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Mathematics Learning Within Culture And Nation Character: Using Traditional Dance In Learning The Concept Of Symmetry At Grade IV Primary School

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Abstract

This paper introduces a new approach in mathematics learning within culture and nation character. Indonesian traditional dances are used as a context in learning the concept of symmetry. Using context as a starting point in learning processes is the major concern in Realistic Mathematics Education (RME), one of the innovations in mathematics teaching developed in the Netherlands. Adapted to Indonesian culture, this approach is called *Pendidikan Matematika Realistik Indonesia* (PMRI). This approach is used to combine the so-called math traditional dances with mathematics learning. This can be seen as building nation character in appreciating Indonesian traditional culture. Design research is used in research methodology. This research was conducted to 22 students in grade IV at MIN 2 Palembang. The result shows that within the use of culture and nation character in learning mathematic can improve students' understanding of the concept of symmetry. Besides, students can optimize cultural values which indirectly showed in learning process such as accuracy, perseverance, hard work, curiosity, and unyielding attitude.

Key Words: PMRI, design research, math traditional dance, symmetry, nation character.

I. INTRODUCTION

Various efforts have been given to improve the quality of education in Indonesia. New policies, curriculum revision, and educational reform are examples of these efforts. Character education is one of the current issues in education. Deputy Minister of National Education, Fasli Jalal, explained that the present problems in the society, such as corruption, violence, and anarchize actions are the reason for character education (www.maarifinstute.org). In addition, character education is in line with national goals of education as stated in Article 3 of the National Education System Act. National education is aimed at producing noble, healthy, knowledgeable, skilled, creative, independent, responsible, and democratic citizens who have faith in God the Almighty.

This means character education should be included in every classroom including mathematics classroom. Mathematics education should help students develop among others their self-potentials, creativity, and curiosity.

Pendidikan Matematika Realistik Indonesia (PMRI) is a movement of mathematics education reform in Indonesia. This approach is adapted from Realistic Mathematics Education (RME) deveined by Freudenthal Institute in the Netherlands. Here mathematics is viewed as a human activity. Students are guided to reinvent mathematical ideas and find their own their own understanding on mathematical concepts through group and class discussions. This teaches democratic attitude, confidence, hard working, and perseverance. In this paper we designed math lessons on symmetry and reflection using Indonesian traditional dances as contexts. Students are expected to build their national pride and appreciation of traditional arts. According to Anawita (2010: 13), teaching materials are commonly used as materials or media to develop cultural values and national characters. Therefore, teachers do not need to change the existing subject, but use the subject matter to develop the cultural values and national character. Also, teachers do not have to develop specific learning process to develop value.

There are a lot of mathematical ideas that can be found in dances such as symmetry, time and space, combinatorics, rotation, number, geometry, patterns, and also for learning in higher education, such as graph. This opinion is supported by McCutchen (2006: 315): "*Math is a good partner for dance because of the geometric shapes in space, patterns, symmetry and asymmetry, and counting of phrases. However, geometric shapes are mathematical constructs that can be difficult to translate into artful movement. Oftentimes they are too stiff and contrived. Geometrics can be more useful the concepts are more organic and less contrived.*" Learning mathematics using dance is known as Math Dance. It is interesting because using dances means students do learning activities by moving their limbs. It is parallel with Fruedhethal (1991: 16-17) who emphasized the idea of mathematics that must be connected to reality through problems. The term "reality" in this context does not mean that the problem that always encounter in daily life. The term "reality" means that the problem will occur based on students' real experience.

II. RESEARCH METHOD

Design research has been used in this study. It consists of three phases: design, teaching experiment, and retrospective analysis (Cobb et al., 2001; Gravemeijer, 2004). Figure 1 illustrates the reflective relation between thought experiment and instructional or teaching experiment in design research; see Gravemeijer and van Eerde (2009) for details.

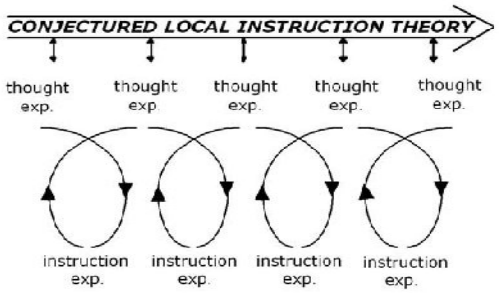

Figure. 1. Reflective relation theory and experiments

Hypothetical learning trajectory (HLT) and related activities were developed prior to teaching experiment. The trajectory was dynamic and adjustable to to students' actual learning during the teaching experiments. Two lessons with duration of 70 minutes each were conducted in teaching experiment Finally, the retrospective analysis, HLT was used as guidelines and references in answering research questions.

III. RESULT

Students first learned the concept of reflection. They worked in groups to find the "mirror" of reflection, which is the axis of symmetry. The teacher them prepared a video "dancing symmetry." This is an art-infused lesson about symmetry that links dance and math. When dancers move symmetrically, students were asked to think of a line of symmetry as a vertical line from top to bottom dividing dancers' bodies into right and left parts.

At the beginning, teacher gave apperception like the following

Teacher : "Why should you fold your clothes at home?"
Student : "So, they become neat."
Teacher : "How do you that neatly."
Intan : "Every corner of the clothes should coincide, Miss."
Teacher : "Good."

Later students realized that the folding line would be the axis of symmetry of clothes. Following this, students watched "badindin dance" video and worked on student's worksheet together in small groups. This worksheet contains problems to determine the axis of symmetry. In Figure 2, for example, students were asked to find any axis of symmetry.

