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Integrating computational thinking and science learning in Minecraft

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Using the popular game Minecraft, our work seeks to integrate computational thinking and science learning for K-12 informal STEM learning. Learners engage in solving problems that are inspired by real-world challenges and suited to computational approaches. Current scenarios address sustainable agriculture, fire containment and suppression, habitat construction, cellular repair, and more. Preliminary data from 24 middle school learners showed that sufficient coding skills could be acquired in about 4 hours, even by those with little relevant experience. Students generated a range of solutions to our challenges.

An updated curriculum featuring more difficult computer science concepts and new open-ended STEM problems were presented to the same students a year later. Interviews suggested that students greatly enjoyed coding for agricultural automation in tasks such as automated irrigation, vertical tower-based bamboo farming, and terrace farming (on hillsides). They also readily adopted the goal to minimize damage to local ecosystems. Our interviews and student learning progress over two years indicate motivation to code achieve Minecraft goals appeared more desirable than using a traditional programming IDE. Lastly, most of the children approached solving problems using multiple forms of a trial-and-error iterative approach, including simple techniques like swapping out values or lines of code as well as more advanced strategies, such as converting fixed values to abstract variables. We observed this process on a granular basis by examining each alteration with a custom-designed comparison and tagging platform. Next, we will design more complex challenge problems and investigate to what extent coding enables higher levels of creativity.