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Learning mathematics through modeling tasks in elementary school: using growth of population context

Learning mathematics through modeling tasks in elementary school: using growth of population context

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Abstract. This study aimed to obtain modeling task to learning mathematics on Elementary School using growth of population context. It used method of development research which consists of three stage, i.e. firstly analysis, secondly design, and lastly evaluation. On the step of analysis, i.e. firstly analysis of student, secondly analysis of curriculum and lastly analysis of mathematical modeling were conducted. On the step of design and product of mathematical modeling tasks were implemented (Hypothetical Learning Trajectory). Then the last stage utilized a evaluation of formative design, i.e., firstly, self-evaluation, secondly, one-to-one, thirdly, expert review, fourthly, small group, and lastly, field tests. The criteria of success of this research were produce local instruction theory of mathematical modeling tasks for elementary school which was valid and practical for learning mathematics. The subjects in this study were three students of SDIT Bina Insani of Ogan Komering Ilir. Data were collected and analyzed utilizing method of analysis of descriptive, i.e., firstly, walkthrough by Experts. They comment on the prototype in term of content and competencies of students. Then, secondly, analyze student's solution and comment on one-to-one and small group activities to get practicality; and lastly, explaining student's solution and comment on the field test to get potential effect. Based on the validation, practicality evaluation, and try-out, We conclude that the designed mathematical modeling task using growth of population context for mathematical learning in elementary school was valid, practical and useful.

1. Introduction

Mathematical Education Reform efforts throughout the world continue to be carried out for pedagogical teaching to understanding of students' cognitive reasoning can be involved carefully via Problem-based learning [1-2], modeling activities [3-4], opened-ended problems [5-6] and teaching through problem solving [7]. This reform is very needed to face an increasingly complex of world of work. This also indicate to include mathematical modeling in elementary school. Rational to change the appearance to equip students with work-based knowledge who have the competence and skills outside of school to solve real-world problems [8-9]. So, teacher should be to include real-world problem in mathematical leaning to prepare competence and skill outside of school. Mathematical modeling progressively becomes an area focus in mathematics education [10] after many researchers proposing it to use a new approach for studyon problem solving [4] is also considered one of very important goals of mathematics and science education [11-12]. Based on research recommendations Eric [1] that further study is needed in the area of mathematical modeling to connect theory and practice, to understand a match between modern and traditional approaches, and the teacher as a facilitator. Therefore, mathematical modeling in elementary is crucial to implement.

Studies have shown that mathematical modeling supports and motivates students' interest in mathematics [13-15]. The result of this study show that using mathematical modeling in elementary school is needed to make student interested, motivated and pushed to learn mathematics. Additionally, when students are provided opportunities to engage in modeling tasks, their engagement reflects improvement in their mathematics achievements [16]. Based on this result indicate that mathematical modeling can improve student achievements in mathematics. But in fact, mathematics is a discipline whose teaching and learning is considered to be difficult [17],[19]. This is caused by mathematical modeling is a complex task. So, teacher and student must continue to strive to implement mathematical modeling everyday in learning mathematics. Until now, based on experience reseacher, learning mathematics only use word problem and application problem everyday teaching. To differentiate between modeling and applications we indicate to [11] who axplain modeling as concentration more directly on the processes brought in going from real-world problem to mathematics, i.e., "starting outside mathematics searching in trying to discover many mathematics content to solve the problem". In compare, applications consentration on going from mathematics content to real-world, emphasising the objects relevant—particularly those parts of the reality for which mathematical models or rules already exist. When considering applications, "we are starting inside mathematics searching" trying to discover somewhere the mathematics already chosen can be implemented.

Ikeda [18] state that mathematical modeling is a cyclical process in which real-world problems are transform into mathematical problem, solved within a mathematical principle, and the solutions checked back within the real-world problem. Figure 1 indicate modeling process according to Australia Curriculum [20].

