Student teachers' learning and teaching mathematics with programming

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Sweden's school curriculum was revised to include programming as a mathematical content from the year 2018. However, teacher education included using IT-tools for teaching, but not specifically programming. To correct this situation, we have developed a new programming strand in the training of secondary school mathematics teachers at the university of Gothenburg. The aim of this study is to observe how student teachers towards the end of the program use their knowledge to plan uses of programming in their own mathematics teaching. It is part of a larger research and development project on introducing programming in secondary school mathematics education.

Two theoretical frameworks are relevant here: instrumental genesis, i.e., the process where an instrument is formed from an artefact, when students use programming as a tool in mathematics (Trouche 2004), and the theory of didactic transposition, to frame the student teacher's transformation of their own knowledge into knowledge to be taught (Chevallard 2006).

Each mathematics course in the teacher education program for secondary teachers at the university of Gothenburg contains a few computer lab sessions. About half of them are focused on using IT-tools (e.g. Geogebra) to learn mathematics. The other half of the computer labs use programming to highlight mathematical concepts. There is no course in programming per se. In the first mathematics course, the students build a first block program in Scratch to draw regular polygons, using loops and variables. In the second course, in Calculus, they estimate integrals with Riemann sums, using loops in Python. The strand then continues in Python, with data analysis in Statistics and prime numbers and cryptography in Number theory. Four school practice periods are spread throughout the program, and in the third of these, student teachers plan a mathematics lesson with programming, to use with their school class.

In this study we analyze the student's lesson plans and discussion in a seminar where the students discuss their lesson design. Of interest is both the design itself and the students' attitude, self-efficacy and reflections regarding their teaching of mathematics through programming. In particular, we are interested in the students' argumentation on how their planned lessons may help the pupils to achieve the learning goals. Preliminary results indicate that students struggle to meet the double goal of introducing programming and supporting the mathematics in the curriculum.

References:

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