cognitive style of students in solving geometry problems concluded that: Profile reflective of student creativity in solving geometry problems tend to be high. Profile impulsive student creativity in solving geometry problems tend to be very low.

To design a math learning that accommodates cognitive style, there are several things to consider, so that learning can be effective and efficient. For it is necessary to identify learning strategies, learning tasks and learning system (individual or group) may even design appropriate scaffolding to be arranged. According Riding & Rayner (2005) required on the identification of strategies for particular styles and specific types of learning tasks. Further research is then necessary to see how student can be helped to develop strategies that will enable them to deal with learning materials that they would naturally find difficult. Further, Riding & Sadler-Smith (1997) suggest three types of interventions to facilitate learning: 1) improving job-individual fit; 2) improving the effectiveness of training interventions; 3) managing group compositions.

Each student has a different cognitive styles, this diversity should also be considered an appropriate approach to design learning mathematics based on cognitive styles. Sadler-Smith & Riding (1999) there are a number of approaches to acknowledging and accommodating individual differences in preference and style: (a) matching students' preferences with the intention that this will have some beneficial effect on learning performance; (b) mismatching learners preferences in order that they may become more 'rounded' as learners (as suggested by Honey & Mumford, 1992); (c) selecting instructional methods and media on the basis of their intended purpose without reference to learner preferences.

In addition to some of the results of research and expert opinion as identification information, the author also examines the learning of mathematics now. Some results of studies and interviews with some math teachers use curriculum in 2013 gained some major problems as follows: a) The material in the mathematics curriculum in 2013 and tend to be much more emphasis on problem solving and have a systematic sequence of slightly different material to the previous curriculum; b) Problem solving is directed to solving some of the problems that are used in the mathematical olympiad; c) Learning-oriented mathematical model of problem-based learning with a scientific approach; d) Means of support is still limited.

2. The Design Phase

Learning math is basically a process of goal-directed learning. The purpose of mathematics learning in terms of cognitive is the transfer of learning. Hudojo (1988:102) states, transfer of learning with regard to the existence of a mathematical concept that has been organized in the mind so that with the concepts and theorems can be used to solve the problems encountered. Transfer learning mathematics can be seen from a person's ability mathematics materials that have been studied, both conceptually and practically.

Student difficulties in learning mathematics probability models used seem still rarely done before, so that students still need intervention (scaffolding) from the teacher. For the provision of contextual problems in early learning is good for students, as well as the motivation of the students also will be understand as mathematics are studied more closely with activity. According to Ausubel (in Hudojo, 1988:61) said meaningful learning when the information learned learners can associate new knowledge with its cognitive structure. By learning meaningful learners become stronger memory and learning transfer easily achieved.

Finding mathematical concepts through problem-solving discussion is a good thing, when students understand the direction that the problem will be taken to where the mathematical concepts. One model of the cognitive instructional Bruner (Dahar, 1988:125-126) is studying the discovery (discovery learning). Bruner considers that the study in accordance with the invention actively search for knowledge by humans and it self gives good thing. However, when the student has no idea of the mathematical concepts that can be used, then the student will not succeed and he did not get anything, for it is an important scaffolding role, because it can help students find the idea of solving.

Problem Solving including high-level thinking, for it is not easy for students and teachers to teach. To accommodate the differences in cognitive styles of students, need to emphasize the learning community among students. Vygotsky's theory (in Slavin, 1994:49) emphasizes the sociocultural nature of learning, the students learn to handle the tasks that are learned through interaction with adults and peers. Furthermore, Vygotsky believes that higher mental functions generally comes up in conversation or collaboration between individuals before the higher mental functions were absorbed into the individual. Vygotsky's theory is closely related to learning mathematics. One is the emphasis on the learning community among the students with other students, and between students and teachers and students with learning devices, so that each student gets the positive benefits of such interaction. To accommodate the differences in students' cognitive styles need to be grouped several different cognitive styles of students in a group.

3. The Realization/Construction Phase

Learning mathematics based on reflective vs. impulsive cognitive style performed with cooperative approach to enhance the problem solving capabilities. Two students' cognitive styles, ie reflective and impulsive combined with the cooperative approach and scripted Polya problem solving in mathematics in junior high school to improve problem-solving abilities. Some modifications in the learning model that will be developed are as follows.

