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Realistic Mathematics Education in Traditional Community Culture

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Abstract

This study purposed to explore the values of indigenous culture in Cigugur traditional community related to Realistic Mathematics Education (RME) learning process. This study used qualitative method through ethnopedagogy approach to assess their cultural values. It is done by deep observation, documentation, in-depth interviews, and discussions of participants started from process that related to their daily life and to articulate the meaning of the tradition they have been doing. After conducting those steps, the author used triangulation to determine the data related to the study. The result of the study shows that the local wisdom of Cigugur traditional community is relevant to RME on agricultural system and traditional Seren Taun ceremony.

Keywords: Culture; Local Wisdom; Realistic Mathematics Education; Tradisional Community

Introduction

Mathematical learning at this time must be facilitated in order to provide opportunities for students to explore their own mathematical ideas. The process must provide guarantees for students to be able to discover mathematical concepts so that their understanding can be developed by providing some broader opportunities to represent their mathematical ideas and procedures. One goal that needs to be achieved by students to broaden their understanding is to master mathematics taught through constructive understanding based on existing problems in the real world towards mathematical concepts. This process is commonly known as mathematization. This process is used to minimize and anticipate the use of mechanistic approaches. One alternative method that can be used is through the use of realistic mathematics education, abbreviated as RME.

RME was born from the Wiskobas project by Edu Wijdeveld, Fred Goffree, and Adri Treffers in 1968 based on the importance of reforming the approach that applies to mathematics education (Van den Heuvel-Panhuizen & Drijvers, 2014). Realistic comes from the Dutch expression "*zich REALISEren*" which can be interpreted to imagine, so that the consequences of the problems presented in RME can come from the real world or the fantasy world of fairy tales or the formal world of mathematics as long as the problem is real in the minds of students (Van den Heuvel-Panhuizen & Drijvers, 2014). Based on this, the contextual problem becomes the main thing that must be the focus of attention in developing the learning process. The context problem in RME is intended to support the process of reinvention that offers students the opportunity to do progressive mathematics so that students can understand formal mathematics through the interpretation and recreation of conventional mathematics which has a role from the beginning onwards (K. Gravemeijer & Doorman, 1999).

RME as a mathematical approach, was born because of the need to reform mathematics learning. This need is based on the reason that RME is a domain-specific instructional theory that is

very compatible because it relies on applications and modeling that emerge based on the real world (Cobb, 1994). The use of RME is felt to be very appropriate for the purpose of minimizing the use of a mechanistic approach that seems to focus on memorizing facts and mathematical concepts and prioritizing activities on the computational aspects. In this case, the implementation of RME in mathematics learning must be supported by a variety of concrete efforts, especially in the development of teaching materials that are in accordance with the concepts and principles of RME. The concept of RME is characterized by providing broad opportunities for students to rediscover mathematics under adult guidance (K. P. E. Gravemeijer, 1994) and the reinvention of mathematical ideas and concepts that begin with the presentation of various problems and situations that arise in the real world (De Lange, 1995).

Meanwhile, the principle of RME consists of: (1) starting from the experience of students so that they can engage in meaningful mathematical activities; (2) take into account students' mathematical ways; (3) instructional sequences involving student activities in creating and describing symbolic models of informal mathematical activities; (4) interactive instructions, namely explaining and justifying solutions, understanding students' solutions, agreeing or disagreeing, questioning other problem-solving alternatives, and reflecting; (5) the use of real phenomena, where the structure and concepts of mathematics must be able to manifest systematics in the learning process (Cobb, 1994) and (De Lange, 1996). The concept and principle of this RME is the main basis for the use of RME in learning, because in reality mathematics is a human activity so mathematics learning must be developed in an effective way.

