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Problem of students of elementary school teacher program in creating ethnomathematic-based lesson plan of Kraton Yogyakarta: A case study

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Abstract

Lesson plan serves as an essential learning guide in the learning implementation. To improve the learning quality, lesson plans are generally developed based on some particular learning models, strategies, media, materials, and philosophies. Ethnomathematics is a recently developed learning model, and thus the development of ethnomathematics-based lesson plans to introduce and encourage cultural awareness is still not widely practiced. This research aims to reveal students problems and difficulties in preparing ethnomathematics-based lesson plans, and the characteristics of lesson plans related to ethnomathematics. The experience of 10 students of Elementary School Teacher Education (PGSD) program at Universitas Negeri Yogyakarta (UNY) about the difficulties in creating enthnomathematic-based lesson plan is used as a case study. The in-depth interviews revealed about the following difficulties of these students in preparing a lesson plan: syntax, methods, and models, with the extent to which ethnomathematics should be presented in the lesson plan being the most essential problem.

Keywords: *Learning Implementation Plan, ethnomathematics, Elementary School Teacher Education students, Kraton Yogyakarta*

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INTRODUCTION

Lesson plan is a comprehensive and systematic learning design that describes the learning procedures and organization compiled by teachers to achieve a predetermined basic competency. Lesson Plan is designed to simplify and expedite the learning process to help teachers better prepare, analyze, and predict the possible occurrences during classroom learning (Prastowo, 2015). Lesson plan guides the learning implementation to ensure efficient and effective learning process. These are four benefits of preparing lesson plan: 1.) To predict the likely arising problems; 2.) To solve classroom learning problems; 3.) To make the best use of learning resources; and 4.) To direct learning process in a systematic and well-organized manner (Hendra, 2013).

Lesson plan is needed to anticipate class needs, to adapt student to the current circumstances, and to develop media, methods, learning resources, and the applicable curriculum. Teacher and prospective teachers are required to profess their skills in developing lesson plans. For this reason, the ability of students of Elementary School Teacher Program (PGSD) to prepare quality lesson plans is an indispensable competency (Fitrianawati & Setiyawati, 2021). To develop lesson plans, teachers should refer to the following principles: compliance with the applicable curriculum, adaptation to class characteristics, encouragement of active participation, increase in student literacy, facilitation of student creativity in writing, verbally and in practice, creation of fun learning, and provision of a complete and integrated learning experience (Kosasih, 2014).

Although teachers and prospective teachers have developed lesson plans, some problems are still commonplace when it comes to choosing an appropriate methods, media, learning resources, and the conformity of the material, as well as the abilities to constantly improve (Suciati & Astuti, 2016). In fact, the selection of methods, media, and learning resources is an essential component in the preparation of lesson plans. In order to carry out good mathematics learning, Marsigit et al. (2014) suggested to explore students' informal knowledge to teach formal mathematics. Marsigit et al. (2014) also held that it is necessary to find concrete learning resources in order to provide an interesting learning experience, one of which is through the local culture. The use of culture in the study of mathematics is widely referred to as ethnomathematics (Suwarsono, 2020). Ghufron et al. (2017) mentioned that the development of culture-based learning is carried out with a non-directive model so as to provide creative space to observe cultural values as part of the learning process.

Javanese culture, especially in the Special Region of Yogyakarta, contains invaluable wealth, such as cultural heritage buildings, dance arts, puppet arts, and temples, which are rarely addressed in mathematics learning. Thus, it is pivotal to explore cultural wealth of the Kraton Yogyakarta, in the form of traditional parties, Jumenengan commemorations, Sekaten celebrations, batik, for the development of mathematics learning. The term ethnomathematics was introduced by D'Ambrosio (2013) a Brazilian mathematician in 1977.

> *The prefix ethno is now widely recognized as a general term referring to the socialcultural sense, which includes vocabulary, jargon, rules of conduct, myths, and symbols. The word mathema has a complicated derivation, but it usually means "to explain," "to know," "to comprehend," and "to do" things like ciphering, calculating, classifying, inferring, and modeling. The suffix tics comes from the same source as technique and is derived from techné.* (Orey & Rosa, 2008, p. 2)

Orey and Rosa (2008) explained that based on its dimensions, ethnomathematics consists of 6 aspects, namely: cognitive, conceptual, educational, epistemological, historical, and political aspects. In its development, at the 13th International Conference in Hamburg in 2016, there were two approaches proposed in ethnomathematics. At the conference Rosa and Orey (2016) suggested an ethnomathematical approach consisting of ethnocomputing and ethnomodelling.

There have been several ethnomathematical-based studies carried out in Indonesia relating to elementary school mathematics learning, including a research by Fadillah et al. (2015) about the measurement of rice fields area by Setail farmers using the term *seprapat bahu*. Another ethnomathematical research related to elementary mathematics learning is conducted by Laurens (2016), who discussed fractions and the introduction of three-dimensional shapes observable in the traditional food of *kuyabu* and *suami*. Rachmawati (2012) held that ethnomathematics in Sidoarjo has brought about the following ideas: 1.) Learning mathematics can be done outside the classroom; and 2.) The cultural values can serve as a reference material for compiling contextual strategy to solve mathematical problems.