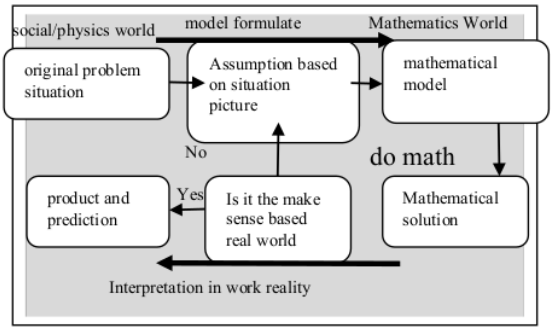


Figure 1: Modeling Process by Australia Curriculum [20]

Permendikbud Number of 20, year of 2016 states that the principles of learning on the 2013 curriculum it shows that the importance of learning mathematical modeling. Because the principle of learning is suitable to mathematical modeling approach. Curriculum of 2013 demand to use real-world problem and higher order thinking skill (HOTS) in mathematical learning. This show that using mathematical modeling is crucial to implement in indonesian school, especially elementary school.

The research problems were formulated, firstly, how is mathematical modeling tasks in Elementary School made valid, seen from attitude, engage and value?, secondly, how is mathematical modeling tasks in Elementary School made practical, seen from attitude, engage and value? and, lastly, how is mathematical modeling tasks in Elementary School made useful, seen from attitude, engage and value?. This research aimed to obtain valid, practical and useful mathematical modeling task in Elemetary School, seen from seen from attitude, engage and value.The benefits of expected of the results of this research were for firsly, students, secondly, teachers, thirdly, policy makers, and lastly, researchers.

2. Methodology

This research used method of development research that developed by Akker, Gravemeijer, McKenney and Nieveen. It consists of three stages, i.e. firstly analysis, secondly, design and lastly evaluation [21]. On the step of analysis are analysis of student, analysis of curriculum and analysus of mathematical modeling are conducted. The step of designed and produced of mathematical modeling tasks. The last step implemented a evaluation of formative design on Figure 2 indicate firslty, self-evaluation, secondly, one-to-one, thirdly, expert review, fourthly, small group, and lastly, field tests [21- 23].

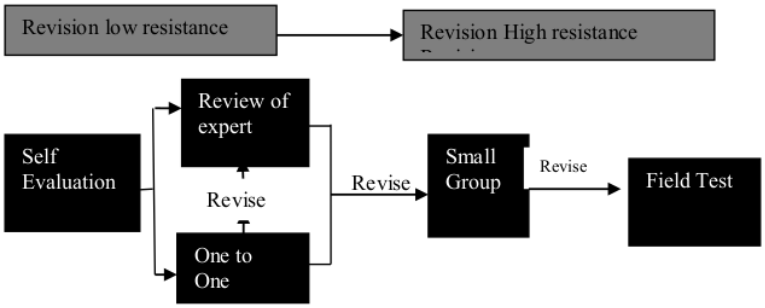


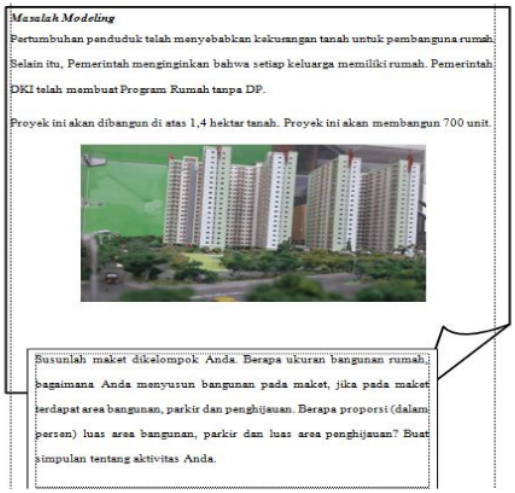
Figure 2: Formative Evaluation [21 – 23]

The criteria of success of this research is obtained the modeling tasks using growth of population contexts for learning mathematics that was valid, practical and useful for learning mathematics that seen from attitude, engage and value. The validity was obtained from the validation of expert review and the practicality be produced from the students' comment, interview and observations of the one-to-one and small group. Definition of practicality is easy to implement, interpretable, and clear or unambiguous. Useful means have a potential effect.

