# The Development of Problem-Based Quantum Learning Model in Elementary School

Elisabet Dyah KUSUMA[1], Gunarhadi[2],Riyadi[3]

**ARTICLE INFO**

*Article History*:
Received 20.01.2018
Received in revised form 03.04.2018
Accepted
Available online 01.07.2018

**ABSTRACT**

The aim of this study is to develop Quantum Learning problem based model in elementary school. The method of this research is a research and development method by Borg and Gall simplified by Sukmadinata. The steps of development processes are preliminary research, developing, and testing. The instruments used are interview guide, observation guide and test. The steps are arranging the first draft, limited trials, and extensive trials. The steps of model testing are pre-test treatment post-test. The technique is simple random sampling. The result it can enhance the ability to solve the problem. Based on the result of the research and discussion, it can be concluded that (1) this model is able to increase the students problem solving skill,(2) this model is one of learning innovation which improve students activeness in learning activity. The result of this development could be used as an alternative learning innovation through learning model to improve students cognitive and noncognitive skills.



**Keywords:**
Development, Problem Learning, Quantum Learning.

## INTRODUCTION

A good quality of learning is learning which is able to produce a good quality output through teacher and students interactions as delivery component strategy. İn pedagogy, teachers have important roles to provide a good quality of education (Fabian Arends et al., 2017). Learning process, interaction between students and teachers related to principle and attitude transfer needs to be improved (Bruner, 1963:72). Positive interaction will help students to improve their motivation in learning to excavate their thoughts. Based on the regulation number 20 the year of 2003 about National Education System subsection 1 verse (1) stated that education is a conscious effort and planned to create learning environment and learning process so the students actively improve their potentials to have spiritual religious power, self regulation, personality, intelligence, noble character, and skills needed by themselves, citizens, society, and country. In order to reach education goal which has been set, teacher can utilize any resources, methods, and other education tools.

Teacher's role in organizing learning activity in the classroom is very important. Peters in Prastowo (2013: 22) stated that student's process and learning result depends on teachers' competency and their teaching skills. The success of an education system largely depends on the quality of the teachers who plan and practice teaching and learning process (Duman & Karagöz, 2016).

Teaching is a specific profession responsible for educating the new generations according to the demands of the time. The teaching profession requires perceptual qualifications such as attitudes and behaviours, besides cognitive qualifications such as knowledge and skills. Preparation for teaching profession is assured through liberal education, education for specific field, and pedagogic training. For prospective teachers, acquiring certain values and attitudes related to the profession is as necessary as acquiring knowledge. Besides, for the teachers to have positive attitudes towards the profession, it is important to for prospective teachers, who undergo training on field knowledge, knowledge for teaching profession, and liberal education; to be conscious about sympathy for profession, sincere attachment to the profession, internalization of the importance of the profession for the society, and continuously educating oneself in accordance with the demands of the time (Celep, 2010; Çelik, 2010, Helvacı, 2007);

Learning is students need. It is not only about recalling idea, but also exploring idea. As Haluk (2000) said that most of learning process is still based on memorizing facts directing the students to have less

[1] Corresponding e-mail: elisabetkusuma02@gmail.com, orcid.org/0000-0002-0129-6881 Sebelas Maret University

critical thinking (Cobb et al., 1992). The negligence of the importance of thinking ability in teaching and learning affects the students ability to think (Henningsen& Stein, 1997).

According to Sudjana (2005: 30), "Some of major components in learning are purpose, material, method, and assessment instrument." Those components are close related one to another and can not stand alone, but connected and influenced each other. These components build atmosphere in learning activity to be more active and directed. Joyce & Weil (1996:46) explained that learning model is a plan which is used as guideline in planning learning activity in classroom or learning in tutorial and to decide learning tools also to direct in designing learning activity to help the students so that the purpose of learning can be achieved. The change of learning process is influenced by the correct learning model chosen by the teacher in creating environment system which is possible in learning process so that the purpose of learning can be achieved effectively. As Firdaus (2015) argued that choosing learning model can help teachers and students to achieve the purpose of learning. Thus, it is needed a different point of view to see the whole factors that support the innovation process in organization (Ancok, 2012:58).

