

Abstract

This curriculum unit is based on the Teacher Institute of Philadelphia's seminar entitled "Robotics in Healthcare: From Science Fiction to Reality". The seminar gave a lot of background information about diseases and disorders throughout history and in our present day. We learned a lot about how these situations are already being made easier by robotics and what is coming up in the future for robotics. During the seminar we also learned about how robotics is making its way into the classroom. We experimented with several robotics kits and learned about coding and construction. Through the seminar I decided to create a unit based on robotics, coding, and teaching students how these subjects are a part of everyday life.

This unit gives first grade students an abbreviated background about disorders that cause muscle weakness. Students learn how robots can make these disorders easier to deal with. Students spend some time learning about robots and how they have become more commonplace in the world. The bulk of the unit is spent giving students instruction and practice with coding and using Sphero Sprk robots. This unit can be given at any time during the school year and can fit in with science, social studies, and/or ELA.

During this unit students will develop higher order thinking skills such as comparing, contrasting, creating, assessing, and analyzing. They will learn how to gather information through reading and analyzing. They will also be using the Block programming language used with the Sphero SPRK. They will be creating their own rehabilitation games and will present what they learned which will also meet oral communication standards.

Coding in First Grade

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Rationale

The K-2 students in my school are not expected to be interested in S.T.E.M (Science, Technology, Engineering, and Mathematics Education), robotics, or coding. All programs offered by my school are geared toward 5th through 8th grade students. All programs that are offered from neighboring universities are targeting 3 through 8 grade students. The students in the K-2 band are very interested and deserve a chance to explore these subjects. My curriculum unit will give first grade students a chance to learn about robots; how to build them, play with them, and use them for their everyday needs.

The typical students in my first-grade class come from poor neighborhoods. Our school is located in the Southwest area of the city and 100% of our students qualify for free lunch. They struggle with reading as we began the year with only 39% of our K-2 students reading at grade level. Many students struggle with traumatic living situations, which negatively affect their behavior in school. In my classroom, my co-teacher and I use science and social studies as ways to engage our students. Science topics like space, plants, and colors catch their attention allowing us to add in extra reading instruction across content areas. It was evident

from the beginning of the year that robots and how they work were of great interest to children and I am creating this unit to build on that interest while still meeting state standards for learning.

Robotics and S.T.E.M. education can be very engaging. According to Curto and Moreno (2016), it can give students a more interesting and fun view of science and engineering. So many students nowadays are tech savvy. They use phones, tablets, smart TVs, etc. to navigate their daily lives. Technology has an instant gratification and a game element that captures attention. Robots are an even bigger draw than the Chromebooks we use in our school. Students are fascinated with how they work, what they can be told to do, and how much control students can have over them. This sort of interest begins at a very young age and I think teachers and administration should take advantage of it.

Robotics is more than just an attention getter. S.T.E.M. education can help foster critical thinking and creative skills that students can use across all subjects (Curto & Moreno, 2016). Many students enjoy working with their hands, but some students actually learn better when they create and take apart their subject.

Working in the S.T.E.M. field gives students this opportunity. The S.T.E.M. career field is projected to grow to more than 9 million between 2012 and 2022 (Vilorio, 2014) and S.T.E.M. education gives students the tools to be prepared for these careers. These careers are not just limited to web developers and programmers.

Vilorio (2014) projects a need for S.T.E.M and robotics educated students in fields such as architecture and engineering as well. Students in the K-2 grades have so much curiosity and so much creativity. I think this is the perfect age for them to get started in S.T.E.M.

Our school district uses the ISTE (International Society for Technology in Education) Standards for teaching digital literacy. In the K-2 grades students are encouraged to use technology to solve problems and create something new. S.T.E.M. lessons fit into these standards perfectly especially when other subjects are included. In this unit I will show students how robots make our lives easier and help us solve everyday problems. This will fill science, technology, and mathematical standards as students create and code robots to work for them.