Ethnomathematical-based materials for elementary school students can enrich the design of lesson plans, such as the materials related to two-dimensional figure and three-dimensional figure (Ain & Huda, 2018; Nelawati et al., 2018). Other materials designated for lesson plans are geometry-related materials, namely: straight lines, curved lines, parallel lines, symmetry, points, angles, rectangles, triangles, and circles (Zayyadi, 2017). In practice, there has been some learning materials developed based on ethnomathematics (Marsigit et al., 2014). Ethnomathematical-based learning materials are proven to better contribute to the learning process, by way of creating and encouraging awareness of local values. This has been in line with the primary goals of education in Latin America summarized in the OEI (Blanco-Álvarez & Oliveras, 2016). The use of ethnomathematical elements by teachers can produce effective mathematics learning (Balamurugan, 2015).

Lesson Plan serves as an essential guideline in the learning implementation. The development of lesson plans to improve the learning quality is mostly done based on learning models, strategies, media, materials, and philosophies. Ethnomathematics is a recently developed learning model, and thus the development of ethnomathematical-based lesson plans to introduce and encourage cultural awareness is still rarely found. This study aims to uncover the problems, and

difficulties experienced by students in compiling ethnomathematics-based lesson plans, as well as the characteristics of ethnomathematics-related lesson plans.

METHOD

This is a qualitative research by involving 10 students of Elementary School Teacher Education (PGSD) program in their third year who have created lesson plans based on visits and explorations at the Kraton Yogyakarta. This research is part of the advanced mathematics course at the Doctoral of Elementary Education Program, the Universtias Islam Negeri (UIN) Sunan Kalijaga. Researchers actively participated in the learning process, observation, and exploration of students taking the Bachelor of Elementary School Teacher Education (PGSD) program in the ethnomathematics course. The data were obtained through in-depth interview with students who created lesson plans, and were analyzed using descriptive qualitative analysis. The researchers carefully observed students when preparing the lesson plans and presenting them. Their lesson plans were documented and analyzed. The observation was done to assess the following components: 1.) Apperception whether it has been related to ethnomate-matics; 2.) The variations of the ethnomathematical media in the lesson plan; 3.) The variations of the materials in the lesson plan; and 4.) The use of ethnomathematical values in core activities and ethnomathematics in student worksheet.

RESULTS AND DISCUSSION

Interviews with the research subjects regarding the difficulties when compiling lesson plans generated various answers from these 10 subjects. Subject 1 was of the opinion that it was hard to choose an appropriate culture to be linked with the related material. Since ethnomathematics-based mathematics learning shall utilize the existing culture as a learning medium, Subject I found it difficult to choose an existing culture as a medium for learning mathematics. During the stroll at the Kraton Yogyakarta for observation, the students was perplexed about which object to choose and was nearly unable to find any objects that were suitable for a medium for learning mathematics. Along with the difficulty of finding these media, students also find it difficult to determine the right method in ethnomathematical learning. Similarly, Subject 2 encountered 4 difficulties, namely: 1.) Students are finding it difficult to determine apperception in line with the material to be studied in apperception activities; 2.) Students find it hard to write the steps of core activities for the lesson plan; 3.) Problems in writing questions using the scientific syntax; and 4.) PGSD students have difficulties in generating questions from their students as well as in developing worksheets suitable for their students based on their grades. Furthermore, Subject 3 had difficulty in conforming between his intended ideas and the syntax of ethnomathematics-based learning method.

Subject 4 had problems in making ethnomathematics-based worksheets. Thus, he asked whether the ethnomathematics-based worksheets were only limited to the use of images based on culture or more than that. However, after the observation stage, his focus was completely unrelated to culture. In addition, Subject 4 also still had difficulty in expressing his learning objectives, including the steps of making lesson plans. Subject 5 also experienced some difficulties, among others in determining the appropriate learning approach or model, compiling appropriate worksheets, compiling core activities in lesson plans, and determining appropriate apperception materials for ethnomathematics-based lesson plans. Meanwhile, subject 6 had difficulty in relating the selected material to the observed cultural objects, determining the appropriate apperception, and grouping the core activities according to the syntaxes of the methods used.

Subject 7 had problems in compiling lesson plans and asked the way to use learning resources and choose a suitable learning model. Meanwhile, Subject 8 had difficulty in writing syntax in lesson plans and worksheets, and combining two learning methods at once, for example by combining between the scientific method and the TPS (Think Pair Share) method. Both subject 9 and 10 had difficulty determining the proper syntax, preparing lesson plans as well as lesson plans syntax, relating them to ethnomathematics, selecting methods, and preparing the worksheets.