Quantum Learning is one of learning model which can make students active. Students activeness is conducted happily, comfortably, easily, with high level of success. Gunarhadi's research (2014) found that t-test showed Quantum Learning strategy had better impact to students achievement at school. Andrew W. Davis's research (2012) stated that learning with Quantum Learning was able to create fun learning environment sthat influenced to students scores. Quantum Learning less constructed students way of thinking because it only focuses on its fun activity but less effective in embedding the concept in students and needs real experiences also takes time in giving motivation.

Education innovation and development especially on learning is an important thing to be focused on improving learning quality. İnnovation is derived from Latin word which means renewal and modification. The verb form is innovo which means renew and modify. İnnovation is a new modification process into betterment; totally new or different from the former which is conducted intentionally and planned (Ihsan, 1991). İnnovation is a new change, tend to qualitative, different from the former, and intentionally afford to improve the ability to reach certain goal in education. İnnovation is conducted with certain purpose to solve problem (Subandiyah 1992:80). Learning innovation emphasize on teachers' ability in organizing classroom teaching and learning activity (Rosenblum, 1981).

Nurzaman (2017) stated that through the use of problem in real life as something which students can learn to train and fix their ability to think critically and solve the problem to help students achieve their skills. Problem solving is also a need to learn about social and emotional (Tarik, 2012). Learning through problem can improve students critical thinking (Benzer, 2013). Inability in problem solving skill can cause many mental health and simultaneous problem (Eskin, 2009). Effective problem solving in daily real life can help reducing the effects. Weak problem solving skill causes stressfull life events. Besides, the effect which improve negatively can influence individuals prosperity.

Problem solving skill decrease negative effect from stressful moment on prosperity and depresion (D'Zurilla dan Nezu,2010). Angell, Tellefsen, C.W., & Bøe,M.V (2015) stated that,"Knowledge of how quantum and relativity can be taught in a way that experienced as meaningful learning and motivate students." İn the end, it could be a new challenge for teacher to present learning activity which is not only interesting and fun, but also effective to achieve learning goal which has been set and give a meaningful learning for the students.The development of Quantum Learning model gives positive contribution in learning. The contribution can be used as an alternative and variation moreover when the teacher wants to stimulate, grow, and improve students thinking skill in constructing their thoughts through problem solving so the learning material is more meaningful with integration which connected each other.

The learning process in the classroom runs less interactive because it is only based on the provision of subject matter. Teachers are less able to provide learning by using appropriate learning models, especially in thematic learning that requires not only mastery of concepts but also improves students' skills in constructing their thoughts based on the connectedness of learning materials. Teachers only provide material through books that have been provided by the government without developing it. The learning model is only limited to what is contained in the teacher book guide only.
The results of observation and interviews students showed that in general students learn by only given the

problem and read the material then given the problem and answer it. Students are focused only on the subject matter and the giving of the course so that the students get less varied learning. Teachers do occasionally assign group tasks but are limited to groups regardless of the essence of the group itself.

The aim of this study is to develop Quantum Learning problem based model in elementary school. The method of this research is a research and development method. In elemetary schools, students are oblidged to be in these activities but it was noticed that these activities were not practiced with enough importance, usually activities were performed just to complete and they were decrating from the aim and even teachers were not volunteering for these activites, so mainly they were not considered very important (Ankara ili Eğitim Denetmenleri Başkanlığı, 2011)

## METHOD

The method of this research is the research and development of Borg and Gall (2003, p. 571) as modified by as modified by Sukmadinata (2013, p. 164) into three steps, namely: (1) Preliminary Study/ Study of Exploration Stage; (2) Stage of Product Development; (3) Product Testing Stage. The products development stage include: (1) preliminary field testing activities which were conducted on fifth grade students in Elementary School because fifth-grade use thematic is relevan to the study. To collect the data, interview, observation, and test are conducted. Data analysis process is conducted by Miles and Huberman with interactive through data reduction, data display, conclusion drawing or verification, data analysis technique conducted 31 students in SDN 03 Karanganyar.

The data obtained through observation were then analyzed; (2) The second product revision, revision was based on preliminary field testing activities; (3) main field testing activities were conducted in SDN 01 Karanganyar and SDN 02 Bejen; (4) The third product revision was based on test results using the product of learning education in the fifth grade elementary school students in the main field testing. Data collection techniques in this study are using interviews, observation, achievement tests (pretest-posttest), student responses, and documentation.

