DESIGN OF LEARNING MATHEMATICS USING WEBBED MODELS

Marion
SMPNegeri1 TanjungRaja
marion.rebai@gmail.com

Abstract

The aim of this study is to obtain mathematical learning trajectories that gives greater opportunities to the students on their own to build mathematical knowledge through learning activities using webbed models. Student's center learning builds knowledge like to construct spider webs. Beginning with the giving of the problem individually, students are given the opportunity gradually to attempt to settle their own, then ask peers, read the literature, watch the environment, pay attention to the guidance of teachers like spider makes webs, move freely without being tied down to a classroom layout. Knowledge is formed, being reinforced by classroom discussion, reinforcement by the teacher, and the subsequent confirmation of the wider learning resources such as the Internet, libraries, family and community environment. This study used Design research Methodology with starting point problems or mathematical problem, Hypothetical Learning Trajectory (HLT) shaped spiderwebs and ending points in the form of math learning. The study resulted in Mathematics Learning trajectory shaped spiderwebs that described the activities of students build mathematical knowledge. The results of the questionnaire showed the students were more motivated to learn, do not feel pressured, strengthen the relationship between students and teachers, feel more confident and the results showed a tendency to increase student learning.

Keywords: design of learning mathematics, webbed models

INTRODUCTION

Mathematics is a human activity, according to the Frudenthal (in Wijaya, 2012). Mathematics is not only a product but also a form of knowledge so the activity or process of mathematical thinking. The learning process of mathematics for students will occur if meaningful for learners. Activities are activities that intended learners to rediscover mathematics (The Students reinvent mathematics). As a process of thinking, mathematics has an abstract object of study (Ward,2010). This abstraction is often a problem for students learning maths owe need to bere-examined further. The results of this study introduce to many proposed solutions to overcome difficulties in learning mathematics. For example, learning mathematics using Student Active Learning Method approach (CBSA), Creative and Fun Active Learning (PAKEM), Process Skills Approach, Cooperative Approach, Mathematics Learning Indonesian Realistic Approach (PMRI) and the final implementation of the curriculum offered in 2013 that the scientific approach. The report from some results of studies suggest most of these approaches have contributed substantially in the advancement of learning mathematics. In other words, the application of some of these learning approaches recognized a positive

impact on the development of students in learning mathematics.

In contrast to the above description, the empirical facts on the ground, especially personal experience as a practitioner researcher education, for most students, math is still a big problem if it does not say trouble. The problem in question is partly individual learners who learn math difficulties loss of motivation to learn mathematics. The results of personal interviews with this group revealed that they thought math was misunderstood, rarely given the opportunity to ask, if given the opportunity to feel embarrassed because of fear of ridicule and besides it is not allowed to leave these at when teaching mathematics to ask friends who know more and read the book of difficult to understand.

To solve the problem above, researchers tried to design a mathematical model of learning and researching spider webs. This research question is how the learners' learning trajectories solve mathematical problems in mathematics that uses webbed models and are there any positive effects of learning mathematics that uses webbed model so the activity of learning and understanding of students towards mathematics.

Thus, the purpose of this study is too bta in the trajectory of learners in solving mathematical problems through mathematical learning to use model Spiders and analyze if there is a positive effect of the use of models of spider webs in mathematics learning and understanding of the learning activities of students towards mathematics. Furthermore, the results of this study are expected to be useful for students, facilitate the understanding of the mathematics, useful for, as an effort to improve the quality of learning and for other researchers in an effort to develop a theory of learning.

THEORETICAL FRAMEWORK

1. Stages Of How Children Learn

According to Piaget (in Bell,1981:100) cognitive development of children is affected by (1) maturation, which is a process of intellectual maturation, (2) physical experience, physical experience of the process due to the interaction with objects in the surrounding environment, (3) logical-mathematics experience, the experience which helps to build mathematical scheme suitable experience,(4) social transmition, interaction and cooperation with one another, (5) equilibrium, a process in which the structure of the mental imbalance as a consequence of new experiences to the equilibrium through the process of assimilation and accommodation. In general it can be said that the cognitive development of students affected by the development of the individual. This means that in the learning of mathematics, it is necessary to give each individual the opportunity for learners to construct knowledge independently. Furthermore, Piaget (in Mulyati,2008) asserts thats age thinking children vary according to their developmental stage. Children build their own knowledge structure. They do not passively accept knowledge but organize and transform the knowledge structure. In connection with that learning requires active engagement with the child's physical and mental environment. Suggested less on activities according to this theory, according to Mulyati (2008:5), students need opportunities to learn through activities according to their own pace rather than the rule group. Because of differences in the

pattern of student growth will vary greatly in how they achieved success with certain tasks. The most important of all, students need time and opportunity to classify the composition of their own knowledge. Meanwhile Vigotsky (in Russefendi,1992:23) argues that the learning process will take place in an efficient and effective when the child learn cooperatively with other children in a supportive atmosphere in coaching or mentoring someone who is more capable.

