Minecraft

Another example we presented in our 2023 workshop series focused on Minecraft Education, which has the potential to be both a three-dimensional turtle programming environment and a collection of interdisciplinary microworlds constructed with a wide range of functional and decorative blocks. Bryan Sanders shared and analyzed a multiplayer Minecraft world developed by his sixth grade students as an imaginative graduation experience for themselves. The purpose was open-ended and invited students into the opportunity to explore multiple domains in their individual and small-group building projects. Each project unto itself contained intersections with more than one content domain, and when completed, the collection of these projects contained in this one Minecraft world demonstrated a myriad of content domains, from mathematics to physics to writing to culture and language and more. There were numerous natural inflection points where learners had the need to ask questions and cull knowledge from various domains. Interdisciplinary work was never a forced objective, rather it was just expected to emerge as a byproduct of working in a nurtured environment.

The compelling nature of working in Minecraft, following a creator-first philosophy, was further demonstrated by showcasing an immersive virtual body syntonic approach to programming with the built-in turtle coding agent. This agent operates relative to the learner's avatar position within the three-dimensional world and is programmed much like the well-known turtle from the inception of Logo that Papert discussed in *Mindstorms*. The learners, while remaining in the Minecraft microworld, interact with a coding interface to draft a program, activate it, and return to the world to implement and test its functionality and precision. An iterative process of debugging code and experimentation ensues inside the microworld before learners soon join forces with their programmed robot to work placing blocks alongside each other. In this manner, a 'double spiral' process is created whereby the learner uses the computer as an object-to-think-with to create and

enter a microworld with a virtual robot companion which the learner programs to assist in the creation of that very world.

Another aspect of Minecraft's depth, appeal, and flexibility for exploring microworlds and powerful ideas lies within the use of in-game sensors, motors, data gathering, feedback, and also the ability to connect to both the digital world outside of Minecraft and the physical world. Learners can use redstone and command blocks to perform complex cycles of work for elaborate goals, even create a functional computer, complete with binary logic, memory units, and clock circuits, all inside of a Minecraft microworld. Other possibilities include automated sorting systems, interactive music sequencers, animated pixel art displays, traffic light systems, elevators, automated farms and factories, and the list goes on. With the use of webhooks and URL commands, learners can create interactive experiences between the avatar's perspective and reactions outside of the game to turn on lights in a room or broadcast messages to LED displays or even operate robots in another room. Further, the flexibility of Minecraft to also be "skinned" with any textures or behaviors that learners create and import makes for limitless possibilities. Minecraft Education exemplifies the philosophy and pedagogy of microworlds and powerful ideas with its adaptable architecture, cascading canopies, wide walls, flexible floors, and dynamic decor.


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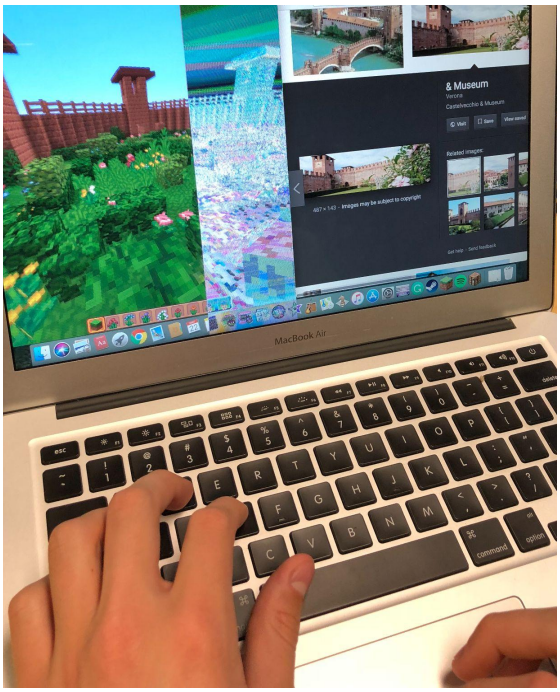
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