Data analysis techniques used are the analysis of qualitative and quantitative data. Analysis of qualitative data derived from the results of the students' responses, while the quantitative data obtained from the results of main field testing; scores of pretest and posttest from students essay writing results as consideration for the improvement of the draft next textbooks. Testing data on main field testing stage design is using one group pretest-posttest of Sugiyono (2015, p. 500). Furthermore, to determine the significance level the learning textbooks influence before and after the learning, student learning results are, then, tested by using t-test. Data analysis process is conducted by Miles and Huberman data analysis technique. They are data collection, data reduction, data serving, and data verification.

## RESULTS

The result of preliminary research includes learning activity conducted at school all this time, the use of learning model on delivering the material, students and teachers' expectation in learning ativity. After conducting observation and interview to analyze the need of learning model development, it is found that generally, learning process in classroom is less interactive because the teachers focused on delivering the materials. Teachers seldom used suitable learning model when teaching, moreover in thematic learning which not only focused on mastering concept but also improved students skill in constructing their thoughts based on the relation of learning materials.

Teachers only taught using book provided by government without developing its materials. Learning model used is only limited on teacher's book guideline. The result of observation and interview to fifth grade students of Elementary School shows that generally, students learn by reading the materials and answering the questions given. Students focused on materials and questions only. They did not get various learning. Teachers sometimes gave a group work without knowing the essential of the group work itself.

**Table 1.** *The validation model includes evaluation from experts,*

| No | Criteria | Frequency | Percentage (%) |
|---|---|---|---|
| **1** | Very Poor | 0 | 0% |
| **2** | Poor | 2 | 9% |
| **3** | Adequate | 8 | 36% |
| **4** | Good | 12 | 55% |
| **5** | Very Good | - | 0% |
| | **Total** | 76 | 100% |

**Preparing the Initial Model**

Preparing learning model is conducted by paying attention on some components which is expected reaching the targets as follows:

1) Designing, prepare learning design based on interactive multimedia can integrate students skill in learning activity based on current information and alternative solution. Design preparation includes: formulating goals in line with learning based on interactive multimedia, students centered learning strategy, learning material, and learning environment. This preparation is written on teachers' learning preparation. Formulating learning goals is conducted to help students understanding to the material. (2) Developing, developing of Quantum Learning problem based as George (2004) said abaut learning principles are: a) Learning and knowledge are in diversity ideas, b) Learning is a process to connect the sources of information, especially on certain knot, c) Learning could happen from something outside human body, d) the ability to understand is more important than what is already understood, e) Keeping the simultaneously learning is needed in learning sustainability, f) the ability to see the connection between idea and concept as core skill in learning, g) Recency (the accuracy and current knowledge) is the important thing in learning, and h) Decission in choosing what to learn is very important in learning process to face informations. (3) Utilization is the use in implementation Quantum Learning problem based model, using relevant learning media with formulated goals and students competence demand. (4) Management, managing is an activity in problem based learning, includes: delivery learning system, good time allotment, and supporting learning resources, such as: learning facilities and infrastucture. (5) Evaluation, learning models evaluation. Evaluation done by conducting students competence and understanding test, observation on learning activity process, and students motivation in thematic learning. Meanwhile, the result of study is a parameter of students competence achieved after learning process.

**Limited Trial**

Limited trial is a kind of trial on a limited scope. The limited trial is conducted in SD Negeri 03 Karanganyar. İn this trial, learning activity was conducted based on arranged syntac model by the researcher and teacher. During the learning activity, observed and noted the important thing were also conducted. Besides on teacher's activity, observation to the students responses, activity and improvment was noted. After the first meeting, discussion was conducted to discuss what was going, moreover the lackness or deviation. Based on those inputs, correction was conducted an noted everything important for learning activity.

**Extensive Trial**

Extensive trial was conducted in extensive area with more participants. This trial was conducted in SDN 01 Karanganyar and SDN 02 Bejen. Sample was taken from fifth grade students each school with total

participant 72 students. As limited trial, extensive draft model was implemented on extensive trial. The next step is to improve learning model by paying attention on learning activity inputs. Observation, discussion, and improvement is conducted repeatedly until no more lackness found, then the trials stopped. The meeting between teachers and researcher was conducted to improve the final draft and after the final draft finished, it is ready to be implemented

.