As a consequence of these concepts and principles, teachers must develop interactive instruction, provide stimulus and opportunities for students to contribute actively in the learning process. Based on this, the RME is seen as having different characteristics from other approaches. The main characteristics of RME include the application of meaningful contexts, the development of models that transform contextual mathematics into formal mathematics, conceptualization of mathematics by students, interactive interactions between students and teachers, and are able to bring up mathematical perceptions as subjects integrated with the real world (Clements & Sarama, 2013). These characteristics lead to the process of linking, identifying and solving mathematical problems through the interpretation of mathematical solutions based on the context. Simply stated, the characteristics of the RME lead to progressive mathematical processes (Laurens et al., 2018).

Based on this, then in every mathematics learning teacher must begin to introduce appropriate problems or contextual problems based on human activity. The real context and a sense of respect for students' ideas are needed in applying the approach to be carried out in class. RME is a transformation from procedural mathematics into learning that starts with a real context (Sembiring, 2010), the context itself must be related to daily activities based on student experience. This has consequences for the development of RME in various studies especially those carried out in accordance with the local cultural context. Some of the studies that have been carried out include: the application of RME in learning geometry (Jupri, 2017), the effect of RME on student achievement and attitudes towards mathematics (Zakaria & Syamaun, 2017), the effect of RME on the cognitive abilities of elementary school students (Zubainur et al., 2015), the effect of RME on mathematical beliefs, mathematical representations and mathematical problem solving (Yuanita & Zakaria, 2016), RME to mathematical connection capabilities (Sirait & Azis, 2017). Some of these studies emphasize the effect of RME on students' mathematical abilities and attitudes without including analysis of the use of contexts that contain local cultural wisdom.

We consider this important, considering that culture is a manifestation of the lives of every person or group that is constantly adapting to changes in nature. Cultural values emerge, grow and

attach to culture in society are believed to be able to bring up unique characteristics in students because learning mathematics is not only learning concepts but also the values contained therein. This is in accordance with one of the goals of mathematics education according to NCTM in terms of the mathematical position in the social environment that is practical goals, social goals, professional goals, and cultural goals (Wijaya, 2012). Mathematics education can be used as a tool in understanding and solving problems that are found and faced in everyday life, so given the problems associated with real life, students will easily understand and realize whether or not the character of these cultural values can inherent in students because it is integrated in a given problem.

Learning material developed through the RME approach must also have meaning and high relevance to the empowerment of their lives in real terms, based on the reality faced by taking into account also the sociological and cultural constraints faced. Attention to sociological and cultural constraints can only be done through the integration of the values of the local wisdom of the community because local wisdom is a guideline in the life and character of the Indonesian nation. Local cultural wisdom can be known through the exploration of unique values that exist in society. In this study, we explored local wisdom in the Cigugur indigenous community. The Cigugur customary community is a cultural community that still adheres to customs that have been carried on from generation to generation so that they can be used as role models for the development of local culture-based RME. In mathematics learning, affective component development can form the mathematical disposition of students to think and do mathematically in a positive way that is in line with the meaning contained in cultural education and national character (Sumarmo, 2011). This is important to do because mathematics is often understood to be unrelated to values (A. Bishop et al., 2006), whereas three types of values that can be considered in mathematics class consist of general education values, math values, and mathematics education values (A. J. Bishop, 1996).

In relation to character education and values, it is important to realize that mathematics is not only related to mathematical objects but also related to social activities that cannot be separated from mathematical ideas, concepts, and procedures. This is relevant to the classification of mathematical objects, which consist of direct objects and indirect objects (Gagne, 1983). Direct objects consist of facts, concepts, principles, and skills while indirect objects consist of logical thinking, problem solving skills, positive attitudes, honesty and cooperation. The objects in mathematics provide evidence that mathematics as knowledge has a special value in human life. Based on this stigma, we see that some previous RME studies focused on achieving students' attitudes and cognitive abilities. This motivated us to examine how relevant RME is to local cultural wisdom as a basis for developing character education in mathematics learning. This is consistent with the opinion that reveals that the RME is a reform movement in mathematics education, so that it is not only a method of learning mathematics, but also an attempt at social transformation (Sembiring, 2010).

