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Mathematics Learning Through the Conceptualization of Materials from Game and Activities of Students in the Border of the Republic of Indonesia

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Abstract: ***This article presents the results of research on the design of elementary school mathematics learning through the conceptualization of mathematical material from games and daily activities of students in the border regions of the Republic of Indonesia, especially Makalehi Island and Marore Island. Referring to the existing theories, the use of natural objects and social objects which are the background of the students' games and daily activities become the core of material design and mathematics learning activities that involve the participation of parents and the community. The results of this study are learning designs for a number of Grade 5 elementary school mathematics materials consisting of material conceptualization designs, activity scenarios, and evaluation instruments that meet valid, practical and effective criteria. In addition, it also produced a draft of guidelines and scenarios for the role of teachers, parents / community in field activities by students who support learning activities in schools for a number of grade 5 elementary mathematics materials that meet valid, practical and effective criteria. Theoretically, it can be said that the design of mathematics learning through the conceptualization of material from games and children's daily activities has the potential to enable elementary students to learn mathematics by learning in an ideal way. Another finding is that the use of natural objects and social cultural objects directly experienced by students has a positive impact on the nationalist and patriotic attitudes of students in the border regions of the Republic of Indonesia.***

Keywords: Conceptualization mathematics learning, games, activities, draft guides, natural objects and social culture

1. Preliminary

This article discusses the results of the development of mathematics learning design with the conceptualization of material through games and daily activities of elementary school children who are in the border regions of the Republic of Indonesia, especially children who are on the island of Makalehi and on the island of Marore. Educational facilities and infrastructure in the two islands are already available such as schools ranging from elementary, junior high and high school. Special emphasis on the border regions of the Republic of Indonesia is due to the social and cultural dynamics that dominate the behavior of people's lives. The life fairies of neighboring countries such as Malaysia and the Philippines, which are seen by some Indonesians as a country with a more prosperous life, naturally affect the life behavior of people in the border regions of the Republic of Indonesia. The pattern of life of the community thus certainly affects the lifestyle of children who appear in activities of daily life and also in the form and style of the game. According to Mercer et al (2007), small islands have special characteristics related to biophysical, socio-cultural and economic conditions. Ecologically, small islands are vulnerable to global changes such as climate change (van Aalst, 2006), sea level rise (Rodolfo and Siringan, 2006) or interactions between global pressures and local dynamics that contribute to increased environmental vulnerability (Pelling and Uitto, 2001). On the other hand, small islands have socio-cultural power that develops in response to various pressures or difficulties of natural factors and external socio-cultural influences. The natural and socio-cultural conditions of the community determine the forms of children's daily activities and patterns of children's play.

Although educational facilities and infrastructure are available on Marore and Makalehi islands, access to education is still a serious problem, especially in the field of mathematics education and learning. Issues that appear are related to the availability of teachers and the implementation of teacher's tasks, learning materials, and the support and views of parents / community towards learning. Learning materials only depend on textbooks that are prepared nationally and teachers have not been creative in utilizing learning resources from the surrounding environment (Medellu et al, 2014; Runtu 2016). Mathematical learning strategies have not exploited the wealth of natural and socio-cultural elements as well as objects of natural and socio-cultural elements which lay behind children's games and daily activities. Utilization of the environment (natural and socio-cultural elements) as a source of learning on small islands has strategic values including, (1) increasing knowledge, skills and positive values of the natural and socio-cultural potential of the community, (2) increasing mastery of the relationship between the concept of subjects with the realities of life around children, (3) community participatory activities can be developed towards the implementation of education. The form of games and students' daily lives are part of the use of the environment for learning which has a strong influence on learning motivation because it answers the needs and problems of children.

The identification, inventory and classification of mathematical learning objects about games and children's daily life is part of the mathematics learning resource mapping strategy that is established as a strategic plan for mathematics learning research at Manado State University. This mapping is the basis for the development of mathematics learning research for various levels of education, so that it becomes a means to apply educational services by Unima. Innovation of mathematical conceptualization of games and children's daily lives and the design and implementation of learning can be developed and adapted in other areas as an expansion and development of mathematics learning research.

The aim of this research is to produce a mathematics learning design sourced from the natural and socio-cultural environment and design and implementation of designs that can be followed up by the teacher and the community. The specific objective of the research is to produce a mathematics learning design that utilizes the conceptualization of mathematical material through children's games and daily activities that are interactive between learning in school with mathematical tasks that solve using the characteristics of games and children's daily lives.