Based on the opinion of Piaget and Vigotsky above, it can be said that the process of learning mathematics or mathematical thinking activity for students would be more effective if the students learn cooperatively with other children in a supportive atmosphere in coaching or mentoring someone who is more capable. Based on the above two theories, the learning of mathematics using the model of spider webs is designed to develop students' cognitive abilities while developing social attitudes and skills of students as mandated by the 2013 curriculum by giving greater opportunities to dig up information from the environment and interact with their environment.

2 . Learning Webbed Models

Learning model with spider webs that there is more inclined to the notion of learning using concept maps in the form of spiderwebs that we are familiar with another term integrated learning or mathematic learning. According to Fogarty (in Resmini, 2012) is a model of learning by starting from athematic approach as alloying materials and learning activities. In this connection, the theme cantie learning activities both in a particular subject and across subjects. To help you understand this model, consider the following picture:

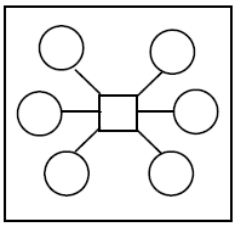

Figure 1. Trend Integrated Learning Webbed Models

In contrast to the above model, the researchers design learning mathematics using webbed models as illustrated below:

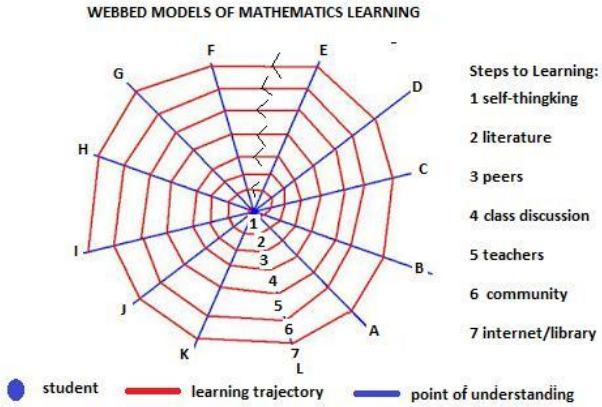

Figure 2 . HLT Model spider webs

Learning to use models of spider webs is centered on the individual student. The illustration aboves hows the path to be traversed student learning, which is when students are given a question or a problem, individual students are given the opportunity (1) to think independently in advance to try to resolve the issues raised. Furthermore, if the problem cannot be resolved, then the student is given the opportunity (2) to read literature or book sources or other supporting books and if not successful, the student is given the opportunity(3) ask the closest peers and when it has not been able to help the students given the opportunity to ask their peers who have first to resolve the issue with outbound where his seat. This means that students are free to leave their seats to meet peers who may be able to help resolve the problem. For comparison and reinforcing his students presented the results in (4)and class discussion (5) directs the teacher to summarize and provide reinforcement. Knowledge that has been formed through learning in this class, students further expanded by adding information efforts through (6) family, is considered an expert or more people to know and other community and (7) the Internet or library.

So in general ,the learning steps using a mathematical webbed models are :

1) Students are given a math problem or issue
2) Students try to solve individually
3) Students try to read the literature supporting
4) Students are asked to nearby peers
5) Students ask peers who are considered better know and can help
6) Students describe their work and other students respond in class discussion
7) Students receive reinforcement and guidance of teachers
8) Students add information independently or in groups via the internet, reading literature in the library, next of kin, people who are considered experts and other communities.

METHODOLOGY OF RESEARCH

This study uses Research Design (Design Research). According Gravemeijer and Eerde (in Zainab, 2013), research design is a method of research that aims to develop local learning theory. While Wangand Hannafin (in Wijaya, 2008) defines a systematic but flexible method, which is intended to improve the practical teaching through analysis through repetitive, repetitive design, and implementation, refers to the collaboration between researchers and

Practitioners in everyday life situations, and leads to the principles and theories that are sensitive and contextual design. Activities of students during the lesson consists of conjectures and thinking strategies learners will be developed in the research.

