

Robotics and Coding: Fostering Student Engagement

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Abstract: Coding and the use of robotics will be discussed in this paper along with statistical evidence suggesting the high impact and importance in education. Robots have a wide range of application in areas, such as literature, math, science, art, writing, and social studies among a few. 40% of schools teach computer programming. With that said, by 2018, the U.S. will have more than 1.2 million unfulfilled STEM jobs because there will not be enough qualified workers to fill them. The paper's goal is to communicate the necessity of integrating coding and robotics into the curriculum for K-12 students and help explain that STEM prepares students for their future.

Keywords: coding, robotics, stem, steam, computer programming

It is easy to say that we are living in exciting times in the world of education. The 21st century is upon us, and with that said, new pendulum swings have given rise to creativity and innovation in the school setting. What is the overarching goal of teaching day to day? Getting high test scores? Responding to intervention? Creating attainable goals for students? All of these are worthy goals, but most importantly is getting students to want to come to school every day. Making learning fun is something that is missing from our standards and our curriculum and must be implemented by each teacher in a personalized meaningful way. One way to engage students is through the use of robotics and coding in the classroom. According to Mauch (2001), “many robotics kits, such as the LEGO Mindstorms NXT kits, remind children of toys they know from at home and thus immediately engage them in a playful way and keep them engaged for extended time periods.”

Studies on the subject have concluded that technology teachers face a number of challenges within the STEM fields, like teaching students how to solve problems and providing them with the skills they'll need to succeed at non-scripted jobs or jobs that may not exist yet (DiMaria, 2016). This paper attempts to build on earlier reports by advocating for the necessary additions of coding and robotics as part of our standards, thus making it a priority in all classrooms at all levels. Still other studies indicate that:

Although the world is rapidly changing, public education has maintained almost the same system since its introduction to the world [3], though educational reform efforts have been made around the world, the trouble lies in the fact that the majority of schools are trying to prepare students for the future by continuing what was done in the past. (Robinson, 2010)

Robots and Innovation in the Classroom

When educators think of STEM or STEAM, they think of integrating Science, Technology, Engineering, Arts, and Math into the curriculum. The U.S. Department of Commerce estimates that jobs in STEM will grow 17% by 2018. Eguchi (2014) states:

Educational robotics is an effective learning tool for project-based learning where STEM, coding, computer thinking and engineering skills are all integrated in one project. Robotics provides opportunities for students to explore how technology works in real life, all with one tool through the act of making.

When students are allowed to explore and tinker, they begin to think critically about the world around them and ask questions. STEM and coding are all about exploring, failing, rethinking,

and eventually solving real world problems. Students want a hands on experience with their education. They want real world examples to help shape their understandings. What is impressive about robotics and coding is that many subjects can be taught and understood in an engaging, fun, and unique experience. The following section gives an example of how robotics and coding can be integrated into a variety of subjects through hands-on projects.

Ozobots (<http://ozobot.com/>)

A great place to start in elementary school with robotics and coding is through the use of Ozobots. Ozobots are tiny robots that can be coded either with colored markers or using block-based programming. Students can easily follow the predetermined codes that allow the robot to move in a variety of ways. Students are engaged and excited to come to class to create with their Ozobots.

So what exactly can you do with Ozobots? Ozobots are the world's smallest smart robot. (2017) This right brain – left brain integrating bot builds both creativity and coding skills in ages 6 and up. Advance from basic color coding to intermediate block-based programming with Bit (Fig. 1). The site contains a plethora of free lesson plans that teach a variety of subjects. For example, the site has a literacy lesson on fairy tales. Students gather into groups and read a stories from Grimms Fairy Tales (2013). After reading, students decide who the main character is and discuss character traits. They then build a story map with Ozobot playing the main character. Students decide what codes to give Ozobot to illustrate the main characters movements and behaviors. The creativity is left up to the students as to how their 3D story map will look like as Ozobot moves through the story.

Figure 1 Ozobot



Another lesson is on math, teaching area and perimeter. Students are given a challenge with multiple rectangles. The goal is to find the shortest route for Ozobot to go around, thus introducing concepts, such as perimeter and constrained optimization. There is also a free lesson in Social Studies where students use Ozobot to recreate Ferdinand Magellan's journey. Students label different parts of world geography.

Conclusion

The example of using Ozobots is just one avenue in exploring robotics and coding in education. There are so many more innovative projects for teachers to get their hands on. With the inundation of social media and websites, such as gofundme and donorschoose, teachers have options to secure these robots in their very own classrooms. It is imperative that school districts, schools, and most importantly-teachers jump into coding and robotics as the need for jobs is growing. STEM teaching gives students the creativity they desire to solve problems. STEM addresses the 4 c's that are crucial in education today, which are; creativity, collaboration, communication, and critical thinking. Coding is our future. Coding and the IT world touches every industry we have. Teaching kids to code through robotics will give them the skill set and confidence they need to compete in a future job market that may not exist as this article is written.

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