**Testing**

**Table 2**. *Testing Steps*

| Test | N | Maximum Score | Mean | Standard Deviation | Mean difference Pretest and Post test |
|---|---|---|---|---|---|
| **Pretest** | 72 | 100 | 7.07 | 3.206 | 2.06 |
| **Posttest** | 72 | 100 | 9.13 | 3.138 | 1.05 |

From the table, the average of pretest is 7,07 with standard deviation 3,206 and improved on post test with score 9,13 and standard deviation 3,138.

## DISCUSSION AND CONCLUSION

Based on the data analysis, it is known that Quantum Learning problem based model development is needed and by this method, there is an improvement process on problem solving. This is because Quantum Learning problem based model makes students not only learn about concept but also have another skill which is supporting. It is strengthen by result of the study about the excellence of learning based problem that students have chance not only to learn about concept but also to practice the skills related to the research, such as creating and testing hypothesis and collecting and analyzing data (Phithiyanuwat, and Bunterm 1998). Teachers think that these club activities help students to discover and improve their interests and talents and help them to learn how to socialise and work with a plan. These activities also improves their general knowledge, creative thinking skills and push them to take responsibility (Karaagac, 2016). Goman Rumapea et al (2011) showed the result of their research by using Quantum model. This model can improve students achievement, especially on algorithm operation. Besides, Etherington, Matthew B. (2011) showed that problem based learning model was successfully done in science learning by using open investigation, even though conducted individually. Learning is not only about mastering the learning material but also having motivation in learning through challenge by providing problem. Challenge in learning is creating meaningful learning experience to students (Costa & Kallick, 2000). Sharing learning experience stimulates students intelligence and support meaningful learning (Armstrong, 2009). Rich experience allows students to learn together in some dimensions at once. For example, strong spatial intelligence can improve ability to concepts and music intelligence to support interesting in writing (Moranetal, 2006). Learning experience is derived from content, process, and social climate (Joyce dan Calhoun, 1996). Teacher becomes important factor to grow students interest to solve the problem related to the research that in learning activity teacher is a part of effective factor program and suggest developing students problem solving ability and making decision (Nurdan Baysal, 2011). The result of Serin's research (2010) in Turkey showed that giving problem solving questions to students can improve their skills to solve the problem. The ability to solve the problem is one of social component need and emotional learning (Tarik Totan, 2011). Quantum learning development is based on the needs of students development. Some of them need support for their needs (Norris, 2003). Self regulation used to solve problem in daily life (Brownlee, Leventhal dan Leventhal, 2000). To solve complex problem, motivating and struggling is needed to solve the problem by organizing self resource until the result is completed to continue. Faith will motivate on problem solving attitude process which is needed in daily life by self regulation to solve more complicated problems and rarely found as problem as important element (Zimmerman dan Campillo,2003). Through problem based learning, there is responsibility and students liveliness to solve the problem. According to Bingham (2004), problem solving, entrepreneurship, creativity, self confidence, acceptance, objectivity, responsibility,

and fearless can solve the problem successfully. Everyone has responsibility in solving the problem (Çam ve Tümkaya, 2006). Problem solving skill can push students to develop their critical thinking skills. Developing critical thinking skills in Indonesia society is an important thing in this global era because of the problem complexity level in every aspect of this modern life gets higher. By critical and creative thinking, society will be able to develop themselves on making decision, evaluation, and problem solving. Johnson (2011: 185) said that critical thinking is an organized process which is possible for students to evaluate evidence, assumptions, logic, and language as the basic of people's statement. By critical thinking, hopefully the students are able to achieve deep understanding. A critical thinker, systematically handles a bunch of question which help them making decision, solving the problem, or investigate complicated social issues. The different person related to their activity in solving the problem. One of them is student's academic competency. The different of each student's academic competency influences their point of view and responds to the problem they face. Some of them can be fast respond and the other might be slow. So, patient is needed on problem solving activity. But, this activity is possible to work systematically. And when student works slower, many of them could be successful. Besides, problem solving is not always a difficult activity or in another word, not all difficult activity is a kind of problem solving activity. It shows that problem solving activity can be given to all students and it must be for all students (Arcavi & Friedlander, 2007). Problem solving is a facility that is possible for student use their basic knowledge, skill, and understanding to complete extraordinary situation demand (Krulik & Rudnick, 1995: 4). Moreover, Haylock and Thagata (2007: 147) said that problem solving happens when someone uses their knowledge and reasoning to handle the gap between the reality and expectation. Thus, the development of Quantum Learning problem based model can improve students learning competence on cognitive and non cognitive skill, improve students problem solving skill, and become one of learning innovation which can improve students liveliness in learning.