Design research is "*a cyclical process of thought experiments and instruction experiment*" (Gravemeijer,1994;Sembiring, Hooglandand Dolk,2010 in Zainab,2013). Cyclic process (repeated) which is of a thought experiment intended then to experiment with learning in the form of a diagram illustration of the experimental idea Gravemeijer and Cobb (in Akker,2006) are shown in the image below:

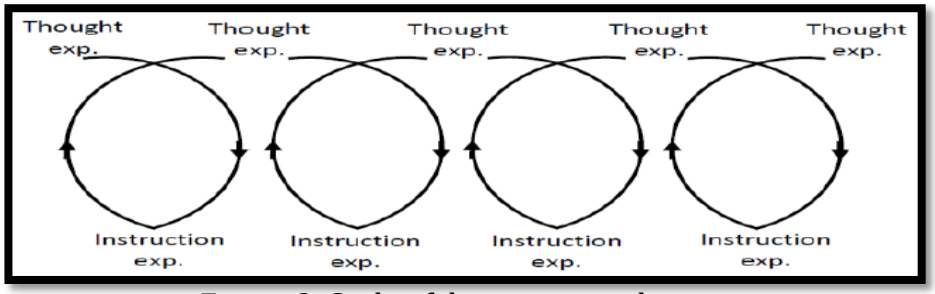

Figure 3 .Cycle of design research

The subjects of this study were grade students of SMP Negeri1 Tanjung Raja class IX.3, Ogan Ilir, South Sumatra, Indonesia school year 2013/2014, amounting to29 students consisting of 13 boy and 16 girl. The procedure consisted of three steps are performed repeatedly until revised discovered a new theory of learning theory is tested, namely the preparation stage (preliminary design), stage of implementation (Teaching Experiment) and evaluation phase (Retrospective Analisys). During the preparation stage are view of the literature on learning theories and learning models in particular model of spider webs, set the starting point in the form of the questions or problem solving appropriate learning materials, set the ending point in the form of students' understanding and designing learning materials include destination Local Instructtional Theory learning, learning activities and devices that assist the process of learning a learning Trajectory Hipotetycal dynamic so that it can be revised during the learning process as shown in Figure 2 above. In the implementation phase, starting with the Local Instructtional Theory on small groups with the goal of understanding and anticipating students thinking strategies that may arise during the learning activity, observations of students during the learning activity undertaken with the purpose of exploring and suspect strategy and thinking of participants students in the learning process really is. These results are used to revise and prepare Local Instructional Theory at subsequent meetings. Last stage of the evaluation, ananalys is of the results of the study by comparing Hipotetycal Learning Trajectory (HLT) with the trajectory of learners in the learning process in order to obtain the actual answer to the problem formulated at the beginning of the study. The data was collected using observations, questionnaires, interviews, photos, videos, and achievementtest. The collected data were analyzed by comparing the results of observations during the earning process that has been designed by HLT on preliminary design stage. This is done because, according to Wijaya (in Zainab,2013), the results of the research design is not the job of designing it but bring the principles to explain how and why such a fine job. HLT in a retrospective analysis that has been designed and then compared with their lessons so that students can be investigated and explained how students acquire mathematical concepts learned.

RESULTS AND DISCUSSION

1. Learning Trajectory

On learning activities using webbed models, found student's learning trajectories in mathematics learning, including the following:

a. Student 1 John Wesley is able to solve a math problem set by the teacher after trying to think independently, earlier than his friends in the class. In this way, John's learning trajectory as figure 4.

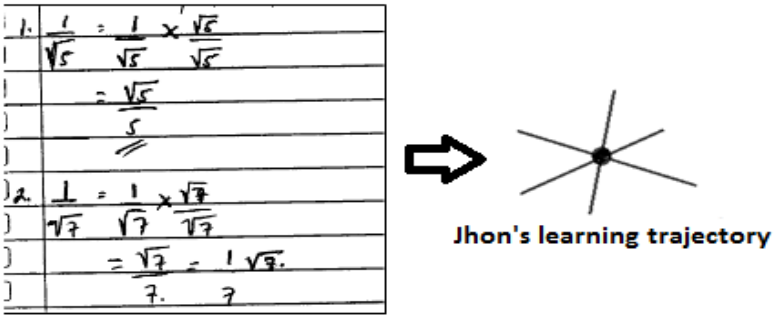

Figure 4. Jhon's learning trajectory

b. Student 2 Adelia Marenstainitiallynot beenable to solve their own math problems setby the teacher.ThenAdelia understandthe math settlementafteraskingthree peers, includingask John.Adelia's learning trajectoryis shown in Figure5.

