

Developing Instruction Based on Open Approach and Its Impact on Levels of Geometric Thinking and Geometric Achievement of Eighth - Grade Students

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ABSTRACT

This research studied the impact of the instruction based on the open approach on van Hiele geometric thinking levels and on the geometric achievement of eight-grade students. The researcher also traced changes in geometric thinking level according to the four constructs: recognition, definition, classification and proof. Quantitative and qualitative evidence revealed that (a) there was the increasing number of students who exhibited Level 3 of geometric thinking and the corresponding decrease in the number of students exhibiting Level 2 of geometric thinking, (b) there were no significant differences on geometric achievement between the experimental and the control group, (c) target students in Level 2 of geometric thinking made progress to Level 3 of geometric thinking in some constructs: definition and classification and (d) there were two sociomathematical norms. The first sociomathematical norm was what counted as a valid way of showing that the triangles were congruent. The classroom mathematical practices which were compatible with this norm were the use of measurement, the use of fit on top and the use of reasoning. The second sociomathematical norm was what constituted a valid proof. The classroom mathematical practices which were compatible with this norm were the use of drawing and examples and chain of reasoning.

Key words: van Hiele Geometric Thinking Level, Open approach, Open-ended problems, Middle School, Reasoning

INTRODUCTION

Geometry plays an important role in school mathematics curriculum. Many students in various parts of the world have been facing difficulties in learning geometry. Pierre van Hiele and Dian van Hiele-Geldof (1959/1985) formulated a model to explain why students had those difficulties. They proposed five levels of geometric thinking which were visualization, analysis, informal deduction, deduction and rigor (Crowley, 1987). After their discovery, various studies have been conducted to verify and elaborate the theory including that of Gutierrez and Jaime (1998). They analyzed the list of descriptors of van Hiele Theory from many publications. They proposed a framework of geometric thinking with different key constructs across the levels : recognition, definition, classification and proof. According to this model, students' thinking in geometry progresses sequentially through levels. Several studies (Burger and Shaughnessy, 1986; Fuys et al., 1988) and also a study in Thailand (Chaiyasang, 1987) found that most middle school students were functioning at lower levels of thinking than they should be. In fact, they should be capable of logical deduction which is consistent with van Hiele Level 3 of geometric thinking, i.e., informal deduction. However,