

Integrating writing to support students' understanding of reading in mathematics

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In Sweden, the dominant practice in mathematics education involves students working individually in the mathematics textbooks (Myndigheten för skolutveckling, 2008). Consequently, the textbook influences how students learn and apply mathematical concepts (Bryant et al., 2008). However, to read mathematical textbooks means understanding the global meaning from the page and this requires specific reading skills. One of the challenges becomes to identify the main idea of a particular sentence, paragraph or section of a textbook (Paliscar & Brown, 1984). This is needed to help students activate their prior knowledge so they can connect it to the new knowledge being learnt (Carter & Dean, 2006). The students also need to understand the mathematical words that may be found only in mathematics and comprehend the concepts behind them (Lee, 2006). This is complicated by some mathematical words having different meanings in conversational language (Lee, 2006), such as odd and volume.

In the fourth Year in Sweden the texts in the mathematics textbook are considering to become longer and many new mathematics concepts are being introduced (Myndigheten för skolutveckling, 2008), which puts special demand on the students' reading skills.

The aim of the study was to explore how writing tasks, inspired by Paliscar and Brown's (1984) reciprocal activities (reading strategies): clarification and summarisation, might support Year 4 students to gain more meaning from reading their mathematical textbook. Clarification considered how students made sense and understood different components in the text, such as mathematical words and summarising concerned identification of the main ideas.

The approach of the study was inspired by Educational Design Research (EDR) to studying the design of teaching in cyclical periods where theory and practices were interacting during several cycles (McKenney & Reeves, 2012). To identify the study's cyclical periods the model of McKenney and Reeves' (2012) was used, which is divided into; analysis and exploration, design and construction and evaluation and reflection.

The analysis and exploration phase starts with three main activities: initial orientation, literature review and field-based investigation. The initial orientation in this study was to find a Year 4 mathematics teacher that wanted to participate in the study and in collaboration define the mathematical goals for the students.

The literature reviewed was about reading and writing, particularly in mathematics. From this review, the aim of the classroom tasks was to develop the students' ability to identify, describe and understand the main ideas being expressed in the textbook.

The field-based investigation built on: a questionnaire study with 136 students in year 3-5 regarding their writing in mathematics education; an analysis of a number sense chapter in a textbook; an interview study involving six Year 3 students, with different achievement levels in mathematics, reading strategies when they approached a page in a textbook; and a questionnaire study with nineteen Year 4 students about their reading strategies connected to two pages in the textbook.

From the result of the three activities the design and construction were decided. The first design concerned integrating a dictionary connected to the content in the textbook (clarification). Mind maps were used to identify the main ideas of the content and to summarise the students' understandings (summarisation).

In the evaluation and reflection phase, Halliday's System Functional Linguistic (SFL) was used to analyse the students' written descriptions and explanations conducted by the field, tenor and mode. According to SFL every text is about something and is constituted by the field, is addressed to someone and constituted by the tenor, and is based on the text structure constituted by the mode (Halliday & Hasan, 1985). By using this analysis tool students' understandings connected to the mathematics content in the textbook were revealed. The result of the analysis also contributed to knowledge on how to design the next cycle. In the presentation the result will be revealed.

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