Robots are cool. They are useful, they stretch our minds and imagination. They are becoming instrumental in our daily lives and they can become instrumental in our classrooms. This unit will introduce robots to K-2 students and get them hooked early on S.T.E.M. education. It has an important place in their future.

Background

This curriculum unit is centered on robots and coding but it may help to give students some background on the types of disorders or events that cause muscle weakness. I chose cerebral palsy because it affects a lot of young people and stroke because it affects a lot of older people. I am choosing to present the information in the form of two case studies to make the information more personal and engaging.

Cerebral Palsy

Cerebral palsy is a type of brain damage. Currently about 8,000 infants are diagnosed with cerebral palsy each year (cerebralpalsy.org, 2018). People who have cerebral palsy, or CP, have trouble controlling their body movements.

Cerebral palsy can happen with premature babies, babies in utero, or sometimes in children who suffer a brain injury early in their life (Kid's Health Network, 2017).

There are three types of cerebral palsy: spasticity, athetoid, and ataxic (Kid's Health Network, 2017). Depending on the kind of cerebral palsy a person may make sudden movements they can't control or constantly shake when they want to be still. The most common is spasticity which involves a stiffening of the muscles. Spasticity is the type of cerebral palsy I will use in my case study because it is the most common form making up about 76.9% of cerebral palsy cases (cerebralpalsy.org, 2018).

In addition to the case study I will be showing a short Youtube video (<https://youtu.be/VFNDSEFWBYTM>) about a girl with cerebral palsy called Tegan's Story. The girl in the video is a thirteen years old African American girl who talks about cerebral palsy effects from birth to her current age. She talks about her struggles such as feeling trapped with everyone staring at her and not having a world that adjusts to her limitations. She also talks about what she enjoys in life such as horseback riding and swimming. This video helps students see both sides of cerebral palsy and that it is something that can be managed. This video adds a personal touch to the information about living with cerebral palsy.

Stroke

A stroke happens when there is a lack of blood flow to the brain. Usually a blocked or burst blood vessel is the problem (cdc.org, 2017). Either way when no blood flows to the brain, the cells there die from lack of oxygen. I will use a short video from Youtube (<youtu.be/ryIGnzodxDs>) to explore this topic as well. The video demonstrates the flow of blood to the brain and what happens if it stops. Because this video is animated it will be engaging and informative for students.

Strokes kill about 140,000 people each year. Stroke statistics vary based on race and age. Black people are twice as likely to have a stroke and, though a stroke can happen at any age, the risk increases with age (cdc.org, 2017). The two types of strokes are ischemic and hemorrhagic. I will be focusing on the ischemic type of

stroke for my case study because about 80% of strokes are ischemic (Hopkins, 2017).

A stroke usually happens suddenly with several signs that people can be on the lookout for such as weakness on one side of the body, dizziness, trouble talking or seeing, and a bad headache (Gupta, 2016). A second YouTube video (<https://youtu.be/jxxsdrhu7T0>) I will use has an animated song about the signs of stroke and how to act fast. This video tells the story of a girl helping her grandmother through a stroke. This will tie in with the case study I have created about an older woman who suffers a stroke. A person who suffers from a stroke may need to relearn things like walking, talking, and using their muscles. I will focus on this sort of rehabilitation in my case study.

Robotics

Best practices for teaching robotics in a classroom can vary greatly depending on grade and experience level. Students in first grade may or may not come to school with some background knowledge about robots. An effective curriculum at this grade should allow students to explore the robot while giving students ways to apply mathematical and critical thinking skills in real world situations (Berry, Remy, & Rogers, 2016).

Most students may not know how robots work and what they are used for besides playing games. To begin a unit on robots, teachers may want to provide

some background knowledge on well-known robots from popular culture. I have designed a visual presentation of well-known robots that students can scroll through and discuss. This can be used as a part of the KWL section of the lesson plans. I plan to use read alouds, videos, and shared reading experiences to teach my students briefly about how robots help people. I hope that this inspires them when they are creating their own projects.