The research subjects were 3 students of SD IT Bina Insani Kayuagung, District of Ogan Komering Ilir, Provinci of South Sumatera. Data collecting techniques were firsly, walkthrough, researchers analylize the expert review to obtain a valid mathematical modeling tasks using growth of polulation contexts in construct, content and language aspects, secondly, interview, the interview conducted from one to one and small group to get the practicality and useful of the modeling tasks. The data were analyzed by implementing method of descriptive analysis: firsly, walkthrough, on walkthrough researchers do analysis of sheet on the comments on review of expert to obtain valid mathematical modeling tasks; secondly, interview, the results of interview based on student's opinion from one-to-one and small group to obtain practicality and usesful.

3. Result and Discussion

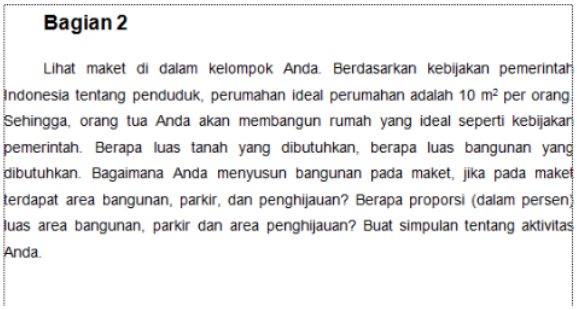
The Validity of mathematical modeling tasks using growth of population context in Elementary School was done by expert, i.e. Darmawijoyo. The validation of expert of growth of population context produced two valid mathematical modeling tasks in Elementary School using Growth of population context. The first mathematical modeling tasks with growth of population context is in figure 3. This task demand student to solve the problem using proportion, especially percent.



Mathematical modeling problem:
Growth of population has cause deficiency to build house. Other than that, government want that every family have house. DKI goverment has make a program of buy house without down payment (DP).
This project will build on 1,4 hectare field.
This project will build 700 unit.
Your tasks:
Arrange the maket on your team. What is measure of house, how you arrange of the houses on your maket, if on the maket there exist build area, parking area, and green area. What is proportion (in percent) large of build area, parking and green area? Make conclusion

Figure 3: The first Mathematical Modeling Tasks with with growthth of population context

The second Mathematical Modeling problem about Growth of Population context indicate in figure 4. This task ask student to determine how much land is needed for building a house for his/her family. This task also demand the student to make assumption, i.e. how much land needed for his/her family. Mathematical Modeling problem about Growth of Population context necesstitate student to solve the problem using proportion.



See the maket on your team. Based on government policy about population, ideal housing is 10 m^2 per people. So that, your parent will build a ideal house like government policy. How much land is needed, how much building is needed? How you arrange the building on your maket, if the maket there exist building, parking and green area? make your conclusion!

Figure 4: The second Mathematical Modeling Tasks with growth of population context

Student is demanded to solve mathematical modeling using mathematical modeling process according to Bliss, et. al. [24]. In this research one-to-one was implemented to product the practicality of modeling tasks for learning mathematics in Elementary School using population growth context. One-to-One was implemented at SD IT Bina Insani Kayuagung on Monday, Juny 4th, 2018. The Research subject were three of students of third grade from SD IT Bina Insani Kayuagung, namely Chika Aurora Metriana, Adinda, and Faizah. Figure 5 indicate the students was solving the modeling tasks.

