

A Case Study of a Mathematics Teacher's Use of the Textbook: Adapting the Teaching Activity on Polyhedron

Summary

Introduction

It is found that some pre-service teachers are not sure how to appropriately interpret and adapt the mathematics textbook in teacher education programs, because sometimes the textbook adaptations they make deviate from the original intention of the textbook. This phenomenon calls attention to the fact that textbook adaptation is a big challenge to the pre-service teachers. However, over the past ten years in Taiwan, the teachers who teach fifth and sixth grade of mathematics are most likely less experienced junior or substitute teachers. Thus, the issue of the textbook adaptation becomes more critical when lessons are getting more difficult in primary five and six. Moreover, as solid geometry receives relatively less attention in Taiwan, this study chooses the unit of polyhedron to explore how a fifth grade teacher adapts mathematics textbook in order to understand the factors that affect the adaptation in teaching this unit.

Methods

The data of this study was collected from a primary school teacher, also an experienced textbook editor, who has been teaching for twenty years; the method used includes classroom observation, in-depth interview, and focus group discussion. Seven lesson protocol copies are used to explore the types of textbook adaptation. A copy each for in-depth interview and focus group is used to analyze teacher's intention and the influential factors.

The types of textbook adaptation are suggested by Sherin and Drake (2009): to create, replace, and omit. The influential factors are analyzed according to the three elements (teacher, curriculum and context) proposed by Remillard (2005) in his concept of the “framework of components of teacher-curriculum relationship”. The first two elements (teacher and curriculum) refer to Design Capacity for Enactment (DCE) framework (Brown, 2009). Teacher resources include subject matter knowledge, pedagogical content knowledge, and goals and beliefs. Curriculum resources include physical objects and representations of physical objects, representations of tasks (procedures), and representations of concepts (domain representations). Context refers to time, aspects of the local cultures, and the extent and nature of support provided for the teacher, as suggested by Lloyd, Remillard, and Herbel- Eisenmann (2009).

The analysis process is a circulated and evolved procedure, and during the process, some new types may appear and certain old types may need modification or be abandoned.

Results

This study found four types of textbook adaptation used by the teacher in teaching the unit of polyhedron, including addition, replacement, omission and reorganization. Addition is to add new activities or questions originally not in the textbook. Replacement is to replace textbook activities or questions with different ones. Omission is to remove textbook activities or questions entirely with neither replacement nor addition. Reorganization means teaching the textbook material in a different order.

Three factors may affect the adaptation. The first one is the representation of the textbook, which includes physical objects, tasks, and concepts. The second factor is teacher’s personal knowledge and habit which includes mathematics knowledge, knowledge of students’ mathematical learning, mathematics pedagogical content knowledge, and personal habit and perspective. The last one is the context which includes time, quantity of teaching aids, and support from the experts.

Conclusion

By comparing with three types proposed by Sherin and Drake (2009), this case study summarizes four types of textbook adaptation, where “addition” is used as a substitute for the idea of “to create”, and reorganization is a new type suggested in this study. This study only presents the way the teacher adapts the mathematics textbook in her lesson; the discussion does not include the relation among the adaptation types, the teacher’s professionalism, and the quality of the textbook.

Three representations of the textbook which affect teacher’s adaptation in this study correspond to curriculum resource mentioned by Brown (2009). However, the four aspects suggested in the teacher’s personal knowledge and habit are different from the three teacher resources proposed by Brown. Goals and beliefs (Brown, 2009) are renamed to personal habit and perspective. In addition, knowledge of students’ mathematical learning is singled out from mathematics pedagogical content knowledge, not only because it is one of the most recognizable types of knowledge, but because students’ learning difficulty requires the teacher’s concern and triggers the replacement in perspective drawing activity. The aspects proposed in context are also different from those summarized by Lloyd et al. (2009). Last but not the least, this study makes suggestions on the design of the textbook, teacher training and important aspects of further study.

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