The interviews from the ten respondents resulted in an inventory of the problems in preparing lesson plans, namely: how to write the syntax, what method is suitable, what kind of apperception is in accordance with ethnomathematics, which learning model is appropriate, how to connect the material with culture, the extent to which ethnomathematical elements can be applied, and what kind of worksheets are suitable. By narrowing these problems down, there are two main problems in compiling lesson plan, namely the syntax, model, and method. Furthermore, the second problem in preparing the lesson plans is related with the extent to which the ethnomathematical components are presented in the lesson plans. The lesson plans compiled by 10 respondents generated the following components: apperception, ethnomathematical media variations, material variations, ethnomathematics in core activities, and ethnomathematics in student worksheet. The results can be tabulated and presented in Table 1.

Table 1. Tabulation of Problems Based on Components

	Apperception	Ethnomathematical media variations	Material Variations	Ethnomathematics in Core activities	Ethnomathematics in Student Worksheet
Subject 1	Not yet connected to ethnomathematics	Decorative pots, poles, motifs on the walls	Rhombus	Observation of student worksheet drawings and presentations	The rhombus model at the Kraton Yogyakarta led to a mathematical problem of determining the diagonal
Subject 2	New stage C1	Various decorative square patterns and ceramics of the Kraton Yogyakarta	Rectangle	Exploration of Kraton Yogyakarta through student worksheet	Activities and tests: batik, ceramics, and decoration
Subject 3	Not yet connected to ethnomathematics	Not explicitly mentioned in the lesson plan	Triangle and angle	Scientific methods and activities using student worksheet	Triangle shape on the pole, form the iron frame, triangle on the floor
Subject 4	Not yet connected to ethnomathematics	Not explicitly mentioned in the lesson plan	Rectangle	Group work on worksheets	There is no ethnomathematical component
Subject 5	Not yet connected to ethnomathematics	Not explicitly mentioned in the lesson plan	Rectangle	Scientific methods and activities using student worksheet	The big and small squares of the Kraton Yogyakarta wall
Subject 6	Has achieved C1 level	Not explicitly mentioned in the lesson plan	Rhombus	Scientific methods and activities using student worksheet	Multi Rhombus motif on ceramics and pole decoration
Subject 7	Not yet connected to ethnomathematics	There is a paving motive at the Kraton Yogyakarta	Addition and subtraction of fractions	Two examples of ethnomathematics are very clear in the core activities	*Paving and carriage wheels*
Subject 8	Not yet connected to ethnomathematics	Not explicitly mentioned in the lesson plan	Trapezoid	Scientific methods and activities using student worksheet	5 examples of ethno elements from the Kraton Yogyakarta
Subject 9	Not yet connected to ethnomathematics	Not explicitly mentioned in the lesson plan	Rhombus	Scientific methods and activities using student worksheet	5 examples of ethnomathematical elements from the Kraton Yogyakarta
Subject 10	Not yet connected to ethnomathematics	Batik at the Kraton Yogyakarta museum	Combined area	Coloring activities combined with batik motifs	Batik motif on combined area

Recapitulation of tabulated data showed that 8 out of 10 lesson plans or 80% of apperceptions had not been connected with ethnomathematics. Six out of ten lesson plans or as many as 60% of the ethnomate-matic media were not explicitly explained in the lesson plans. The materials were less various, since the most of the material (90%) was related to geometry, while the remaining 10% was about adding and subtracting fractions. 60% of the core activities were not explicitly about ethnomathematics, while 90% of ethnomathematics was contained in the student worksheet by 90%. This result pinpointed that many teachers found it difficult to compile a special lesson plan for ethnomathematics.

There are many factors to contribute to these difficulties in preparing lesson plans, even though the systematics of writing lesson plan have been explained in the literature or educational documents (Prastowo, 2015). To prepare for ethnomathematics-based lesson plans, first and foremost, teachers need to understand the objectives of ethnomathematics learning. By understanding the learning objectives, they can better plan the learning steps through the analysis of the learning components written in the lesson plan. The second point is to understand the content of mathematics. By understanding the content of mathematics, teacher has several options of learning materials or mathematical problems to include in the learning process, which will help them in determining ethnomathematical learning objectives. The third focus is to understand cultural aspects as learning media to help develop ethnomathematics.

CONCLUSION

This study concludes that the difficulty of preparing a Lesson Plan for ethnomathematical topics covers almost all components of the lesson plan, including: how to write the learning steps, what kind of apperception is appropriate to ethnomathematics, what learning model is appropriate, how to relate the material to culture, the extent to which ethnomathematical elements should be presented, and what kind of presentation of mathematical problems in student worksheets is appropriate. By observing the lesson plan in this study, most of lesson plans (80%) have not explicitly presented ethnomathematics in apperception, while the core activity of ethnomathematics in these lesson plan was about 60%. Geometry material dominates in the lesson plan with 90%, while most of student worksheet (90%) contains ethnomathematical elements. Therefore, the dissemination of research results and ethnomathematical learning practices needs to be carried out more actively.

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