Syntax

The syntax for math learning based on cognitive style consists of 6 phases. Phase term here refers to a term used Arends (1997). Phase term can be interpreted as measures of learning activities. Phase of this model are: (1) introduction, (2) the presentation of information, (3) Organize students into groups based on cognitive style (4) discussion and presentation, (5) problem-solving exercises, (6) closing/evaluation. The details of each phase are presented as follows.

Introductory phase, the activities teachers are: (1) organizing classes for learning, (2) form a measure of cognitive style (this is done only one time, ie before the study), (3) deliver the learning objectives and provide motivation, (4) provide information about what the student will do, and (5) describe the problems related to mathematical topics to be discussed. *In the presentation information phase*, the teacher activities are: (1) disclose mathematics information based on problems that have been proposed, (2) a randomized, provide an opportunity for students to present their work. *Phase organize students into groups based on cognitive style*, teacher activities undertaken are: (1) teachers form groups based on different cognitive styles, (2) in addition to cognitive style also consider a student's academic ability, (3) motivate students to be able to work well together to achieve mutual success. *Discussions and presentations phase*, teacher activities are: (1) provide an opportunity for students to discuss more in-depth understanding of mathematical concepts especially in solving problems through the help of student activity sheet (SAS/worksheet), (2) a randomized, provide an opportunity for students to present their work, (3) gives opportunity for other students to respond to the results of his presentations, and discussions, (4) facilitate class discussion, and (5) guiding students to work on and understand the problem correctly. and (6) provide reinforcement for students who answered correctly, and provide guidance for students whose answer is not correct. *Phase of problem-solving exercises*, teacher activities are: (1) provide problem-solving exercises, (2) provide opportunities for students to work on the problems and present the results of his work in front of the class, (3) provides the opportunity for other students to respond to the results of his work, (4) provide reinforcement for students who answered correctly, and provide guidance for students whose answer is not correct. *In the closing/evaluation phase* is the final lesson, the teacher guiding students to summarize the lesson and give homework.

The syntax described above is a general pattern in a flow activity, and if there is an excess on a meeting time, then before entering the closing phase, the teacher can go back to the second phase, and so on.

Social systems

Social systems are the roles and relationships between students and teachers as well as the norms prevailing in the model. In mathematics learning based on reflective impulsive cognitive style, among students who have speed and accuracy different thinking will help each other to achieve common goals and success. Students who impulsive will be helped by an student reflective, so it will be more reflective thinking, and not too fast in making decisions. Similarly, students who reflective will be helped by the impulsive child, they will be faster in thinking while maintaining the accuracy of thinking. So both will complement each other's weaknesses.

Interaction between students occur during group discussions, and class discussions. At that time students had the opportunity to collaborate, each defend opinions, ask each other, help each other, and make agreements. The teacher's role is to guide, direct, and control nets discussion. Thus, the social system based on mathematics learning reflective impulsive cognitive style are environmentally sensitive, cooperative, and democratic.

Principles of Management/Reaction

Reaction principle relates to how teachers attent and treat students, including how teachers respond to questions, answers, responses, or what was done the student. The principle of this model of learning with a focus on: (1) the principle of engaging students to be able to discover mathematical concepts and problem solving skills with attention to cognitive style (speed and accuracy of thought), (2) interaction with peers and teachers, and (3) the implementation of activities a job well done.

In mathematical learning model based cognitive style is the teacher acts as a facilitator, motivator, mediator and consultant. As a facilitator, the teacher provides learning resources and provide assistance so that students are able to organize the knowledge and skills to find the rules, relationships and structures are not yet known. As a motivator, a teacher should always encourage students who have to work well to further improve the quality of their work. As a mediator, the teacher leads the discussion, directing the discussion group and class discussions, so it is effective. The teacher as a consultant is asked when students are having trouble, responsive if the student wishes to express grievances and problems, and to facilitate students to work effectively.

