Features of modelling processes of group with visual and analytic mathematical thinking styles

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Mathematical thinking styles denote how individuals prefer to present mathematical tasks, and to understand and process mathematical facts (Borromeo Ferri, 2010). Thus, teachers' awareness of different mathematical thinking styles is particularly important when students are exposed to mathematical modelling activities that offer them the opportunity to meet everyday challenges and demands, and that provide them with the capabilities to deal with real-word situations. Mathematical modelling is the process of translating between the real world and mathematics (Blum & Borromeo Ferri, 2009). Knowledge about students' modelling processes can ameliorate their teachers' interventions (Blum & Leiß, 2005). Though modelling processes have been studied widely almost no studies have focused on modelling processes with respect to thinking styles characterizing groups, in which all modelers have the same mathematical thinking style. This study aims to shed light on the influence of group mathematical thinking style on members' modelling processes while engaged in modelling activities. This leads to the research questions: Do groups of students with different mathematical thinking styles (visual or analytic) differ in their modelling processes while working on a sequence of modelling activities, and if so, how?

Method

For the first stage of the study, a questionnaire comprised of eight tasks for identifying participants' thinking style was administered to 35 students in an eighth-grade class. We adopted the categories (visual thinking style, analytic thinking style and integrated thinking style) described by Borromeo Ferri and Kaiser (2003) for analyzing students' problem-solving processes. In these tasks, the visual thinking style was characterized by sketches and drawings, while the analytical thinking style was expressed in a formula-oriented task. Based on the thinking styles reflected in solving the tasks in the questionnaire, students were classified as: analytic (14 students), visual (11 students), and integrated analytic and visual (10 students) thinking styles. In the second stage, we selected five students in the analytic group and in the visual group respectively. We made the selection with the assistance of their mathematics teacher, in order to maximize the similarity between the groups. Each group worked on three modelling activities adapted from the literature (e.g., Blum & Borromeo Ferri, 2009). Their work was documented by video recordings and transcribed. We used the constant comparative method to analyze the students' modelling processes, taking into account the cognitive aspect of modelling cycles (Blum & Leiß, 2005).

Findings

The findings indicate that the analytic and visual groups demonstrated similar features in working on the three modelling activities, but differed in their modelling processes. The analysis of the modelling

processes of the two groups when doing the three activities revealed that the major differences between them were in their real model and their ways of simplifying, mathematizing, and creating a mathematical model. The students in the analytic group tried to simplify the three activities by mathematizing them. In contrast, the visual group tried to simplify the activities by drawing and illustrating. In addition, the findings revealed differences in the illustration of the mathematical model. The findings also indicate that the analytic group went through more modelling cycles than did the visual group to obtain the final model in each activity. In addition, the analysis indicates that the analytic group skipped more of the modelling phases than did the visual group. The modelling cycles of the analytic and visual groups for the same activity are presented in Figure 1 and 2 respectively.

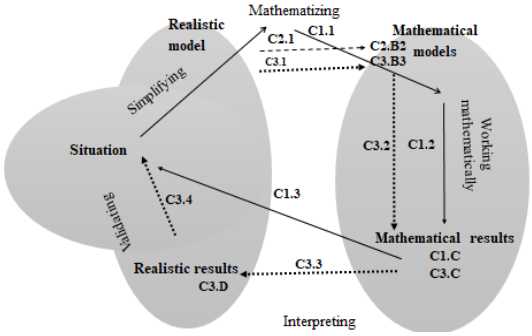

Figure 1: Modelling cycle of analytic group

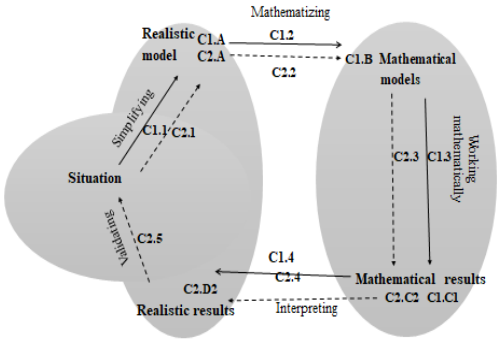

Figure 2: Modelling cycle of visual group

Summary

The findings revealed differences in the two groups' modelling processes and in features of modelling cycles. The major difference between the groups was in their ways of simplifying, mathematizing, and creating a mathematical model of the real-world situation. In the light of these findings, it is important to improve teachers' awareness of students' mathematical thinking styles, because this awareness can play a vital role in designing effective interventions for their students who are engaged in modelling activities.

References

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