Doctoral Dissertation

Development of an Ethnomathematics Curriculum through Emergent Modelling in an Indonesian Primary School

(Summary)

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To overcome the difficulties in connecting what students learn in and outside of the school and make mathematics more meaningful for them, ethnomathematics enables using mathematical ideas found in any students' culture. However, the implementation of ethnomathematics risks superficiality by remaining solely introductory. Emergent modelling that emphasizes a bridging model to connect what students learn in school and their culture is one way to fill this gap and strengthen ethnomathematics as a proposed curriculum within the mathematics education curriculum.

This research has four aims: (1) to develop a framework for an ethnomathematics curriculum, (2) to develop a lesson plan based on the framework, (3) to analyze the implementation of the developed lesson plan, and (4) to develop the principles of ethnomathematics curriculum. Four research questions to achieve these aims were formed as follows:

1. What is the appropriate framework to develop an ethnomathematics curriculum?
2. How well does the lesson plan developed based on the framework?
3. How do students perform based on the developed lesson plan?
4. What are the principles of the ethnomathematics curriculum by deliberating on the results of 1 to 3?

To address all research questions, literature reviews were conducted of previous studies on ethnomathematics, models and modelling, and emergent modelling. By investigating the remaining issues in each period of ethnomathematics development, ethnomathematics limited focus only on the anthropological issue rather than mathematics education then attempting to bring into the classroom and remain an introductory part. There is a need to bridge ethnomathematics and mathematics perspectives to address the superficial issue of its implementation. The result of investigating models, modelling, and emergent modelling find out that emergent modelling is the appropriate framework to work with ethnomathematics because the mathematical activity proposed in the emergent modelling promotes: (1) mathematical depth at each level; and (2) relationships in each activity by producing a model and interrelating all the activities throughout each level. These crucial points can help the students connect what they learn and obtain meaningful learning from mathematics lessons. The cultural elements do not stop with the first activity because the emergent model level could be treated as a backward modelling level, helping the student connect what they learn from the beginning of the lesson. Through this process, the culture embedded in the classroom is more clearly seen. To validate the framework, the lesson plan was developed by reviewing the literature on local cultures and modifying it for the

curriculum and textbook reviews relate to the integers. A rubber band game was selected to enhance the students' understanding of integers, and several activities were created for the lesson based on the framework proposed.

66 students consist of grades 5 and 6, in Alor regency, East Nusa Tenggara Province, Indonesia, who have participated in this research. Before and after implementing the lesson, the pre-test and post-test were held to see how students' understanding of integers improve based on the lesson plan developed.

The data was analyzed using quantitative and qualitative methods. The results consist of lesson analysis, test analysis, and interview analysis. The result of lesson analysis reveals that students can develop their model from the situational level, and gradually, they will reach the model for abstraction (forward emergent modelling). Students could make a model-of table of the game; then, they developed their model-for table to reach formal mathematics by extending the mathematics expression from the table. Students realized that the game context could not explain some of the mathematical expressions they encountered from their model-for table, showing them that they needed a new context to explain the new mathematical expressions. At the end of this stage, students could generalize all the new mathematical expressions into formulas. Based on the interview analysis, students could provide new mathematical expressions and create a new context to explain some expression that could not be cover by rubber band context (backward emergent modelling). Test analysis shows students' performance on the developed lesson plan increased in terms of the correct answer percentage. Intertwine of these three results found some of the principles during the learning process. These principles could develop a new lesson plan that promotes culture and students' mathematical thinking. The principles of ethnomathematics embedded throughout the emergent modelling process are ethnomathematics as context, ethnomathematics as tools for mathematization, and ethnomathematics as a value-driven concept.

In conclusion, to develop an ethnomathematics curriculum through emergent modelling, these principles based on the case of cultural material of one local that could be used for other material need to be considered when establishing the whole curriculum. The ethnomathematics curriculum gives us insight into the mathematics curriculum, especially in multicultural countries. It is highly recommended that the curriculum developer considers this new endeavour towards new mathematics education challenges by utilizing cultural materials.