Mathematical Conceptualization of Students' Games and Daily Activities

Mathematical conceptualization of children's games and daily life is the basis for the development of mathematics learning by utilizing learning resources from the surrounding environment. The understanding of mathematical conceptualization here is the formulation of the forms and procedures of play and children's daily lives in the form of mathematical symbols, relationships, comparisons and quantities. Conceptualization has involved various parties such as mathematics and mathematics education experts, teachers, parents and the community. Knowledge, skills and values that exist in the community must be entered and strengthened through instructional materials and learning targets. The design of learning devices that utilize mathematical conceptualization of games and children's daily lives, is schematically presented in Figure-1.

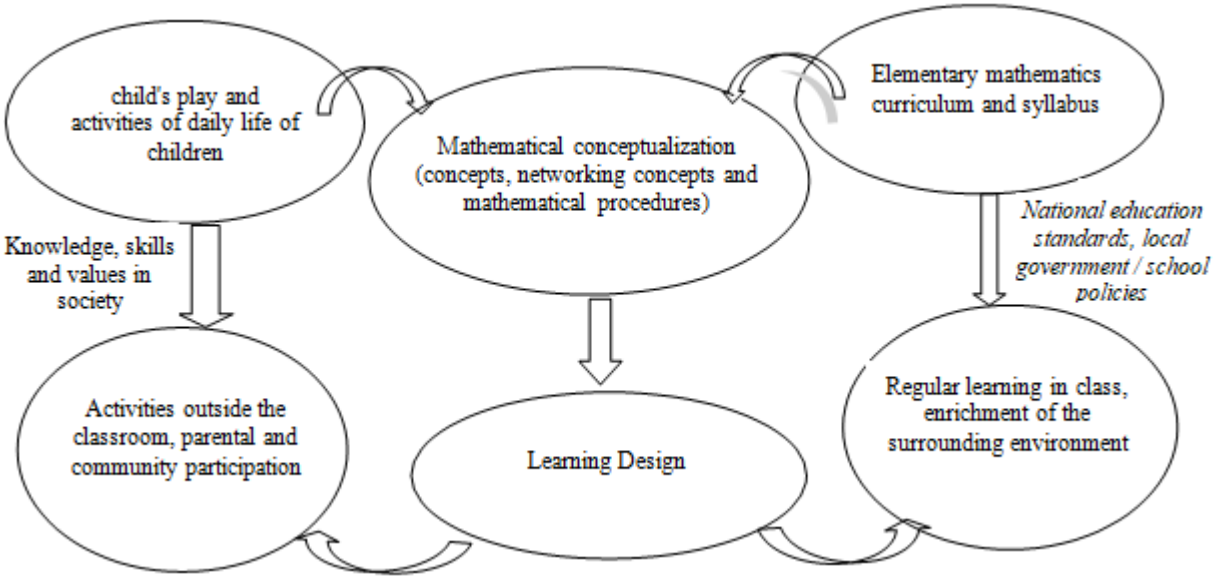

Figure 1: Scheme conceptualization, design and implementation of mathematics learning design sourced in games and children's daily lives

Learning with Mathematical Conceptualization on Small Island

The learning design on the small island needs to be adjusted to the characteristics of the small island which includes natural and socio-cultural characteristics as a whole, and involves all components of learning, in this case are teachers, parents and the community. A small island inhabited by a group of people who have the same relative characteristics, both natural and socio-environmental conditions, can be a learning design idea that utilizes children's games and daily life. The natural and socio-cultural elements on the small islands are unique and are a unity that has developed through a long process from generation to generation. Small islands have special characteristics related to biophysical, socio-cultural and economic conditions (Mercer et al., 2007). Utilization of the surrounding environment as a source of learning mathematics must cover all components of the environment both natural, socio-cultural as well as natural-socio-cultural interactions. Thematic learning about the environment will increase (1) positive knowledge and attitudes towards the utilization of natural resources, (2) the relationship between experience and what is learned, (Medellu et al, 2015), (3) motivation to obtain information and exchange ideas (Chen, 2012; Bekoe et al, 2013), (4) increasing collaborative activities between students and between students and parents (Ajaja and Eravwoke, 2010; Medellu et al, 2015), (5) learning across ages or across education levels (Ultay) and Ultay, 2010; Uzun et al, 2013; Rende, 2016), (6) group interactions with different socio-cultural backgrounds, (7) increase problem solving skills and critical thinking (Kazempour, 2014). Mathematics is a science that is taught since the first grade of elementary school which is entered as a subject and is gradually increasing at the grade level and further education. Mathematics is seen as the glue of science or other fields of study where variables and relationships