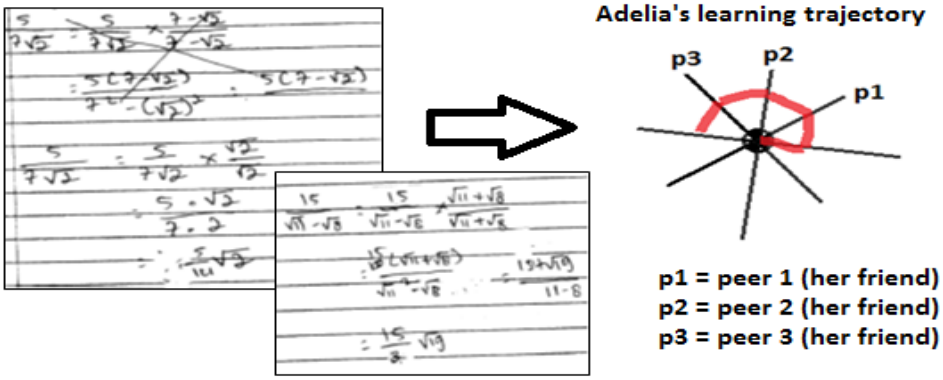

Figure 5. Adelia's learningtrajectory

c. Students 3 Sulaiman understand how to solve math problems after asking two men theme and then read the book. Sulaiman's learning trajectories are shown in Figure 6 .

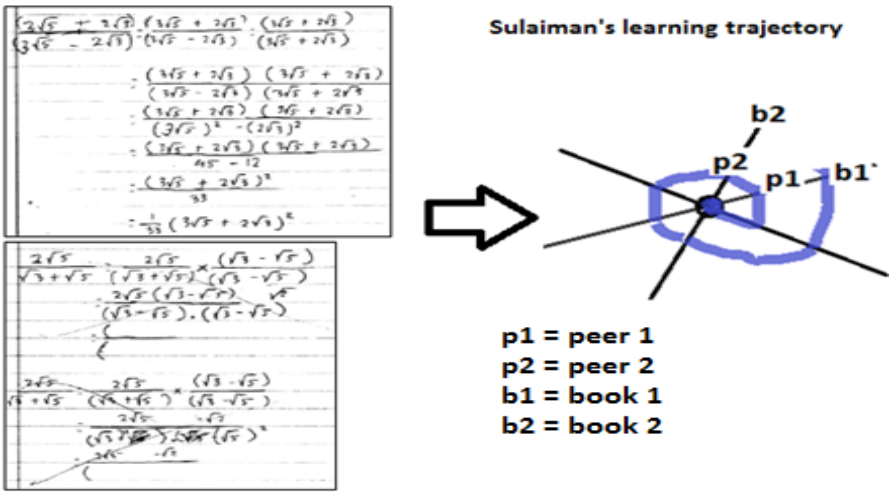

Figure 6. Sulaiman's learning trajectory

d. Student 4 Yandre can understand math settlement after trying to resolve itself supporting reading two books, then enlist the help of two friends, following exposure to a class discussion by observing other students and teachers last aided by reinforcement. Yandre's learning trajectory is shown in figure 7.