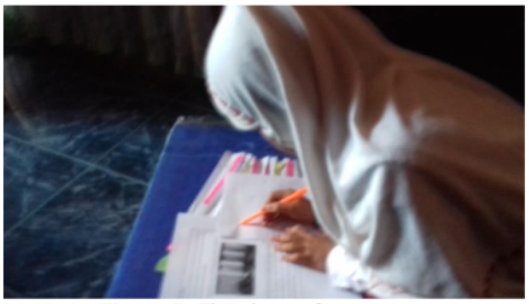


Figure 5: The photo of one-to-one

The result of one-to-one, it based on the student's attitude toward mathematical modeling task that showed the modeling tasks using growth of population contexts was interesting and requires students to high order thinking. In this research, the students say that this task is very difficult because they never learn modeling task. From the solution of the students also show that student only can identify and specify the tasks to be solved. Students cannot make assumption and define essential variable, cannot do the math: get a solution, cannot analyze and asses the model and solutions, etc from modeling process [24]. Nevertheless, students don't understand with term on the modeling process, so that some terms of modeling process had to be explained first, i.e. identify and specify the problem to be solved, Analyze and assess the model and the solutions, and iterate as needed to refine and extend the model. Therefore, it should be explained in earlier to make students familiar with term of modeling process. Mathematical modeling task using growth population contexts make students interesting to learn mathematics. This caused by growth of population context that is real and meaningful for them. Mathematical learning through modeling task impact to positive attitude student's toward mathematics. Using growth population context on mathematical learning engagement student to use mathematics in solving real-world problem, so that student get experience in modeling that is very important for her/him future. By modeling, mathematical learning can arise of the value, i.e. objectivsm, openness and promotion. It caused by mathematical learning that using growth population context and modeling process. Figure 6 indicate the student's opinion to the mathematical modeling tasks.

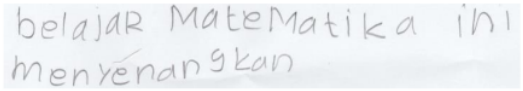


Figure 6: Student's opinion

We see also the student's soluiton of modeling tasks, this indicates that the students only were capable to determine identification and specifications of the modleing tasks and can determine assumptions, but cannot doing mathematics to product the mathematical model and cannot give recommendations, analyze and assess of the model and the solutions, and iterate as needed to refine and general the model. This is caused by mathematical modeling is new for them and never learn it. So, mathematical modeling in elementary school should be taught early. The student solution are in figure 7:

Figure 7: Student's Solution of mathematical modeling problem

From the validation of expert review and the results of one-to-one, we attain valid and practical modeling tasks for learning mathematics in Elementary School: using growth population context must be small revise for learning mathematical modeling for proportion (percent). From these result show that researcher must be revision the term of process mathematical modeling because the student do not understand the term of mathematical modeling process (phase). This show that mathematical modeling process must be guide phase of mathematical modeling process, i.e. using term that can be understood by student. Student cannot solve mathematical modeling problem becauses it is new for them. The mathematical content of this research is proportion (percent) and this content is difficult according to the teacher of SDIT Bina Insani Kayuagung. So, using mathematical modeling make student interesting to learn proportion (percent).

In this research using growth of population context from the comment of the students is very fun, interesting, invite students to imagine, very good, like challenges, and meaningfull or useful for the students as citizen of Indonesian. According to Bliss, et. al. [24] state that application of Model-Eliciting Activities (MEA) allow M &MP researchers well insights into the process of modeling, indicated so as to offer a pathway of evidence of students' altering ways of thinking. Brady [25] argued that there is not related between how teachers teach students and how they are to handle problems in the real-world problem. Teachers give problems that are clearly defined, all information given, closed problem, not related to real-world problem, measurable, and have one right answer. This show that very important include tasks ill-defined (modeling tasks) and many solution or answer (more than one) in mathematical learning. Brady [25] state that A model-eliciting activity (MEA) is an open-ended tasks, real-world problem, not all information given, client-driven problem. This indicate very important mathematical modeling tasks in mathematical learning. This is supported by Brady [25] state that Modeling is the processes to create representations of simplified of phenomena or daily events systems. Nowday, learning mathematics using only word problem is not a matter of mathematical modeling. Mathematical modeling also is approved as an suitable instructional strategy to the STEM education and can use to attain various student-learning achievement [26]. Mathematical modeling also is very important the strategy of students come to follow real-world that are unfamiliar with students. So, mathematical modeling using growth of population context is very important in elementary school mathematical learning.

