STUDENTS' FORMAL WRITTEN COMMUNICATION

Ola Helenius[1], Anna Teledahl[2], Cecilia Kilhamn[1], and Linda Marie Ahl[1]

[1]University of Gothenburg, [2]Dalarna University

For centuries, students writing has been used to assess students' mathematical knowledge. While students' argumentation as well as their writing for other purposes than to communicate formal solutions has been the subject of several lines of different research (Morgan, 1998) we have found no previous design research focusing particularly on directing systematic teaching efforts to the development of students' formal mathematical writing competence. Such design-based teaching development is the purpose of our research.

Our approach hinges on separating the reasoning that makes up the solution to a mathematical problem from the formal written communication of that reasoning. This separation is upheld in the teaching design, where some lessons are solely devoted just to produce, discuss and improve formal written communications of previously established reasonings that solves some particular problem. The separation is also upheld in the framework for assessing formal mathematical writing that we develop within the project. Similar to how Stylianides (2007) deals with the concept of proof in grade three, our aim is to develop a framework for assessing formal written mathematical communication, that at the same time honor general principles for good mathematical communication and is communicationally relevant for any class and age group from 10-year-olds and up. In addition to being a guide for us (and later, others) when assessing students' formal written mathematical communication, our framework will also guide teachers in what should count as progress in the development of formal mathematical writing competence. A systematic literature review we conducted revealed that a framework of that type would be a novelty.

A main result from this early stage of our research project, is that when we gathered formal written communications from 77 Swedish students between 11 and 17 years old and analyzed them with a preliminary version of our framework, we found no improvement in the quality of the formal written communications over the six years of schooling. We take this as an indication of that no effective teaching directed towards improving students' skills in producing formal written communications is carried out.

Acknowledgments

This work is part of *Swedish Institute for Educational Research* grant 2020-00066.

References

Morgan, C. (1998). *Writing mathematically: The discourse of investigation*. Falmer Press.

Stylianides, A. J. (2007). Proof and proving in school mathematics. *Journal for Research in Mathematics Education*, *38*(3), 289-321.

2022. In C. Fernández, S. Llinares, A. Gutiérrez, & N. Planas (Eds.), *Proceedings of the 45th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, p. 227). PME.