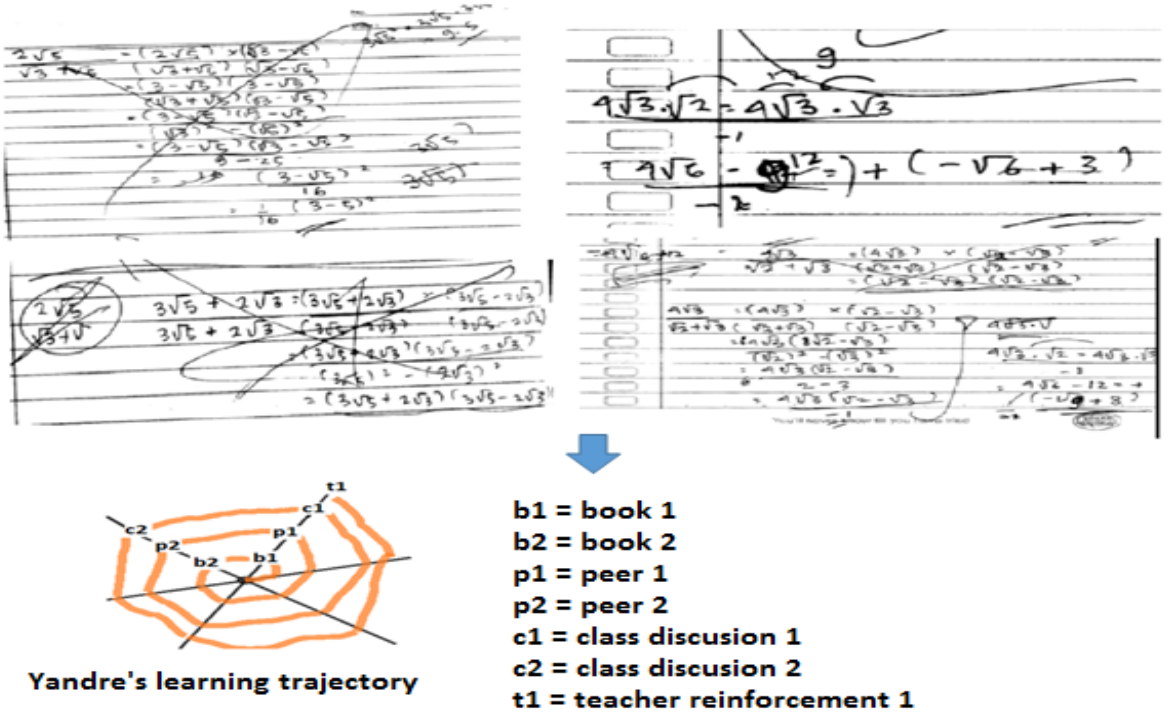

Figure 7. Yandre's learning trajectory

e. Students 5 Zulva Muna Fadhilah can solve a math problem after trying to resolve itself and then access the internet through handhone. Zulva's Learning Trajectory shown in figure 8

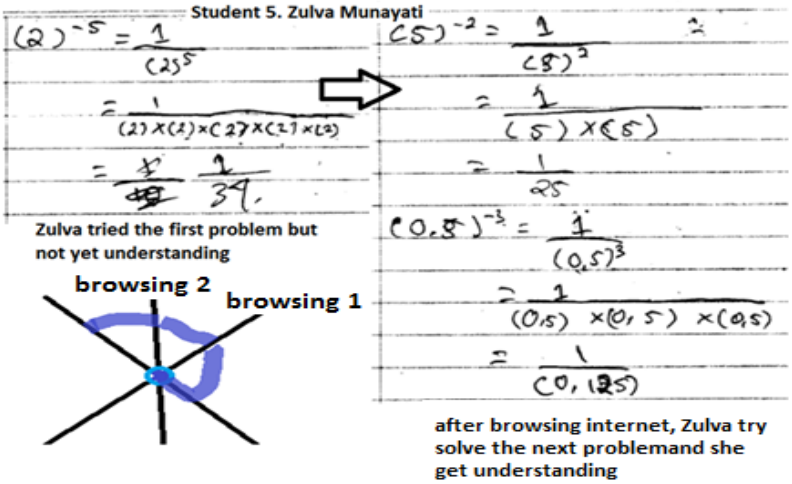

Figure 8. Zulva's learning trajectory

2. Results of Study

Learning results obtained in the early stages obtained an average score of 60 with a standard deviation of 11,3 and the number of students achieving a minimum 65 thoroughness score only 7 of 9 students. Then ext test results obtained by the average score of 57 with a standard deviation of 6,6 and the number of students completed 8 people. While the final test results obtained by the average value of 77 with a standard deviation of 13,6 and 21 students completed the study. See figure 9.