between variables are expressed quantitatively and using symbols. Mathematics is basically universal (as a universal language) because it is not conditioned by cultural differences (Favilli and Tintori, 2014). Favilli (2004) believes that mathematics is the most universal set of concepts and ideas. Even though it is universal, special conditions make mathematics diffuse and patterned into special (Clanché and Sarrazy, 2014). In special contexts mathematics can explain the universal properties of natural and socio-cultural phenomena. Universality provides advantages in explaining, analyzing or analyzing based on mathematical principles and procedures. According to Broaler (2008), students want to learn mathematics as a whole with the environment. Mathematical context can be in the form of natural, socio-cultural, economic, industrial, etc. Mathematical contextualization in science is related to dimensions, size, rate of change, spatial distribution, etc. In the socio-cultural field, increasingly "ethnomathematics" is a group of ideas that pay attention to the history of mathematics, the roots of mathematical culture, mathematics in everyday life, and mathematics education (Bush, 2005). Favilli and Tintori (2014) suggested that ethnomathematics is a research program on the history and philosophy of mathematics that has pedagogical implications, focusing art and techniques on providing explanations, understanding and copying differences in sociocultural environments. Giving an interesting mathematical assignment, will encourage students to develop ideas to study mathematics Hodge, et al (2007), increase efforts to understand the relationship of context with mathematical concepts (Ainley et al, 2006), connect local with global or external contexts based on mathematical concepts (Mandang and Runtu, 2015) and to solve problems (Anthony and Walshaw. 2009). The characteristics of small islands, indicate that inherently, knowledge, skills and mathematical values are inherent or constitute a unity with the socio-cultural community and the community's response to the conditions of the natural environment. The forms of play and children's daily lives (interactions with families, helping parents, etc.) are special forms of objects as well as interesting learning resources because they are the needs of students. The principles of developing mathematical material and learning activities that utilize the environment around students such as the relevance of students 'experiences and needs, are very strongly represented through the forms of play and students' daily lives.

The Role of Teachers, Parents and the Community in Supporting Learning

The teacher has an important role in the development of students' mathematical identities (Cobb and Hodge, 2002). The teacher can help students make careful connections about solution strategies where mathematical ideas are key (Watson and Mason, 2006). Teachers must develop knowledge about social movements, history, culture, local and global sociopolitical forces that influence students (Gutstein, 2006). If the teacher has a variety of knowledge bases in the field of community mathematics, the teacher can develop critical thinking skills, and can lead students to study the process of criticism and accumulate these experiences (Brantlinger et al, 2007). Children's games are very rich in mathematical concepts and procedures. Collaboration between mathematicians, mathematics instructors and educators on rural life (rural educator) can be carried out through at least two levels (1) expansion of traits and goals based on pedagogy, (2) conceptualization and conducting research based on pedagogy (based on place-based pedagogy) (Bush, 2005). In designing and implementing mathematics learning designs sourced from the surrounding environment, teachers need to take advantage of the role of parents and the community. Parent involvement in the child's learning process is a process of democratization in the family environment and has the potential to be developed interactively with schools (Medellu et al, 2015). Aref et al (2009) suggested six categories of parent / community participation in children's education, namely: strengthening, partnership, interaction, consultation, giving information, and manipulation. Community participation is considered important in the development and planning of education based on the needs of students and the community. Utilization of the surrounding environment as learning material, and involving the role of parents of community funds in the learning process of children ensures the development of a democratic learning climate both in school and outside of school (Medellu et al, 2015).

Method

To achieve the research objectives, the research method is carried out through the following stages and procedures:

