The Analysis of The Junior High School Student’s Characteristic in the Development of Mathematics Learning Device Based on Quantum Teaching and Learning Models

Y S Pratama¹, H Syarifuddin¹* and A Armiati¹
¹Mathematics Department, Universitas Negeri Padang, Padang, Indonesia
*corresponding author: hendra@yahoo.com

Abstrak. This research has aimed to develop a math learning device based on Quantum Teaching and Learning model for seventh-grade students. The learning device which is developed involves learning implement plan and student’s worksheet. The development model which was used in this research is Plomp model. This research only until prototype development, which discusses character analysis of students during the learning process occurs. In learning with Quantum Teaching and learning device, learners study in a group and discuss to understand the concept, so this activity could facilitate the characteristic of learners whose like to have a group and have a discussion. The finding of this research is expected to increase learners to study mathematics and become more active in the learning process.

1. Introduction
Mathematics is a universal science than underlies the development of modern technology, it has an important role in any academic discipline and develops human thought. Mathematic need to be given to all of the students start from elementary school to tether students with the ability to think logically, analytical, systematic, critical, innovative and creative with the ability to cooperate.

Based on the aim of mathematic, one of the abilities that must be overpowered by the students is mathematical communication ability [1]. Mathematical communication is the most important thing in learning mathematic and one of competency that must be had and developed by the students. This thing suits with Ontario said [2]” Mathematical communication is an essential process for learning mathematics because through communication, students reflect upon, clarify and expand their ideas and understanding of mathematical relationships and mathematical arguments.”

Mathematical communication is also one of the standard processes in learning mathematics. Baroody (in Deswita [3]) said at least there are two important reasons why communication in learning mathematics need to be grown and development among students, they are: 1) mathematics is not only thinking aids, finding pattern aids, solving problem or taking a conclusion, but also as social activity in learning; 2) mathematics as interaction mode between students and teacher. This thing shows that mathematical communication is one of important ability that must be developed in students. The importance of mathematical communication also said by Sumarmo [4], mathematical communication is an important component in learning mathematics, sharing aids, and clarify mathematical discernment. Therefore, mathematical communication is the most important thing in learning mathematics and one of competency that must behave by the students.
But in fact, junior high school student’s mathematical communication ability is still low. It is appropriate with the result of research by Adityawarman [5] and Yumi [6] maintained that the result of junior high school mathematical communication is still low. In that research is explained that communication ability indicators haven’t fully reached, it’s because of students inadequate to solve sort story questions about real life.

Based on the result of the initial ability test which is held in Junior High School at Indonesia hasn’t satisfying. The sum of students who joined the test in the first Junior High School is 29 and the second Junior High School is 20. The initial ability test consists of two questions, which are related to an indicator of mathematical communication ability. The result that we get is students ability in mathematical communication both the first Junior High School dan the second Junior High School still low. The student’s that answer correctly in every indicator haven’t reached 50% of it. The least indicator that students correct answer si indicator 3 which is giving rational reason to a statement (giving a conclusion at the end of the answer). This is shown that mathematical communication skills which represented with three indicators hasn’t maximal.

The lack of student mathematical communication skill has not come without the teacher’s role, one of them in learning device like learning implement plan haven’t maximal developed. This is shown in one of the examples of lesson plan which used in learning activity in 8th grade of junior high school from the component in the standard lesson plan, it hasn’t facilitated students skill, teacher use an instant RPP, haven’t shown learning method that explores students ability for doing an activity, thinking, communicating. Both teachers with students and among students itself. Students worksheets which used by teachers haven’t able to guide the student to find or construct their knowledge about the studied subject. The teacher only uses student’s book that available at school, without designing their own students worksheets.

By seeing the problem above and the importance for mathematical communication skill, we need the right model to apply in learning mathematics in class. One of the models that made students could receive joy-full learning with interactive class is Quantum teaching and learning models. The quantum studying model is the new breakthrough in the learning approach. This learning approach spearheaded by Bobbi de Porter [7] with his popular slogan “joyfull-learning”, Quantum Learning has its roots in Dr. Georgi Lozanos effort, a Bulgarian educator who experimenting with what called “suggestion” or “suggestopedia”. His principles are that suggestion can and sure affect the result of studying situation, and every detail gives positive or negative suggestion.

Quantum Teaching Learning model is a learning model used by the teacher as guidance in planning and doing learning at the classroom in which the strategy is grown up, face, maned, demonstrate, repeat, and celebrate. The using of TANDUR as framework studying design which helps to simplify the learning process. Quantum learning is a learning activity with a joyful situation. Quantum Learning is one of the lessons that demand independence, relax, amazing, and funny. It seems that learning based on Quantum Teaching and Learning can grow and raise the enthusiasm of the students so students will be more active in the learning process. Then, students can communicate their idea in answering the given question and able to respond with their answers. This learning process can increase a student’s mathematical communication skills.

