

A MULTIMODAL PERSPECTIVE ON NUMBER SENSE IN DIGITAL LEARNING RESOURCES

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There is an increasing use of digital learning resources in mathematics education, which provides potential for multimodal approaches and new ways for students to meet and learn mathematics, but the outcome depends on the design and the implementation of the digital resources (Hoyles, 2018). This on-going study contributes by examining affordances of combinations of different modes in relation to number sense. We use Halliday's social semiotic theory (Halliday & Matthiessen, 2013) and McIntosh et al. (1992) number sense framework for analysing a specific app, *Vektor*.

We analysed the two exercises in the app that relate to aspects of number sense, *Numberpals* and *Numberline*. Each round in respective exercise was analysed with respect to Halliday's three metafunctions: *ideational*, *interpersonal*, and *textual*. For the ideational function, McIntosh et al.'s framework was used to characterise the mathematical content. As an example, figure 1 illustrates the second and third rounds in *Numberpals*.

In these rounds, both coloured rectangles and numerals are used to present the mathematics, and the main aspect of number sense in focus is identified as *Multiple representations for numbers*, for example, two red + three green = one red + four green, and $2+3=1+4$. In the first round there were no numerals in the bars, only rectangles, and in the later rounds there were only numerals in the bars.

Preliminary results, concerning the ideational metafunction, show that the mathematical object in focus may be perceived in different ways; either as just rectangles that should be combined (in a visual/geometrical sense), or as numbers of rectangles, or as numbers (and relations between numerals). This can impact students' development of number sense. Further analyses will include all metafunctions and a focus on progression in the exercises.



Figure 1: Screen shot from the exercise *Numberpals*

References

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- McIntosh, A., Reys, B. J., & Reys, R. E. (1992). A proposed framework for examining basic number sense. *For the Learning of Mathematics*, 12(3), 2-8.