Support System

It is necessary to implement this model of learning is teachers who have extensive knowledge and skilled in managing interpersonal relationships and class discussions. Teachers also must be able to create a classroom climate that is open. At the same time teachers should be able to guide the class toward behavioral assessment, commitment, and follow-up to that behavior. Other necessary support systems are tools of learning, ie learning implementation plan, student books, student activity sheet (SAS), and teacher books.

Impact of Instructional and Accompaniment

In outline, the impact of the learning program is divided into two parts: the impact of instructional and accompaniment impact. Instructional impact is student learning outcomes are achieved by exerting direct students to the competencies expected after completion of a learning program implemented. The impact of learning outcomes other accompaniment is generated during the process of implementation of the program of learning as a result of the creation of a learning environment that is experienced by students without pengarahaan directly by the teacher.

There are two instructional impact on this model. *First*, students can discover and understand mathematical concepts through problem solving. Problem solving, which is used by the teacher through worksheets to help students construct understanding about a particular topic. *Second*, students can apply mathematical understanding of a particular topic. Impact escorts are: (1) students are diligent, honest and brave expression, (2) the student is able to be creative and innovative in solving problems, and (3) students to be democratic, environmentally sensitive, and cooperative.

Organizing Learning

In general, the organization of learning activities include organizing teacher, student activities, materials, and assignments. Organizing activity of teacher include: 1) Giving apperception and motivation to students. 2) The teacher facilitates the students to conduct discussions and presentations. 3) The teacher facilitates the students acquire mathematical concepts. In this case the use of student books and worksheets are integrated. 4) The teacher facilitates the students to be able to apply mathematical concepts in solving problems in accordance with the purpose of learning. 5) The teacher facilitates the students to summarize the subject matter.

Organizing student activities carried out in two stages, namely: (1) a group activity, and (2) individual activity. Activities conducted during the students' group discussions, ie when working discussions and presentations, while the activity of individual students performed at the advanced trainee (evaluation). Individually, students trying to work on the problems (problems) in the worksheet, and then discuss the results in the classical with the guidance of a teacher. This activity is very important, because the expected acquisition of mathematical concepts is constructed solely by students through worksheets working, then the result of the interaction with the class (other students) are expected to strengthen mathematical concepts obtained.

CONCLUSION AND SUGGESTION

Learning math based on a cognitive style was learning designs that accommodate student differences in learning, especially reflective vs. impulsive cognitive style. To accommodate the cognitive style, before learning of cognitive style measurements, eg for reflective vs. impulsive cognitive style could use the MFFT (Matching Familiar Figures Test). Cognitive style is fixed, for the measurement is only done once. The detailed syntax can study are presented in Table 1 below.

Tabel 1. The Syntax of the Mathematic Learning Based Cognitive Styles

No	**Phase**	**Teacher Activity**
1	Introduction	Teachers express purpose of learning and to motivate, provide information about what students will do, and explain the problems associated with mathematical topics that will be discussed
2	Present information	Teachers presenting information based on problems that have been proposed.
3	Organize students in groups based on cognitive styles	Teachers form groups based on different cognitive styles, also consider the student's academic ability, as well as motivate students to be able to work well together to achieve mutual success.
4	Lead the discussion and presentation	Teachers provide opportunities for students to discuss more in-depth understanding of mathematical concepts especially in solving problems through the help of worksheets, the teacher gives students the chance to present, responding to his work, as well as guiding and provide reinforcement for students who answered correctly, and provide guidance for students the answer is not correct.
5	Problem-solving exercises	Teacher giving exercises problem solving, giving students the chance to work on the problems and present the results of their work to the class.
6	Closing/evaluation	Teachers guide students to summarize learning, conduct evaluations and provide homework.

As described in research methods, that to judge the quality of mathematical learning model based cognitive style used Nieveen criteria (1999), which meets the validity, praktikabilitas, and effectiveness. At this writing has not been able to analyze the validity of the results, praktikabilitas, and effectiveness, as research is still being testing stage. So it is still possible syntax above revised after dinalisis trial results. Above learning phase is designed for learning mathematics and is being piloted in Class VII SMP N 5 Tuban, researchers suggested to other researchers, if interested in trying out the syntax in junior high with a different class (VIII or IX) or in high school. This will reinforce the conclusion that the test results obtained. Thank you, may be useful.

