Possible Possibles

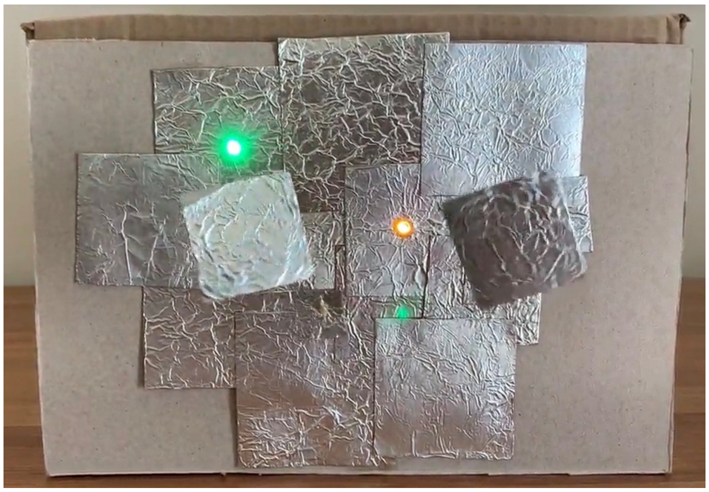
Dr. Bryan Sanders (https://about.me/nayrbgo) is the Director of Technology and a Computer Science Instructor at St. James Episcopal School in Los Angeles (https://www.sjsla.org/). Follow him on Twitter at @nayrbgo (https://twitter.com/nayrbgo).

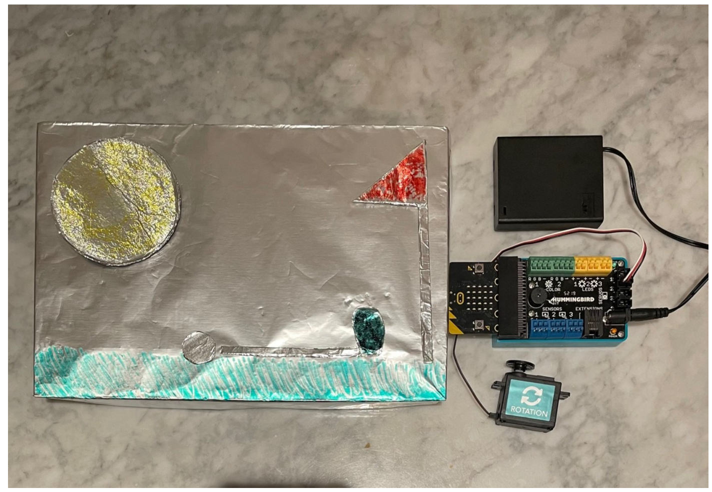
That which was once radical is now mainstream. Case in point, the number of students using computers in classrooms has dramatically increased in the last four decades. Dr. Seymour Papert, widely recognized for his seminal work in educational technology, and his contemporaries envisioned students working on big projects and solving interesting problems. Their intention was for students to work with computers in community, to learn through play, and to explore challenging ideas.

Both research and anecdotal evidence show that students talk less than teachers during class time. We have an opportunity to shift from the teachers-mostly-talking approach to the students-mostly-constructing approach in all subjects and levels. The computer is the way forward in making this shift. Students can use their imagination, ask their own questions, attempt to answer them, develop new inventions, and immerse themselves in three-dimensional collaborative environments where endless iterations of work can be done — this is the land of the *possible possibles*. With a computer as an object-to-think-with, students can engage in redesigned learning environments aligned with the original vision of putting computers in the classroom. This approach to school abandons many artificial barriers, such as age-grouping, content-area specialty, standardized assessments, and textbook curricula. Using the Tynker platform has assisted me in nurturing an appropriate learning environment for students.

We need a high ceiling, multiple entry points, a communication system, and a collaborative workspace. We need a place to practice, dream, and build. We need integration with microcontrollers and Minecraft. No problem, we can do this with our students logged in to Tynker. It's all there. And to meet the emerging and specific interests of students, we can layer in more opportunities and experiences with many physical computing components. The *possible possibles* await us. I teach programming, robotics, and game design in an elementary school. I have all grade levels using Tynker in a self-directed manner to practice computing and develop original projects.

I recently paired up with the art teacher to develop a series of lessons for kinetic art sculptures. This teamwork emerged naturally in our pursuit of open-ended experiences where kids, even in the age of remote learning, could invent and learn with their hands. We introduced them to the pragmatics and aesthetics of engineering design in studying relief sculpture, robotic movement, and intentional use of space. Their materials were cardboard, markers, tape, glue, aluminum foil, rotation servos, position servos, LEDs, and a standard set of data-gathering sensors. The art teacher and I combined our rosters and classroom minutes so we could team-teach for extended blocks of time with flexible focus groups, selected as needed by students. As part of our lesson design, we asked students to try starting from different entry points. This encouraged their flexibility and helped to produce engaging results along the way. We pushed students to continue iterating drafts and remix their ideas with their classmates. They could choose to begin by programming independent of hardware and another day try wiring up various sensors, motors, and lights or the materials for the sculpture itself.





While this was a school assignment, we consciously eschewed traditional structure and instead opted to emphasize play and exploration. A relief sculpture crafted to fit within a physical space is already a challenge. We asked them to also find methods and reasons for it to interact with the inhabitants of that space. As to be expected, students arrived at unexpected results mixing art, programming, and robotics, and that wide range of possibilities helped motivate and inspire new thinking. Student learning experiences grow without limits as educators continue to merge constructivism and computers. Each day of school has the potential to celebrate the student-centered approach to creation with computers. A shift to knowledge construction through everyday interactions with people and objects still requires teachers to help guide and support the development of student thinking and voice. Constructing with a computer helps students solve problems and enhances how they express and share their ideas and experiences.

Instead of teaching students how a particular technology works, we can place students at the center of the classroom narrative in trying to work with that technology in support of their inquiry. Instead of using a computer to deliver quiz questions, we can teach computing to expand how students construct and express ideas. The possibilities within the *possible possibles* still indicate a bright hope for what school can be for students.

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