This is supported with research from some journal some of them did by Agni Danaryanti [8], with title “the effect of Quantum teaching-learning model to mathematical communication skill and studying report of 11th grade senior high school student” with result quantum teaching-learning model that spill over mathematical communication skill as well as students studying result than direct learning model. Research that done by Firdaus [9] state that quantum learning is more effective in increasing mathematical reasoning students than conventional learning, this is signed with the difference of the average of mathematical reasoning test students among its experimental group which used quantum learning with a control group that uses conventional learning. Research that done by Ravita Dewi [10] with title “The Effect Of Quantum Teaching Learning Model To Enhance Student’s Conceptual Understanding on Characteristic Material Concept” with result using quantum teaching models in science learning students will have a positive impact when learning. Research that done by
Gunarhadi [11] with title “The Impact Of Quantum Teaching Strategy On Student Academic Achievements And Self-Esteem In Inclusive Schools” with result it was found that a quantum teaching strategy was more effective compared to the conventional teaching strategy in improving academic achievements of bahasa indonesia and science. A quantum teaching strategy is founded on the belief in learning theory that students learn by developing their potential through social interaction with the environment.

Form these studies it can be concluded that using the Quantum Teaching and Learning model and doing in experimental research. Therefore, researchers are interested in conducting research by developing mathematical learning tools based on the Quantum Teaching and Learning model to improve mathematical communication skills of Junior High School student’s.

2. Materials and Method
This research is a research development and using the Plomp development model. The Plomp model was chosen because it has several advantages in terms of practicality, where practicality is assessed through three stages, namely one-to-one evaluation, smal group evaluation, and fiels test [12]. Analysis of students characteristics is part of the development of the Plomp model [13]. because this study discusses curriculum analysis of students, this research was qualitative descriptive research. Data collecting techniques with triangulation (combination), the analysis data were inductive/deductive, and the quantitative result of the research is more emphasis on meaning than generalization. The descriptive is aimed to describe systematically and accurately the fact and the characteristic of the problem that we get in the field.

The resource is gotten from the interview, observation, and discernment. The data collecting techniques could be a combination of an interview and direct observation. This interview is done with teachers and students. The data analysis in this research uses an interactive analysis model which consists of collecting data, reduction data, data presentation, and taking a conclusion from data. Some of the steps done to analyze student’s characteristic is that to see students habit during the learning process. After this, students are given a solution so that they will not disturb the learning process.

3. Results and Discussion
On students, characteristic analysis is aimed to know the personal quality which can be the clue in arranging a learning device. Focus activity which is done in analyzing students is how students characteristics include thinking level, how students skill to use learning device. The age of students at 8th grade is about Piaget research state that at this age range students cognitive development already in the formal operations stage [14]. On formal operations, stage child has able to reasoning by using abstract things.

Vygotsky emphasize how the process of mental development like memory, attention, and reasoning implicate studies using society inventions like, language, mathematics system, memory stuff. He also emphasizes how children are helped develop with guidance from an expert at those major. Vygotsky theory assumes that learning occurs when children work or learn to respond the lesson which hasn’t studied but those tasks are still in their ability range, or those tasks are still in the zone of proximal development (students ability above their own ability). Vygotsky learning theory is one of the social studied theory so it is fits with the cooperative learning model because in the cooperative learning model occurs social interaction that is interaction student with student and student with teacher, in effort to find concepts and solve the problem[15].

Based on the observation result which has done in the first Junior Hight School dan the second Junior Hight School when studying process occurs seen that students activity in the learning process. There is students talk with their deskmate, face down on the desk. Many students don’t pay attention to what the teacher said in front of the classroom. Students are having trouble answering story questions that applied based on truth. Students get trouble in determining the problem and steps that must be chosen in solving the question, students are happy being given questin in symbols and numeric so they know directly what will be looking for without interpret the question first.
Students do their routine given by the teacher. If it is different from the teacher explained they are not answering, because they have no desire to understand and try doing as best they can. This condition is more indicate that students mathematical communication skill is still low. If this is allowed of course it will give a bad impact, apart from the range of student communication skills, it is also gives an impact on the studying result latter. So it can be concluded that students get trouble in mathematical communication skills.

Interview result which has done with a teacher in the first Junior High School dan the second Junior High School shows that in students learning process still is not able to reveal mathematics expose in their own language, they are not able enough to give written answer of the question. Moreover, the student doesn’t write supportive information from the question and not systematic as well as unclear in explaining the answer so it can cause a difference of interpretation to what student made. The clever student in mathematic often not able to express their ideas. As if they don’t want to share their knowledge with others. This is caused students to lack of ability to communicating mathematic ideas contained in mathematic questions so student is still not able to get used to express their thought both spoken or written.