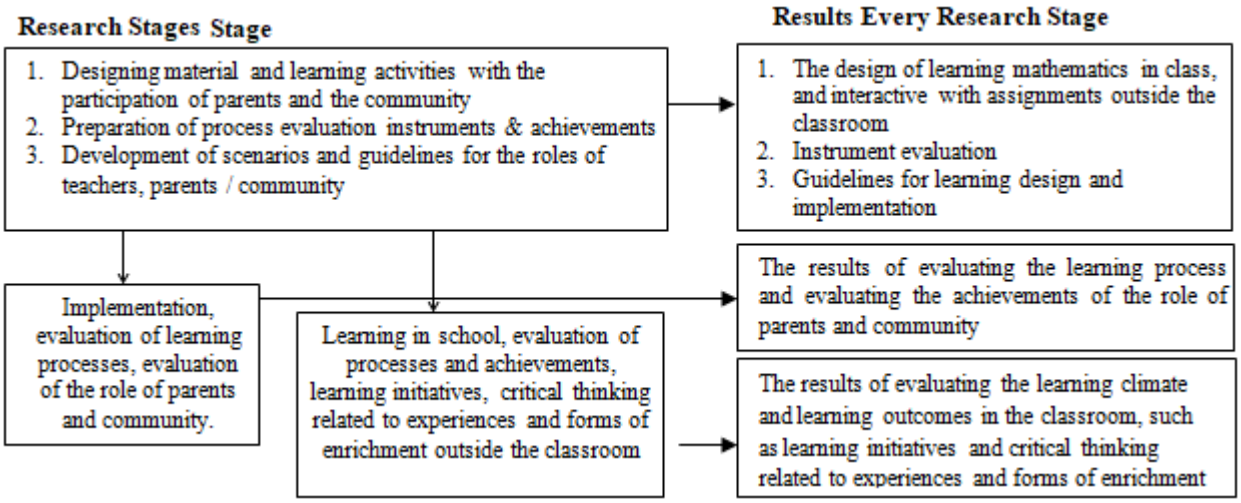

Figure 2: Stages and Research Flow

2. Research Procedure

Based on the research stages presented in Figure-2, the description of the research procedure is as follows.Designing material and learning activities with parents and community participation. Indicators of research performance in the design process of this learning material are: (a) the resulting learning design that includes material, activity scenarios, and evaluation instruments must meet valid, practical and effective requirements (Nieveen, 1999). Validation data is obtained through an assessment sheet filled in by the validator after checking the learning plan implementation documents containing material, scenario activities and evaluation instruments. Practicality data is obtained through an observation format conducted by observers on learning based on the design being tested. The effectiveness data was obtained through the student learning outcomes test instrument (cognitive data), student questionnaire responses (affective data) and observation sheets for learning (practicality data) using a developed design. Data analysis uses quantitative and qualitative analysis.

Preparation and implementation of guidelines and scenarios for the roles of teachers, parents / community. Research performance indicators include: (a) guidelines and scenarios for the role of the teacher, parents / community meeting valid, practical and effective criteria (Nieveen, 1999). Validity data was obtained through an assessment format that was filled in by the validator after checking the guidance documents and the scenario of the role of the teacher, parent / community. Practicality data was obtained through an observation format conducted by observers on the implementation of guidelines and scenarios of the roles of teachers, parents / community. The effectiveness data was obtained through (1) the instrument of the impact test of the field activities carried out by students with the support of the role of the teacher, parents / community, (2) questionnaire related to the perceptions and responses of teachers, parents / community to the learning developed. Data analysis uses quantitative and qualitative analysis.

3. Results and Discussion

The results of the study are (1) learning design for a number of grade 5 elementary school mathematics materials consisting of material, scenario activities, evaluation instruments and guidelines for learning. Mathematical material that supports the development of research activities are Fractions, Scale, Data & Data Collection Method. The third grade 5 mathematics material is constructed by students through the conceptualization of students' games and daily activities. The learning scenario consists of steps (i) *Observation*. The students individually or in groups observe the description of games and daily activities of students accompanied by natural and socio-cultural elements displayed as pictures (photos) in the Student Enrollment Work Format (LKPD), (ii) *Ask*. The students ask with the intention of asking for additional explanation about the contents of the worksheet, (iii) Answering. The students individually wrote answers to questions in the LKPD related to the existence of students' games and daily activities as well as natural and socio-cultural elements, (iv) *Horizontal and vertical mathematical*. Students answer mathematical problems contained in LKPD related to students' games and daily activities as well as natural and socio-cultural elements (v) *Conclude*. The students fill in the questions in LKPD which function to get conclusions about the mathematical conceptualization of the students' daily activities and activities. The evaluation instrument that is designed has the function of measuring students' cognitive, affective and psychomeotic competencies related to Fractional Numbers, Scale, Data and Data Collection Methods. The instrument for measuring cognitive competency is the Learning Achievement Test with indicators of achievement of basic competencies regarding Fractional Numbers, Scale, and Data & Data Collection Methods as contained in the 2013 syllabus elementary school mathematics syllabus revised 2018. The instrument for measuring affective competency is a questionnaire with a feeling indicator students, student opinions, student interests, student communication skills towards the conceptualization activities of mathematical material, mathematical results of conceptualization, LKPD, the atmosphere of learning and the contribution of parents / communities to the tasks of teacher initiation. Guidelines for implementing learning in outline contains the tasks of planning, organizing classes, and strategies to help student activities in class and outside the classroom. In the preparation and testing activities, it was obtained that all of the instruments met valid, practical and effective criteria.