Methodology

The study was conducted in the Cigugur data community using a phenomenological approach with the ethnopedagogy method. Ethnopedagogy views local knowledge or wisdom as a source of innovation and skills that can be empowered for the welfare of society through the use of various life values such as educational values, religious values, moral values, and social values (Alwasilah et al., 2009). The researcher acts as the main research instrument that collects data through observation techniques, in-depth interviews, documentation, and field notes from key informants and additional informants who know about the traditions that exist in the Cigugur indigenous community. In this study, the research setting is natural. That means the writer did not treat them. But researchers take part in their activities with the aim of identifying and examining their

processes, in their daily lives, so that the writer will find new ideas or concepts that are heard and felt fresh by the writer. This study attempts to show input, opinions, from informants who are considered capable of providing information, then the data are analyzed by triangulation. With triangulation, it is expected to provide meaning in accordance with the research design, which is based on the development of instruments in the field because triangulation is part of the examination and validity of the data.

Results and Discussion

The Cigugur indigenous community is geographically located in Cigugur, Kuningan Regency, Indonesia. This community is one of several traditional villages in West Java that still upholds the Sundanese ancestral custom (*Karuhun Sunda*). This research was conducted to integrate RME learning with community cultural values carried out by selecting forms of local wisdom of Cigugur Indigenous community culture that can be integrated and adopted with the RME approach. The Cigugur Indigenous Community has a living and developing local culture system that fulfills seven universal cultural elements consisting of a language system, a knowledge system, a kinship system, a living equipment system, an economic system, a religious system, and an arts system. Therefore, the embodiment of this local cultural system generally shows the existence of a local wisdom that functions to harmonize their lives with the surrounding environment according to their outlook on life.

In this study, researchers conducted an analysis of the economic system and the arts system that is holistically integrated with the religious system. The results of this study provide an understanding of the relevance of cultural values found in society with formal education, especially mathematics education. The cultural form reflected in the values of the Cigugur indigenous community relevant to the RME is described as follows.

Agricultural System

The farming system in the Cigugur indigenous community is reflected in their tradition in the management of rice fields which is based on knowledge passed down from generation to generation. They still hold on to the legacy of the past or known as "*tatali paranti karuhun*". The system that is still maintained is a form of interaction between humans and the environment by preserving ancestral traditions (*buhun*). Rice processing carried out by the Cigugur Indigenous Community is divided into 16 phases, namely: (1) *Mopok galengan*; (2) *ngabaladah*; (3) *nebarkeun binih* (pembenihan); (4) *babut*; (5) *macul* (hoe); (6) *nyongkog*; (7) *dilahankeun* (prepare of the land); (8) *diirik*; (9) *disurungan*; (10) *digarit*; (11) *tandur* (planting seeds); (12) *diayuman*; (13) *ngarambet*; (14) *mupuk* (applying organic fertilizer); (15) *mipit*/*dibuat* (harvest); dan (16) *Nutu* (grind rice). This pattern is always carried out by all members of the community as an environmental preservation effort.

Based on these phases, there are several values that are related and relevant to the RME approach, especially about what community members have done. These values, among others.

The value of agreement

The management of agricultural land management carried out by the Cigugur indigenous community is an agreement that is established based on an agreement agreed upon by the previous generation so that it becomes a standard rule. It is at the same point with mathematics, where we can find agreement in several mathematical concepts. Gagne states that the concept is an abstract understanding (idea) that functions to classify and determine objects or events that are classified into examples or not examples (Ruseffendi & others, 1992). The value of agreement can train someone to be responsible and can accept the consequences of what has been agreed.