REFERENCES

Arend, R.I. 1997. *Classroom Instruction and Management.* New York: McGrawhill Companies Inc.

Dahar, R.W. 1988. *Teori-Teori Belajar.* Jakarta: Depdikbud.

Hudojo, Herman. 1988. *Mengembangkan Kurikulum dan Pembelajaran Matematika.* Jurusan Pendidikan Matematika FMIPA UM Malang.

Joyce, Bruce; Weil, Marsha & Calhoun, Emily. 2009. *Models of Teaching*. Eighth Edition. New Jersay: Pearson Education, Inc Publishing as Allyn & Bacon

Joyce, Bruce; Weil, Marsha; & Showers, B. 1992. *Models of Teaching*. Fourth Edition. Boston: Allyn & Bacon.

Kagan, J and Kogan, N 1970. *Individual Variation in Cognitive Process.* Dalam Mussen, P (Edt.) Carmichael's Manual of Child Psychology (3rd ed. Vol. 1), New York: Wiley.

Nieveen, Nienke. 1999. Prototyping to Reach Product Quality. In Jan Van den Akker, R.M. Branch, K. Gustafson, N. Nieveen & Tj. Plomp (Eds). *Design Approaches and Tools in Education and Training* (pp 125 – 135) Kluwer Academic Publishers, Dordrecht, the Nederlands.

Plomp, Tjeerd., 1997. *Educational and Training System Design.* Enschede, The Netherlands: Univercity of Twente.

Riding, Richard & Rayner, Stephen. 2005. *Cognitive Style and Learning Strategies Understanding Style Differences in Learning and Behaviour.* Canada: David Fulton Publishers.

Riding, Richard & Sadler-Smith, Eugene. 1997. Cognitive Style and Learning Strategies: Some Implications for Training Design. *International Journal of Training and Development*. 1:3 199-208. http://www.ncu.edu.tw/nscdsg96.riding-sadler_smith.training/design.pdf Accessed on April 29th, 2013

Sadler-Smith, Eugene & Riding, Richard. 1999. *Cognitive Style and Instructional Preferences*. Instructional Science 27: 355–371, 1999. http://ncu.edu.tw/nscdsg96-sadler_smith-riding-cognitive_style_instructuctional/preference.pdf Accessed on April 29th, 2013

Slavin, Robert E. 2008. *Cooperative Learning Teori, Riset dan Praktik*. Alih Bahasa Nurulita. Nusa Media: Bandung

Suryadi, Didi & Turmudi 2011. Kesetaraan Didactical Design Research (DDR) dengan Matematika Realistik dalam Pengembangan Pembelajaran Matematika. *Prosiding Seminar Nasional Matematika dan Pendidikan Matematika UNS 2011*

Teng Fatt, James Poon. 2000. Understanding the Learning Styles of Students: Implications for Educators. *The International Journal of Sociology and Social Policy* 20. 11/12 (2000): 31-45. http://search.proquest.com/docview/203776455?accountid=62692 Accessed on June 5th, 2013

Thornell, John G. 1976. Research on Cognitive Style: Implications for Teaching and Learning. *Educational Leadership*. 502-504. http://ascd-org_el_197604_thornell.pdf Accessed on July 9th, 2013

Warli. 2009. *Proses* Berpikir Anak Reflektif dan Anak Impulsif dalam Memecahkan Masalah Geometri. ***Paedagogi.*** *Jurnal Pendidikan dan Ilmu Pengetahuan.* Vol. 5 No. 2 Sept. 2009 ISSN 1693-9689 Hal 40 - 56

Warli. 2010a. Kemampuan Matematika Anak Reflektif dan Anak Impulsif. *Prosiding Seminar Nasional di UMM Malang* Tgl 30-1-2010.

Warli. 2010b *Profil Kreativitas Siswa yang Bergaya Kognitif Reflektif dan Siswa yang Bergaya Kognitif Impulsif dalam Memecahkan Masalah Geometri*. Disertasi PPS UNESA Surabaya.