

The Impact of a Comprehensive Teacher Professional Development Program in Formative Assessment on Teachers' Practice and Students' Achievement

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A vast amount of research has shown that the use of formative assessment is one of the most effective ways of increasing student achievement. However, a strong research base for how to help teachers to implement such a practice is lacking. Thus, research with such a focus has been argued to be a main priority for research in formative assessment. The research that will be presented at this conference is part of a larger project conducted at Umeå Mathematics Education Research Centre (UMERC) in collaboration with a Swedish municipality. The overall project aim is to contribute to the understanding of the support needed for teachers to successfully implement formative assessment in their mathematics classroom practice.

At this conference two research studies will be presented. Study 1 investigates the effects of a professional development program (PDP) in formative assessment on teachers' classroom practice, and Study 2 investigates the effects of the changed classroom practice on students' performance in mathematics. Formative assessment is conceptualized as a classroom practice based on the use of five key strategies and compliance with the fundamental idea of using evidence about student learning to adjust instruction to better meet student needs.

In spring 2011, 22 randomly selected teachers teaching grade 4 the following semester participated in a PDP in formative assessment in mathematics. The rest of the teachers teaching the same grade in the municipality constitute the control group of 27 teachers in Study 2. To investigate the effects of the PDP on teachers' classroom practice (Study 1), teacher interviews and unannounced observations of their classroom practices were made. To be able to describe changes in classroom practice this data collection was made both before the PDP and during the school year after the PDP. In addition, questionnaires about experience of the PDP were administered to the teachers both directly after the PDP and one year after the PDP. The analysis of classroom practice was made using an analytical tool that was developed based on the framework of formative

assessment proposed by Wiliam and Thompson in 2007. The changes in teachers' practice, in relation to formative assessment, were described both in qualitative and quantitative terms. Patterns of similarities and differences in the changes were described, and reasons for these patterns were sought after in the teacher interviews, questionnaires, and in characteristics of the PDP. To study the effects on student achievement (Study 2) all students took a mathematics pretest in the beginning of grade 4 and a posttest in the end of grade 4. The difference in points attained on the posttest and pretest was calculated for each student. This measure was then compared between the group of students taught by the teachers that participated in the PDP, and the group of students belonging to the teachers in the control group.

The preliminary findings of Study 1 show that the PDP had an effect on the teachers' classroom practice. All teachers changed their mathematics classroom practice to some extent. But the changes varied among the teachers, both in qualitative and quantitative ways. Most teachers implemented new ways to elicit evidence of, learning from all students and engage them in learning activities. Other aspects, such as techniques for peer assessment, were less frequently used. Another preliminary finding is that the teachers experienced effectiveness in their teaching when assessment information was used to adapt their teaching to better meet students' learning needs. Significant characteristics of the professional development program that seem to have supported teacher change included the participation of an expert on formative assessment, extended duration of time for teachers' participation, the possibility to try out new techniques and to experience positive outcomes in the classroom, and the possibilities for teachers to share experiences and overcome setbacks. The trying and sharing created mutual expectations between the participants to be active in their classrooms between the meetings during the PDP.

In Study 2, the students that were taught by the teachers that participated in the PDP outperformed the students belonging to the control group. The difference between the groups was statistically significant ($p < 0.05$), and the effect size measured in Cohen's d , was 0.8, which is a large effect.

The two studies show how PDPs in formative assessment can be designed to bring about changes in teachers' classroom practice that have substantial effects on students' performance in mathematics. As such they contribute to the understanding of the support needed for teachers to learn and implement formative assessment in their classrooms.