The value of consistency, logical and rational

These three values are important values that are owned and believed by all members of the indigenous community. Regarding agricultural systems, they consistently adhere to patterns in agricultural systems that are seen as having logical and rational phases. They will not do such a thing when they know they are out of season. These three values are relevant to mathematical concepts that existed long before. For example, for each member of an integer, it is determined that the sum of two integers is an integer. So the result of 3 + 7 must be an integer. Consistency values exist and can be taught through mathematics because mathematics is consistent in the system. Three pairs of complementary mathematical values, namely rationalism, control, and openness (A. J. Bishop, 1996). These three values consistently show consistency that is integrated with logical and rational values which serve to provide confidence that mathematics has the value of truth as a knowledge and tool in meeting human needs in solving various problems in everyday life. The consistent nature of mathematics is able to teach someone to obey the rules and responsibilities.

The value of usability

In the paddy management phase there are activities that use distance calculation, i.e *ngagarit*/*digarit* (spacing of rice planting) marked with a square line about 20-25 cm in size. these activities are relevant to mathematical concepts, where there is value to the use of mathematics. The usefulness of mathematics is born from the fact that mathematics emerges as a form of communication that is strong, short, dense and does not have multiple meanings (Wahyudin, 2012), this arises because mathematics has the right answers which can always be controlled (A. Bishop et al., 1999). Many mathematical concepts can be found and used in everyday life both consciously or unconsciously but generally this is outside the teacher's attention in applying mathematics learning so that the usefulness of mathematics is poorly understood by students.

The traditional ceremony of "Seren Taun"

Seren Taun is a traditional ceremony in the Cigugur indigenous community that is routinely performed every year and is a cultural tradition that reflects the life of an agrarian community. Seren taun ceremony as a tradition is routinely held on 18-22 *Rayagung* (*Saka Sunda* Calendar System). *Rayagung* is the last month of the Saka Sunda Calendar System which implies celebrating the majesty of God Almighty and is a form of gratitude for the harvest blessings that God has given, so that it is hoped that the following year agricultural activities carried out by the community can run smoothly by paying attention to the natural balance and expect an increase in yields.

The highlight of Seren Taun in the form of pounding rice on 22 *Rayagung* also has its own meaning. Number 22 is interpreted as a series of numbers 20 and 2. Rice that is pounded at the peak of the event is 22 quintals with a division of 20 quintals to be pounded and distributed back to the community and 2 quintals used as seeds. Number 20 reflects the anatomical elements of the human body while number 2 refers to the understanding of pairs. Number 22 which contains philosophical meaning is evidence of how the mathematical value is inherent in their lives.

The results showed that there were several values that were successfully explored and fulfilled the elements relevant to the RME approach, including.

The value of tolerance

Seren Taun ceremony was attended and carried out by multi-religious communities without knowing their race and class because it was attended by people who came from or outside Cigugur. Basically cigugur society is a heterogeneous society in terms of religion. This happened because the Cigugur indigenous community held the principle "*walau tidak sepengakuan tapi sepengertian*" (although not as acknowledgment but as understanding). By holding that principle, they keep their lives in harmony, mutual respect and mutual respect for each other. We believe that this value can

represent the value of tolerance (respect) that is relevant to RME learning, especially with regard to social interaction.

Social interaction in learning RME occurs when students work together with colleagues to solve mathematical problems and present their solutions. Social norms and sociomathematic norms introduced by Cobb, Wood & Yackel which explain that social norms are general patterns of social interaction that are not bound to the topic or subject matter while sociomathematics are norms that are specifically related to arguments in mathematics through the process of interaction and negotiation in understanding mathematical concepts (Wijaya, 2012). The value of the usefulness of mathematics is closely related to the position and role of mathematics, especially in aspects of mathematics as a problem solving tool.

Universe / symbol

The Seren Taun ceremony starts with the *Ngajayak* (taking rice) ceremony on the 18th of *Rayagung* which ends with the ceremony of raising rice as the last event on the 22nd of *Rayagung*. 18 is the language spoken "*delapan hingga dua belas*" (eight to twelve) connotes compassion means love and compassion for God. The number 22 is defined as a series of numbers 20 and 2. The number 20 reflects the anatomy of the human body because men and women have 20 characteristics in the human form while the number 2 refers to the notion of a partner. The symbols that we can obtain in ceremonial processions are relevant to one of the characteristics of mathematical symbols that are emptied of their meaning. For example, if x, y, z etc. This means that a variation depends on the user, whether numbers, vectors, statements, or others. Mathematics has the nature to pay attention to the universe of speech in the sense that mathematics can encourage someone to think positively in behavior because the universe can see the merits of a value order somewhere (Rahman, 2016).

