Evaluation of a state-wide mathematics support program for at-risk students in Grades 1 and 2 in Germany

Journal of Research on Educational Effectiveness

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Is an early mathematics support program based on formative assessment effective?

Yes, it is, according to a study conducted with 135 elementary school classes from 40 schools in Germany. The study shows that students at-risk for mathematical difficulties benefited from the two-year "Mathe macht stark (MMS) - Grundschule" (Maths makes you strong - primary school) implementation in Grades 1 and 2. This effect is maintained one year after the intervention ends and without providing Grade 3 formative assessment material. Moreover, students not at-risk for mathematical difficulties also benefited from the program, despite not being the target of the program. Hence, the formative assessment elements the teachers used in the mathematics classrooms for at-risk students were also beneficial for the other students. Interestingly, in an enhanced version of the program, including two extra teacher working hours per week, did not add value for at-risk students in the follow-up test at the end of Grade 3.

This study demonstrates the potential of formative assessment as a tool to improve student achievement. Furthermore, the MMS program answers the call to provide schools with methods, material, and teacher professional development to support at-risk students at an early stage in their school career.

What is the formative assessment program MMS?

Formative assessment plays an important role in supporting students in mathematics. It enables teachers to identify where individual students are struggling, so that teachers can better target their attention to areas of need.

There is a need for formative assessment programs that (a) are easy to implement in the regular classroom without requiring radical changes in teachers' individual teaching style, and (b) are effective in supporting at-risk students at the earliest stage possible in their school careers. MMS was developed to achieve these goals. The aim of the MMS program is to promote the mathematical competence of low-performing pupils in the first two years of primary school in order to prevent persistent difficulties in the cumulative development of competence. The program focuses on arithmetic because of the crucial role of arithmetic in students' mathematics development.

MMS supports teachers in their individual everyday mathematics teaching, rather than dictating how to teach ready-made teaching material. This approach includes a sequence of short student assessments and systematic information to support teachers' use of the assessment results to improve student learning. The program incorporates professional development, assessment tasks, and recommendations for targeted intervention for the milestones of arithmetic development.

How did we do this study?

We used a quasi-experimental design with three groups of schools and pretests/posttests: (1) 10 schools received MMS materials and training (MMS); (2) 20 schools received MMS materials and training plus two additional teacher hours per week to implement the support (MMS+), (3) 10 schools received the support for low-performing pupils usually provided in German schools (comparison group).

The 30 intervention schools were selected from 100 schools in the federal state of Schleswig-Holstein that volunteered for the first wave of MMS implementation. The 30 schools were chosen to ensure broad geographical representation (e.g., urban and rural regions) as well as diversity of socio-economic and cultural background. From the 30 schools, 20 were randomly selected for the MMS+ group. The 10 comparison schools were chosen so that they were comparable to the intervention group schools in terms of geographical distribution and the socio-economic and cultural background. This means that the sample of our study was not selected strictly randomly. However, since the material was offered for free — which was appealing for all schools — a positive selection was not necessarily the case. Finally, the intervention and comparison groups were comparable concerning the student composition with respect to basic cognitive abilities.

Full Article Citation:
Van den Ham & Heinze (2022). Evaluation of a state-wide mathematics support program for at-risk students in Grades 1 and 2 in Germany. *Journal of Research on Educational Effectiveness.* DOI: https://doi.org/10.1080/19345747.2022.2051651.