The strategic step in the learning design is an effort to attract the attention of students, both their feelings and their thoughts in full for learning. This effort is a tough task for mathematics teachers, but can be facilitated by 4 (four) strategic steps in the learning design. This is in accordance with the confirmation of the impact of thematic learning about the surrounding environment that will increase knowledge and positive attitudes towards the use of natural resources, and improve the relationship between experience and what is learned (Medellu et al, 2015), will be motivated to obtain information and exchange ideas (Chen, 2012; Bekoe et al., 2013), and will improve problem solving skills and critical thinking (Kazempour, 2014).

The second research result is a guide and scenario of the role of teachers, parents / community in learning activities that involve their roles and participation. The role of the teacher, parents / community, especially in field activities carried out by students with the aim of getting social objects and natural objects that lay behind the game or the daily activities of students related to the conceptualization of certain mathematical material. Furthermore, with these results students do mathematical horizontal and vertical with questions made by the teacher. The steps in the field activities are designed by adapting and modifying the steps of the project based learning model, and the results include (1) the formulation of fundamental questions, (2) design of activity plans, (3) schedule of activities, and (4) monitor the results of field activities carried out in schools. The main indicator of the success of the roles and participation of teachers, parents / community is the success of students in carrying out fieldwork that supports classroom learning. Through testing the validity, effectiveness and practicality of the guidance documents on the role and participation of teachers, parents / community and their impact on the success of the field activities carried out by students,

obtained results that meet the criteria of valid, practical and effective.

Theoretically, the preparation of field activities supports students' desires as stated by Broaler (2008) that students want to learn mathematics as a whole with the environment. For students working with a number of mathematical problems that are packaged as contextual problems it fosters sufficient internal motivation to solve problems which are horizontal mathematical processes. Because giving an interesting mathematical assignment, will encourage students to develop ideas to study mathematics Hodge, et al (2007), increase efforts to understand the relationship of context with mathematical concepts (Ainley et al, 2006), connect local with global or external contexts based on concepts mathematics (Mandang and Runtu, 2015) and to solve problems (Anthony and Walshaw. 2009). Theoretically it can be said that the design of mathematics learning through the conceptualization of material from games and children's daily lives has the potential to enable elementary students to learn mathematics by learning in an ideal way.

Another finding that was identified was that the use of natural objects and social objects that were directly experienced and often seen by students in learning had a positive effect on students' positive activities during mathematics learning. In daily life, students who are in the border regions of the Republic of Indonesia have natural objects and social objects that are typical of border areas consisting of small islands. On the other hand, the government, in this case the education office, especially schools and communities in the border regions of the Republic of Indonesia, always provides social objects and environmental objects (which can be called natural objects) that give nationalism to students. Therefore, directly, the use of natural and social objects in mathematics learning in the border regions of the Republic of Indonesia has a significant impact on improving nationalist and patriotic attitudes for students.

4. Conclusions and Suggestions

Mathematical conceptualization learning design developed meets valid, practical and effective criteria. Learning design consists of material design, scenarios of student activities and evaluation instruments of learning processes and outcomes. Mathematical conceptualization is done by using games and daily activities of students who have a background in natural objects and social objects that are directly experienced by students.

The design of the role guides for teachers, parents / communities that support the field activities carried out by students meet valid, practical and effective requirements. Field activities are designed by adapting and modifying the steps of a project based learning model, and the results include (1) formulation of fundamental questions, (2) design of activity plans, (3) schedule of activities, and (4) monitoring results field activities carried out at school.

Another finding that was identified was that the use of natural objects and social objects that were directly experienced and often seen by students, had a positive impact on positive student activities during mathematics learning.

The government, in this case the education service especially schools and communities in the border regions of the Republic of Indonesia, needs to provide social objects and environmental objects (which can be called natural objects) that encourage increased nationalist and patriotic attitudes for students in the border regions of the Republic of Indonesia. This issue can be developed for further research.

5. Acknowledgement

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