Based on Huffman [26] state that mathematical modeling is the most of the interesting topics in mathematics education that has been studied and disseminated more extremely as long as the last decades. This show that mathematical modeling are good and interesting topic to use in mathematical learning. According to Huffman [26] state that in a mathematical modeling situation, pure mathematics miss some of its power. This is relevant with this research that students in SD IT Bina Insani Kayuagung very interesting modeling task but they cannot solve the task because modeling task is new for them. According to Riyanto, et. al [28] that mathematical modeling task that was designed for mathematical learning in Senior High School using nutrition context is valid, practical and usesful. Based on this result indicate that mathematical modeling in school is very needed to make student to engage, like, motivate and interest to learning mathematics. This also can change student's view on mathematics.

In this study using growth of population context make students interesting and can motivate student to learn mathematics, this also caused by growth of population context that is real and meaningful for them. Mathematical modeling task impact to positive attitude student's toward mathematics. Using growth of population context on mathematical learning engagement student to use mathematics in solving real-world problem, so that student get experience in modeling that is very important for her/him future profession. By modeling, mathematical learning can arise of the value, i.e. objectivsm, openness and promotion. This is caused by mathematical modeling process with cyclic using growth of population context. According to the researchers that students cannot solve modeling task because this is new for them. One of the major difficulties according to Almeida [27] and Ärlebäck [29] is that elementary school students lack experience in working with real-world problems and modeling tasks, creating a real connected. This show that teacher should use context real or mathematical modeling tasks in learning mathematics.

4. Conclusion

Mathematical Modeling Tasks that was designed for mathematical learning in Elementary School using population growth context is valid, practical and usesful. This refer to validation of experts review and solution and opinion of student on one-to-one and small group which was small revision. Using growth of population context make students interesting to learn mathematics. Therefore, mathematical modeling tasks using growth of population context for mathematical learning of proportion material was valid, practical and usesful seen from attitude, engage and value which is very suitable to curriclum of 2013 in elementary school.

References

[1] Eric, Chan Chun Ming 2010 *Journal of Mathematical Modelling and Application*, 2010, **1** 40
[2] Hiebert, J., Carpenter, T. P., Fennema, E., Fuson, K., Human, P., Murray H., Olivier, A., & Wearne, D 1996. *Educational researcher*, **25** 12
[3] English, L. D 2006 *Educational Studies in Mathematics*, **63** 303
[4] Lesh, R., & Zawojewski, J 2007 Problem solving and modelling. In F. K. Lester (Ed.), Second handbook of research on mathematics teaching and learning: A project of the National Council of Teacher od Mathematics. Charlotte, NC: Image Age Publishing.
[5] Chan, C. M. E 2007 Using open-ended mathematics problem: A classroom experience (Primary). In C. Shagar & R. B. A. Rahim (Eds.), Redesigning pedagogy: voice of practitioners. Singapore: Pearson Educational South Asia.
[6] Becker, J., Shimada, Y 1997 *The open-ended approach: A new proposal for teaching mathematics*. Reston, VA: National Council of Teachers of Mathematics.
[7] Lambdin, D. V 2003 Benefits of teaching through problem solving. In Lester, F. K. (Ed.). *Teaching mathematics through Problem Solving*: Prekindergarten-grade 6 (pp. 3 – 13). reston, VA: National Council of Teachers of Mathematics.
[8] Chan, C. M. E. 2008a *The Mathematics Educator,* **11** 47.
[9] English, L. D., & Sriraman, B 2009 Problem solving for the 21st century. In English, L. D. & Sriraman, B. (Eds.) 2009. *Theories of mathematics education: seeking new frontiers*. Advances in Mathematics Education, Series: Springer.
[10] Barbosa, J. C 2009 mathematical Modelling, the socio-critical perspective and the reflexive discussion. In Blomhoj, M., & Carreira, S. (Eds.), *Proceeding from Topic Study Group 21 at ICME-11* (pp. 133-143). Monterrey: IMFUFA tekst n. 461, Departement of science, system and models, Roskilde University.
[11] Lesh, R., & Sriraman, B. 2005. Jhon Dewey revisited – pragmatisim and the models modeling perspective on mathematical learning . In A. Beckmann, C. Michelsen, & B. Sriraman (Eds.). *Proceeding of the 1st international symposium of mathematics and its connection to the arts and sciences* (pp. 7 – 31). The University of Education, Schwobisch Gmund, Germany.