In addition, the results are also recommended for teachers and other researchers. For Teachers is suggested to be utilized by teachers more widely and more optimally in the learning process. Utilization of products developed by researchers in the form of learning innovation other materials. For other researchers, the result of developing learning model for the fifth grade of elementary school is expected to be disseminated in other schools, especially fifth-grade primary schools and not just in one city, but in other city or district primary schools. The results of this research and development can be used as a reference to develop similar research by adding variety of material and design teaching learning materials. Other researchers should understand the characteristics of the material, learning models, and characteristics of learners so that later expected to get a better teaching learning models.

## REFERENCES

Ancok, Djamaluddin. (2011). *Psikologi Kepemimpinan dan Inovasi.* Surabaya: Erlangga.

Angell, C., Tellefsen, C. W., & Bøe, M. V. (2015) . ReleQuant-Improving teaching and learning in quantum physics through educational design research. *Journal of Education*. 11(2), 153–168. (1983:4).

Arends Fabian, Lolita, & Mogege. (2017). Teacher classroom practices and Mathematics performance in South African schools: A reflection on TIMSS 2011. *South African Journal of Education*. Volume 37, Number 3, August 2017.

Arcavi & Friedlander (2007).*Curriculum developers and problem solving: the case of Israeli elementary school projects*. ZDM Mathematics Education (2007) 39:355–364.DOI 10.1007.

Armstrong, T. (2009). Multiple intelligences in the classroom (3 rd ed.). *Alexandria,* VA:ASCD.

Benzer, E., & N, F. Ş. A. H. İ. (2013). The Effect of Project Based Learning Approach on Undergraduate Students â€™ Environmental Problem Solving Skills 1 Proje Tabanl ı Ö ğ renme Yakla ş ı m ı n ı n Lisans Ö ğ rencilerinin Çevreye Yönelik Problem. *Çözme Becerilerine Etkisi*, *12*(2), 383–400.

Bingham, A. (2004). Çocuklarda problem çözme yeteneklerinin geliştirilmesi. *Çev. A. F. Oğuzkan*. İstanbul: Milli Eğitim Bakanlığı Yayınları.

Borg & Gall. (1983). *Education Research.* New York : Allyn and Bacon.

Brownlee, S., Leventhal, H. ve Leventhal, E. A. (2000). *Regulation, self-regulation, and construction of the self in the maintenance of physical health. İçinde M. Boekaerts*, P. R. Pintrich ve M. Zeidner (Eds.). Handbook of self-regulation. (syf. 369-416), California: Academic Press.

Bruner, J.S. 1963. *The Process of Education*. New York : Vintage Books.

Çam, S. ve Tümkaya, S. (2006). Üniversite öğrencilerinde kişilerarası problem çözme. Çukurova Üniversitesi Sosyal . *Bilimler Enstitüsü Dergisi*, 15(2), 313-326.

Celep, C. (2010). Meslek olarak öğretmenlik. C. Celep (Ed.), *Eğitim bilimine giriş* içinde (s. 45-74). (3. Baskı). Ankara: Anı Yayıncılık.

Çelik, K. (2010). Bir meslek olarak öğretmenlik. A. Tanrıöğen & R. Sarpkaya (Eds.), *Eğitim bilimine giriş* içinde (s.235-265). (2. Baskı). Ankara: Anı Yayıncılık.

Cobb, P; Wood, T; Yackel, E. and McNeal, B. (1992). Characteristics of Classroom mathematics Tradition: An interactional analysis. *American Educational Research Journal*, 29, 573-604.

Dawis, Andrew. (2012). *The Effect of Quantum Learning on Standardized Test Scores versus schools that do not use Quantum Learning.* Northwest Missouri State University Missouri.

Depdiknas. (2003). Undang-Undang Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional. Jakarta: Depdiknas.