In mathematics realized or not, there are some examples or questions that are very concerned with the universe. For example, when we don't care about the universe, we can be wrong about it. So by paying attention to where we are in the universe through mathematics, we can improve it. Mathematical objects flow into symbols which eventually form the language of mathematics. Mathematical language can be easily used as a communication tool, think and express ideas regularly and systematically. The existence of these symbols provides a great opportunity for mathematics to be used in a variety of sciences and real life.

The value of material

In the implementation of Seren Taun there are some concrete objects that are exhibited as tools, such as: transporting rice, jars, tables from Paseban (sacred objects) and other objects. These objects are relevant to mathematical objects that are concrete objects, images or models of cubes, rectangular pools, pyramid-shaped roofs, and so on. Materially, mathematical objects are all around us. Thus this value emphasizes the application of mathematics in everyday life that is relevant to the principles and characteristics of RME.

The value of democratic

In the implementation of Seren Taun there are also democratic values that can be demonstrated through principles held by members of the community where "*mereka tidak memiliki keyakinan yang sama tetapi saling memahami*" (they do not have the same beliefs but understand each other). The value of democracy is relevant to character building in being able to accept differences of opinion and mathematical solutions in RME learning, especially in two-way interactions between teacher and students and between students and other students.

The process of creating meaning through the culture-based learning process of RME has several components, namely active interaction, explanation and contextual application of mathematical concepts, and the use of various learning resources based on certain values. Values in education

reflect attitudes, decisions, actions, behaviors, relationships, expectations and vision (Pathania, 2011). These values can give meaning and strength to the formation of a person's character or behavior and occupy a central place in an individual's life. This is in line with the great interest of the mathematics education research community which seeks to examine the relationship of mathematics education with values (A. Bishop et al., 2003). How to integrate value education into the school mathematics program can be done through the teacher's approach to teaching, the use of mathematics as a tool in instilling values, and through discussion of values exemplified in the lives of mathematicians (Taplin, 1999), in practice in the classroom it is necessary to build more activities that contain values (Chin & Lin, 2001).

Based on how to integrate grades into school mathematics, we view that RME is relevant as an approach that can be used for this purpose. The relevance lies in various theories of local instruction in RME. A number of local instruction theories focusing on certain mathematical topics have been developed over time (Van den Heuvel-Panhuizen & Drijvers, 2014), which involves a cyclic process based on thought experimentation, design of the teaching process, testing of teaching experiments, and retrospective analysis to adjust the design as needed (K. P. E. Gravemeijer, 1994). Based on this, we recommend that RME learning can be developed through the values of the local wisdom of the community because it is proven that some of the values of local wisdom are relevant to the principles and characteristics of the RME approach. The principle of RME as a learning approach that emphasizes Progressive Mathematization, Guided Reinvention, and Didactical Phenomenology, meanwhile the characteristics of Interactivity and Relation are very relevant to the local wisdom that exists in the Cigugur indigenous community.

Conclusion

Based on the results of the study, it can be concluded that there is the relevance of the local wisdom values of the Cigugur indigenous community culture with the principles and characteristics of the RME as a learning approach. Local wisdom values can be integrated with RME explicitly or implicitly. Explicit integration can be arranged in the learning plan and teaching material development. Values in the form of tolerance, agreement, consistency, logical, rational, and systematic can be integrated implicitly. The transformation of local cultural wisdom values also plays a role in building student character so that students are expected not only to learn and understand mathematical concepts but can recognize, appreciate and apply local cultural wisdom values in daily life both at school and in the community.

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