[12] Niss, M., Blum, W., & Galbraith, P 2007 How to replace the word problems. In W. Blum, P. Galbraith , H – W. Henn, & M. Niss (Eds.). *Modelling and application in mathematics education*: The 14th ICMI Study. (pp. 3 – 32). New York Springer.
[13] Lesh, R 2012 Research on models & modeling and implications for common core state curriculum standards. In R. Mayes, L. Hatfield, & S. Belbase, (Eds.), WISDOM e Monograph: *Quantitative reasoning and mathematical modeling: A driver for STEM integrated education and teaching in context*, (Vol. 2, pp. 197–203), Laramie, WY: University of Wyoming.
[14] Asempapa, Reuben S 2018 *Journal of Mathematics Education* March 2018, **11** 1
[15] English, L. D., & Watters, J. J 2004 Mathematical modelling with young children. In J. M. Hoines & B. A. Fuglestad (Eds.), *Proceedings of the 28th International PME Conference* (pp. 335–342). Bergen, Norway: Bergen University College.
[16] Pollak, H. O 2003 A history of the teaching of modelling. In G. M. A. Stanic & J. Kilpatrick (Eds.), A history of school mathematics, (pp. 647–671). Reston, VA: National Council of Teachers of Mathematics.
[17] Johnson, D., & Johnson, R 1999 *Learning together and alone: Cooperative, competitive and individualistic learning*. New York: Prentice Hall.
[18] Ikeda, T., Stephens, M., & Matsuzaki, A 2007 A teaching experiment in mathematical modelling. In C. Haines, P. Galbraith, W. Blum, & S. Khan (Eds.), Mathematical modelling (ICTMA 12). Education, engineering and economics (pp. 101–109). Chichester: Horwood Publishin.
[19] Verschaffel, L., Greer, B., & De Corte, E 2002 Everyday knowledge and mathematical modeling of school word problems. In K. P. Gravemeijer, R. Lehrer,H. J. van Oers, & L. Verschaffel (Eds.), Symbolizing, modeling and tool use in mathematics education. Dordrecht, The Netherlands: Kluwer Academic Publishers.
[20] Australian Education Council 1990 *A National Statement on Mathematics for Australian Schools*: Melbourne: Curriculum Council.
[21] Zulkardi 2006 *Formative Evaluation: What, Why, When, and How*. Retrieved Nopember 2018
[22] Tessmer, M 1993 *Planning and Conducting Formative Evaluation*. Philadelphia: Kogan Page
[23] Zulkardi 2006 *Formative Evaluation: What, Why, When, and How*. Retrieved Nopember 2017.
[24] Bliss, Karen; et. al 2016 *GAIMME: Guidelines for Assessment & Instruction in Mathematical Modeling Education*. United State America: COMAP & SIAM.
[25] Brady, Corey. 2018. Modelling and the representational imagination. ZDM Journal. ZDM (2018) **50** 45
[26] Huffman, T anner J, " The effects of a model-eliciting activity on high school student design performance" 2015 Open Access Dissertations. 477.
[27] Almeida, Lourdes Maria Werle de 2018 Considerations on the use of mathematics in modeling activities. *ZDM* **50** 19
[28] Riyanto, et. al. 2018 Mathematical Learning through modeling tasks in Senior High School: Using Nutrition Context. *Journal of Physics: Conference Series*.
[29] Ärlebäck J. B., & Frejd P 2010 First results from a study investigating Swedish upper secondary students' mathematical modeling competencies. In A. Araújo, A. Fernandes, A. Azevedo, & J. F. Rodrigues (Eds.), EIMI 2010 Conference (educational interfaces between mathematics and industry) Proceedings.Comap Inc., Bedford, MA, USA.

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