D'Zurilla, T. J. ve Nezu, A. M. (2010). *Problem-solving therapy. İçinde K. S. Dobson (Ed*.). Handbook of cognitive-behavioral therapies. (3. Baskı). New York: Guilford Press.

Eskin, M. (2009). *Sorun çözme terapisi*. Kuram, araştırma, uygulama. Ankara: HYB Basım Yayın.

*Etherington, Matthew B. (2011). Investigative Primary Science: A Problem-Based Learning. Australian Journal of Teacher Education. Vol 36 no 9 p36-57.*

Firdaus, Ismail Kailani, Md. Nor Bin Bakar, Bakry. (2015). Developing critical thinking skills of students in mathematics learning. *Journal of Education and Learning*. Vol. 9(3) pp. 226-236 Elementary Education Online, 12(3), 635-658,

Gunarhadi, etc. (2014). The ımpact of quantum teaching strategy on the academic achievements of students in ınclusive schools. *Malaysian Journal of Learning and Instruction: Vol. 11: 191-205.*

Halük Ünsal Costa, A., & Kallick, B. (2000). Activating & engaging: habits of mind. Alexandria, *VA: Association for Supervision and Curriculum Developmen*t.

Haylock, D. & Thagata, F. (2007). *Key concepts in teaching primary mathematics.* London: SAGE publications.

Helvacı, M. A. (2007). Öğretmenlik mesleğinin özellikleri. N. Saylan (Ed.), *Eğitim bilimine giriş* içinde (s. 313-332). Ankara: Anı Yayıncılık.

Henningsen, M. and Stein, M.K. (1997). Mathematical tasks and student cognition: classroom-based factors that support and inhibit high-level mathematical thinking and reasoning. *Journal for Research in Mathematics Education*, 25(5), 524-549

Ihsan, F. (2003). *Dasar-dasar Kependidikan*. Jakarta: Penerbit Rineka Cipta.

Joyce, Bruce & Marsha Weil. (1992). *Models of Teaching.* USA: Allyn and Bacon.

Krulik, S & Rudnick. (1999)." *Innovative Taks toImprove Critical and Creative Thinking Skills. Developing Mathematical Raesoning in Grades K-12*", pp.138145.

Moran, S., Kornhaber, M., & Gardner, H. (2006). *Orchestrating multiple intelligences*. Educational Leadership . September 2006. Association for Supervision and Curriculum Development, 22-27.

Nana Sudjana. (2005). *Penilaian hasil proses belajar mengajar.* Bandung: PT. Remaja Rosdakarya.

Norris, J. A. (2003). Looking at classroom management through a Social and Emotional Learning lens. Theory Into Practice, 42(4), 313-318.

Nurzaman. (2017). The Use of Problem Based Learning Model to Improve Quality Learning Students Morals. *Journal of Education and Practice.* ISSN 2222-1735 Vol. 8 No.9.

Phithiyanuwat, S. and Bunterm, T. (1998). Research-Based Learning. *The Journal of Research Methodology*. Bangkok: Department of Educational Research, Faculty of Education, Chulalongkorn University.

Karaagac,P. (2016). Teachers' views on activities practised in elementary schools. *International Journal of Education Research Review.* Vol.2 (1).

Prastowo, A .(2013). *Pengembangan bahan ajar tematik*. Yogyakarta: Diva Press.

Rosenblum, S. & Louis, K. S., (1981). Stability and Change. *Journal Innovation in an Educational Context.* New York & London: Plenum Press.

Rumapea, Goman. Etc. (2011). Application of quantum teaching learning model to ımprove student learning outcomes. *International Journal of Novel Research in Education and Learning.* Vol. 4, Issue 2, pp: (118-130), Month: March – April 2017.

Subandiyah. (1992). *Pengembangan dan Inovasi Kurikulum*. Yogyakarta: PT Raja Grafindo Persada.

Totan, T. & Kabasakal, Z.(2012). The effect of problem solving skills training on the social and emotional learning needs and abilities of 6 th grade students.i *İlköğretim Online, 11*(3), 813–828.

Zimmermann, B. J. ve Campillo, M. (2003). Motivating self-regulated problem solvers. İçinde J. E. Davidson ve R.J. Sternberg (Eds.). *The Journal Psychology of Problem Solving* (syf. 233- 262). Cambridge: Cambridge University Press.