

Schoolchildren can also learn complex subject matters on their own

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Self-directed learning has long been heralded as the key to successful education. Yet until now, there has been little research into this theory. Educational researchers at the Technical University of Munich have now shown that schoolchildren can independently develop strategies for solving complex mathematical tasks, with weaker students proving just as capable as their stronger classmates.

Calculating the surface area of Gran Canaria is no easy task for a 14-year-old. It's not simply a question of learning the right formula. [Students](#) have to develop a strategy that enables them to put [mathematical theory](#) into practice – working out the information that is important and applying the right geometric models and tools. Realizing that the island has an almost circular shape and so its surface area can be approximated using the area of a circle is not as straightforward as it sounds. Are [schoolchildren](#) capable of developing these kinds of solutions themselves or should teachers explain the strategies before asking the pupils to tackle the problems?

To find the answer, researchers in mathematics education from TUM worked with approximately 1600 8th grade high-school (Gymnasium) students in various German states. Following an introduction on the general topic by their teachers, the school children were given a workbook of geometric tasks that they had to solve on paper and using a computer over four school periods. Calculating the [surface area](#) of Gran Canaria was just one of the real-world, free-form assignments the students had to tackle. The workbook material included explanations and

examples of various problem-solving approaches. The teachers took a back seat during the session but were on hand to answer questions from the children, who worked in pairs.

After testing the students' skills before and after the session, the TUM researchers recorded a significant improvement in their capabilities. "They learnt to apply mathematics more effectively," explains study leader Professor Kristina Reiss. The students were also able to call on these skills in a further test three months later.

The researchers also wanted to find out what degree of child direction is most effective. One group therefore worked on the tasks in a fixed ascending order of difficulty. The other group was free to choose from the assignments provided. This greater degree of freedom did not enhance the learning experience, however. Another discovery came as an even bigger surprise to the researchers: "We expected students who were weaker at math to benefit more from a greater degree of guidance through the module," reports Reiss. "But we didn't see a significant difference between these and stronger students." There were also no differences between boys and girls.

"We now know that students – also those who are weaker in math – have the skills to master even very complex subject matters at their own pace," continues Reiss. "Although extended phases of self-directed learning are often advocated, they are still not part of the everyday school curriculum. But they are an important option for teachers as varied lesson formats ensure a lively and interesting learning experience."

Provided by Technische Universitaet Muenchen

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