Smart learning software helps students study math during lockdowns and beyond

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Intelligent tutoring systems for math problems helped pupils remain or even increase their performance during the pandemic. This is the conclusion of a new study led by the Martin Luther University Halle-

Wittenberg (MLU) and Loughborough University in the U.K.

As part of their work, the researchers analyzed data from 5 million exercises done by about 2,700 pupils in Germany over a period of five years. The study found that particularly lower-performing children benefit if they use the software regularly. The paper was published in the journal *Computers and Education Open*.

Intelligent tutoring systems are digital learning platforms that children can use to complete math problems. "The advantage of those rapid learning aids is that pupils receive immediate feedback after they submit their solution. If a solution is incorrect, the system will provide further information about the pupil's mistake.

"If certain errors are repeated, the system recognizes a deficit and provides further problem sets that address the issue," explains Assistant Professor Dr. Markus Spitzer, a psychologist at MLU. Teachers could also use the software to discover possible knowledge gaps in their classes and adapt their lessons accordingly.

For the new study, Spitzer and his colleague Professor Korbinian Moeller from Loughborough University used data from "Bettermarks," a large commercial provider of such tutoring systems in Germany. The team analyzed the performance of pupils before, during and after the first two coronavirus lockdowns.

Their analysis included data from about 2,700 children who solved more than 5 million problems. The data was collected between January 2017 and the end of May 2021. "This longer timeframe allowed us to observe the pupils' performance trajectories over several years and analyze them in a wider context," says Spitzer.

The students' performance was shown to remain constant throughout the

period. "The fact that their performance didn't drop during the lockdowns is a win in and of itself. But our analysis also shows that lower-performing children even managed to narrow the gap between themselves and higher achieving pupils," Spitzer concludes.

According to the psychologist, intelligent tutoring systems are a useful addition to conventional math lessons. "The use of tutoring systems varies greatly from state to state. However, our study suggests that their use should be expanded across the board," explains Spitzer. The systems could also help during future school closures, for example in the event of extreme weather conditions, transport strikes or similar events.

More information: Markus Wolfgang Hermann Spitzer et al, Performance increases in mathematics within an intelligent tutoring system during COVID-19 related school closures: a large-scale longitudinal evaluation, *Computers and Education Open* (2024). DOI: 10.1016/j.caeo.2024.100162