The result of student analysis is used as foundation of development in arranging learning device fro, language level and adversity level. The result of observation shows, 1) students have a high curiosity. 2) during the studying process students are not focus on teacher explanation. 3) students are easy to forget about the concept that has learned. 4) talking with their deskmate. 5) students like to discuss. 6) students like in a group. Device-based quantum teaching and learning model is to apply the student cognitive development stage that has started to think scientific. In learning with device-based quantum teaching and learning model students study in a group and discuss in understanding the concept, so this activity can facilitate students characteristics who like to have a group and discussion.

The following steps on quantum teaching and learning model which can solve students problem which occurs in the learning process: 1) grow up, it grows students interest in learning that would happen and teacher trying to get involved the student in the learning process. A high motivation makes student interest to follow all the studying process. 2) face, teachers give an experience that can be understood by the students. This step gives chance to students to develop their prior knowledge and also to develop their curiosity. 3) named, students with teacher help struggle in finding the concept with the faced experience and also spur on students cognitive structure to give identity, toughen and give the definition of what happens to them. 4) demonstration, this step provides students a chance to what they know, this step can be done by presenting in front of the class, answering the question, and show their work. 5) repeat, repetition will strengthen neural connection so it can strengthen the student cognitive structure, the more repetition done so the knowledge will be deeper. It can be done by reaffirming the main learning subject. Giving chance to the student to restudy with other friends or through the question. 6) celebrate, it is a sort confession to finish participation and get skills in science can be done by the compliment, clap hand.

Based on the student’s problems during the learning process, so it is done an effort as the solution to solve those problems. One of the solutions that can overcome those problems is by applying quantum teaching and learning model in the learning process. This model support student study in a group and discuss in understanding concept so it can motivate the activeness of students during learning process.

4. Conclusion
Mathematic learning device based quantum teaching and learning model which develop in this research only until preliminary research step which only focuses on students characteristic analysis. Plomp model which is used in this research consist of three steps, it is preliminary research, prototyping phase, and assessment phase which is so helpful in developing mathematics learning device based quantum teaching and learning model. With this mathematics learning device based quantum teaching and learning model hoped it can increase student to study mathematics and become more active in the learning process.
References
[1] Permendikbud 2014 *Lampiran Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 58 Tahun 2014 tentang Kurikulum Sekolah Menengah Atas/Madrasah Aliyah* (Jakarta: Kemendikbud)
[2] Ontario 2010 *Communication in The Mathematics Classroom Capacity Building Series Secretariat Special Edition*
[3] Deswita R 2018 Peningkatan kemampuan komunikasi matematis siswa melalui modle pembelajaran core dengan pendekatan scientific *EJRPM* 1 1 - 12
[4] Sumarmo U 2014 *Prosiding Seminar Nasional Pendidikan Matematika Program Pasca Sarjana* (Bandung: STKIP Siliwangi) pp 4 -15
[5] Hidayat A 2018 Pengaruh model pembelajaran berbasis masalah dengan pendekatan pemecahan masalah terhadap kemampuan komunikasi matematis siswa smp negeri 1 rumbio jaya *JPM* 1 1 - 14
[6] Sarassanti Y 2017 Penerapan pembelajaran kontekstual untuk meningkatkan kemampuan komunikasi matematis dan sikap siswa SMP *JER* 17 199 -204
[7] DePorter B, Mark R and S N Sarah 2014 *Quantum Teaching: Orchestrating Student Success* Terjemahan Ary Nilandari (Bandung: Mizan Pustaka)
[8] Danaryanti A, Pramata S and Delsika 2014 Pengaruh model pembelajaran quantum teaching terhadap kemampuan komunikasi matematis dan hasil belajar siswa kelas xi sma *EDU-MAT Jurnal Pendidikan Matematika* 2 1 - 14
[9] Firdaus M and Fery 2013 Pengaruh quantum learning terhadap penalaran matematis siswa sekolah dasar *JER* 5 2 - 14
[10] Dewi 2018 The effect of quantum teaching learning model to enhance student’s conceptual understanding on characteristic material concept *Journal of Teaching and Learning in Elementary Education* 1 2 - 14
[11] Gunarhad 2014 The impact of quantum teaching strategy on student academic achievements and self-esteem in inclusive schools *Malaysian Journal of Learning and Instruction* 11 191-205
[12] Ploomp T 2013 *Education Design Research an Introduction* Dalam Tjeerd Ploomp dan Nienke Nieveen (Ed) *An Introduction to Educational Design Research* (Enschede SLO:: Netherlands Institute for Curriculum Development)
[13] Arnawa I M, Yerizon, Nita S and R T Putra 2019 *Int J Sci Tech Res* 9 287-292
[14] Jones G A and C A Thornton 1993 Vygotsky revisited nurturing young children’s understanding of number focus on learning problems in mathemantics *ERIK* 15 18-28