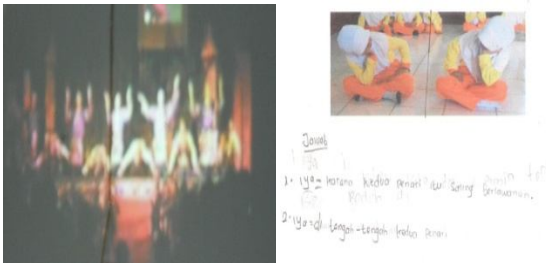

Figure. 2. Axis of symmetry

There are three strategies: estimating, folding the figure, and trying to measure the figure. Students watched the video of "kupu-kupu" dance and decided where the axis of symmetry locates.

In second activity, students folded handkerchiefs distributed to each group. At the beginning, students folded the square handkerchiefs into four parts, but after the teacher gave a clue on how to fold the handkerchiefs into the former shape, they understood and found 4 ways of folding. A group was then asked to present their strategy of folding in front of class.

In the third activity, the students folded the origami paper of various shapes to find axis of symmetry. It took quite a long time before the students realized that the axis of symmetry is just a line that divides the shape into two identical parts. The teacher encouraged in groups to find such lines as many as possible through group discussion. Each group was then asked to present their results on folding symmetry in class discussion. Some students, however, still had difficulty in determining number of folding symmetries of pentagon.

An interesting discussion occurred when the students were discussing the number of folding symmetries of circles. They came up with many different answers as predicted. Here is a snapshot of the discussion.

Teacher : "Now we will discuss the number of folding symmetries of circles. *Durian* group, can you how many folding symmetries of circles?"

Student 1 : "Two, Miss ...."
Teacher : "Well, do you have different answers?"
Student 2 : "Twenty-nine, Miss ..."
Teacher : "Fine... What about your result *Buah Naga* group? "(writing the student's answer on the whiteboard).
Student 3 : "Four, Miss."
Teacher : "Okay ... What about your result *Mangga* group?"
Student 4 : "Two also, Miss."
Teacher : "*Jambu Air* group."
Student 5 : "Six, Miss..."
Teacher : "Waaach, there are so many different answers, let's try again!"
Student 6 : "Fifteen, Miss ..."
Teacher : "Let's try again, it can be different again!"

The teacher wrote other students' answers like 35, 50, and 100. Pasha spontaneously said: "a lot, Miss," followed by others saying, "countless." The teacher directly justified this answer and explained that in mathematics "countless" is known as "infinite." The discussion was concluded with a table of different geometric shapes and their corresponding number of folding symmetries.

IV. DISCUSSION

Development of nation character and culture just been integrated in mathematics classroom. Math dances provide student's with contexts to learning mathematical concepts. A learning design using math dance represents one way of building students' character. Folk dances are introduced in mathematics classrooms to provide context as well as to build studens't nationalism through appreciation of cultural values. *Indang* dance is a part of national cultures that has values and meanings in communication in societies. Some movements in this dance show the concept of symmetry as well. Using this folk dance brings a new experience for students in learning mathematics.

Early activity introducing symmetry concept by showing both palm, later,then the teacher submits to students that if only we do not have palm which is symmetry, what a difficult life for us. Here the teacher have developes attitude of thankfullness to God, self esteem which is given by God little by little will be planted in student.

Figure 3: Discussion of students

Collaborative working is a strategy associated with RME theory. Learning activities should engage an interactive principle. Within group discussions, interactivity among students, as well as interactivity between students and teacher, leads to a different kind of communication. Two-way communication between students and the teacher needs to be built up. The students said that collaborative work and discussion was interesting because it improves their ability to argue about mathematics and to share their mathematical ideas in the discussion forum. Collaborative work also teaches students the spirit of *gotong royong*.

Figure 4: The activity of students

The students feel that this approach is relaxed and less formal. They can share their mathematical ideas. The smarter students can share their experiences to the group work discussion.

In teaching activity, the teacher always starts the class with challenging problems which is n context or based on students' experience. This builds downright behavior to student. Class discussions entangle some opinions from the students. This builds attitude of

appreciating each other's opinion.

Figure 5: Presentation of student in front of class

The result shows that using traditional dance in mathematics classrooms can improve students' understanding on the concept of symmetry. Besides, students can optimize cultural values which indirectly showed in learning process such as accuracy, perseverance, hard work, curiosity, and unyielding attitude.

V. CONCLUSION AND SUGGESTION

PMRI approach provides students a context that links the concept they have to learn with reality of their live more situationally. Traditional dances have helped students reinvent mathematical ideas and understand the concept of symmetry. In this design, the materials are arranged in such a way that the students can re-invent the concept of symmetry. In the learning process, the focus is not on mathematics as a ready-made product but on the activities of guided re-invention, known the process of horizontal and vertical matematization (see Treffers, 1987 and Freudenthal, 1991). This develops students' initiative and creativity. Horizontal mathematizing in symmetry learning process is characterized by traditional dances and math dance, then the vertical mathematizing studied by *model of* and *model for* such as folding a handkerchief and origami paper.

Through these activities, students are trained in critical thinking and argumentation. It is also very useful for students to develop their insight and knowledge. Using math dance through traditional dances at the Indonesian context makes students more interested and excited in learning math. Here students can optimize their cultural values which are

indirectly showed in the learning process such as accuracy, perseverance, hard work, curiosity, and unyielding attitude.

It is then suggested that teachers use local dances to initiate contexts for learning certain mathematical concepts. Other cultural contexts also enrich students with more values to build nation character.

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