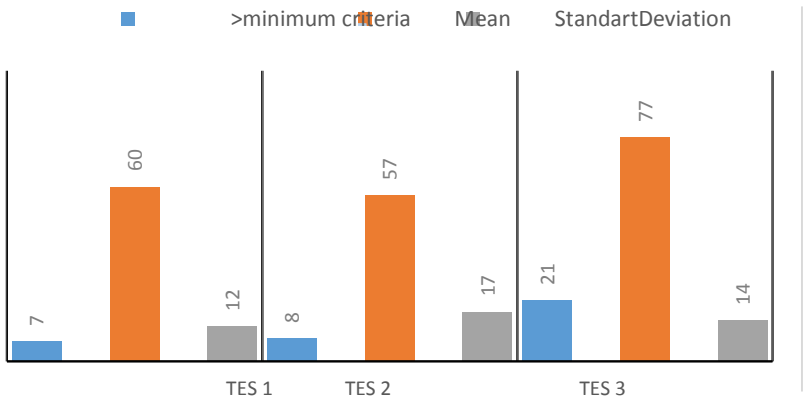

Figure 9. Result of Study diagram

3. Discussion

From the learning trajectory were found in the study above, it appears that every student has a tendency to form mathematical learning trajectories spider webs. As spiders build their nests, most types of spiders make webs began to move from the center of the net, then moves in spirals, forming a spider nest. Similarly, the way students learn, starting from digging yourself capabilities, according to Piaget(inBell,1981) referred to as activities of assimilation and accommodation. Mathematical knowledge gained from previous mathematics learning is the initial schemata are formed in the process of thinking of students. If the schema corresponding to or very helpful given mathematical problem solving so that students are able to finish it, then the process is assimilation, and the problems be solved. Furthermore, if it turns out the initial schemata cannot help the completion of mathematical problems, there will be an imbalance (*disequilibrium*) in the thinking process of students. With simple language students are confused. To resolve this confusion, it would require more information to clarify schemata formed. In this case the student to accommodate as much information from the environment, possibly from its supporting books, explanations peers, class discussion of the results, and the results of reinforcement by the teacher as well as information from broader sources other. Additional information obtained will clarify the initial schemata resulting in cognitive balance. Eventually acquired a new, more complex understanding of the mathematical concepts learned. Thus it can be indicated that students' learning trajectories forming spider webs.

Accordingly, in the process of a multi-property occurs interactions between students and their environment, especially the social environment, according Vygosky (in Russeffendi, 1992) will make children learn more effectively and efficiently. Even if it is connected to the curriculum in 2013, which formed the trajectory learning and develop cognitive aspects (in the process of assimilation), aspects of attitude(on the property)and aspects of skills(problem solving process).

Furthermore, in terms of learning outcomes, the number of students completed consistently increased. While the average value of a decline in the second test. This happens because at the first test models have not been using spider webs in the learning of mathematics and mathematics learning in a second test using a model already spider webs. In the second test the students are not familiar with using a mathematical learning model of spider webs. It looks awkward from the classroom atmosphere. Students still do not dare to ask or discuss with peers away from his seat. Just open a book supporting or discussing with friends. No student who dared to leave his seat to ask their friends.

To overcome this problem teachers motivates that students do not hesitate to ask a friend or teacher even though it had to leave his seat. Teachers also motivate students to seek information from any source that is so much easier to understand math. This efforts enough success, where the results of the third test showed an increase in average learning outcomes. This is reinforced by the declining value of the standard deviation, which means that the gap narrows students' abilities more than ever.

In general it can be said that learning mathematics using spider webs models generate trajectories of learning that make up spider webs, in which students construct their knowledge or solve the problem of trying to start his own according to his ability, and then when experiencing difficulty, dig information of the learning environment (such as reading a book, ask peers, class discussions, strengthening the teacher, ask other family and community as well as browsing the Internet or library).

In addition, the learning of mathematics using webbed models give positive effects for improving the quality of learning and reinforce student's understanding of mathematics. It is shown from the results that increasing student learning and the results of a questionnaire given to students where they all (100 %) responded better understanding of mathematics than to work alone without assistance, more motivated, do not feel pressured because more freely ask anyone in the class and strengthen brotherhood between students and students and students and teachers. Furthermore, students also feel more confident finish the job (86%), more motivated to inquire further to the family at home (69%) and digging through the library and the internet (96%). Students felt the learning of mathematics using a model spider webs very enjoyable (93%)and they suggest that this model of learning can be forwarded to the next lesson-learning.

In addition, there are 39% of students stated rarely asked families at home with family reasons at home do not understand mathematics, very busy family home affairs respectively, was able to understand their own without having to ask the family at home and better understand the search for information on the internet. Only 7% of

students feel less fun with this model because they do not understand their friend's explanation.

CONCLUSIONS AND RECOMMENDATIONS

The study resulted in Mathematics Learning Trajectory shaped spider webs that describe the activities students build knowledge and application of mathematical models of spider webs in the learning of mathematics have a positive effect for the improvement of learning activities and students' understanding of mathematics .

Weaknesses that may become an obstacle in the application of mathematics instruction using the webbed models is the ability of teacher classroom management. Classroom atmosphere that looks crowded and disorganized groups of requiring teachers to have special tricks that activity students can be directed to the purpose of learning. This situation opens opportunities for other researchers in order to enhance mathematics learning activities using webbed models.

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