Robots are often used to do jobs that people don't want to do, can't do or can't do as effectively. These activities range from menial tasks like vacuuming in households and assembling products in factories to vital activities such as helping people with disabilities access areas and do activities they wouldn't normally be able to do. The videos I will use will show robots working in factories, gathering information in volcanoes and outer space, and helping people with disabilities. The videos along with a shared reading book called, *Robots All Around*, show students that robots are used more and more to help people do things they cannot do.

Coding

If students have never used coding before they will need some background in what coding is and how it works. Students should understand that a computer code is a set of instructions that a person creates for something else. Teachers can introduce this concept on and off of the computer. There are many examples of low technology or no technology lessons on coding to help students understand this

concept. One example is with no technology can be found on the Preschool Steam Blog (preschoolsteam.com). Students use verbal directions to help their classmates navigate across the room. Lessons like these help students to understand that precise language is important in coding computers and robots.

In my classroom we will be using the Sphero SPRK robots. Spheros are a good option because they are affordable and they have different levels of challenge depending on the students (Max. 2016). A Sphero SPRK is about \$100 on Amazon with the mini version costing about \$50. Teachers have used this robot to teach a wide range of topics from geometry to coding languages. There are many schools that combine coding languages with critical thinking skills and content areas. A middle school in Colorado, for example, asks students to design a way for their Spheros to deliver supplies to sites of natural disasters during their social studies unit (Max, 2016).

If your students are very young or very inexperienced you could start with the drawing program on the Sphero Edu app. This allows the students to see that coding is just telling their robot what to do. I would recommend giving students some time to play around with giving clear direction through drawing. The Sphero app has many lessons on their app to get students used to this and it can be linked in the Google Classroom if that is easier.

Once students are comfortable using the drawing programs you can move on to the blocks programs. Blocks is a programming language similar to Scratch. It allows students to drag and drop commands for their robots instead of just drawing. These commands can modify speed, direction, and timing of the robot's movements as well as allowing students to add sound effects and colors. Sphero has a new app called Sphero Playground that makes it easy for students to learn how to code through a video game format. This program will not only get your students ready for coding, but it will set the stage for the upcoming project. If you only have a few students who are comfortable with this I would suggest putting them at the head of a couple of groups so that they can assist everyone with the coding.

There are other options for programmable robots that can be used in the classroom. Lego Mindstorms is a robotics kit that combines Lego pieces with robotic components and coding. This system has many benefits such as familiarity and compatibility with Lego pieces from other sets. Like the Spheros, teachers have used these kits to learn about content area subjects as well as coding and robotics. An added benefit of this kit, however, is that it allows for more imagination from students. They can use their imagination to build different shapes and structures. These kits also allow students more experience with hardware such as sensors and wires. An average kit costs about \$350 on Amazon.

With all of this information, you are ready to begin the project. I plan to include a lot of this information in my science curriculum. You can also use the read aloud and videos during reading time for comprehension. Once students understands the diseases and disorders that cause a need for robots and that there are robots that are programmed to help people, they should be ready to do it too.

Objectives

During this curriculum unit students will:

- Identify and describe causes of muscle weaknesses including cerebral palsy and stroke
- Explain how robots have and can be used to help people with disabilities.
- Examine and operate a Sphero SPRK using Blocks programming
- Analyze a case study based on a person with disability
- Design a program that will assist the person in the study using the Sphero SPRK

Strategies

The students and the teacher will use many learning and teaching strategies during this unit.

- Students will gather information about disabilities, coding, and robots through Close Reads

- Some tests will be above the student's grade level and the teacher will use the Read Aloud strategy during this time to show students how to gather information from the text.
- Students and teachers will keep information gathered on Graphic Organizers.
- Teachers will use Think Alouds and Modeling to demonstrate coding while students are becoming familiar with the Sphero SPRK.

Lessons

Lesson One: Students begin this unit by learning about disabilities and disorders that can cause muscle weakness. There is a Google slides presentation as well as an animated YouTube video from a child's point of view who is dealing with cerebral palsy. This gives them enough background information to understand the case studies that are presented later in the unit. This information can be taught during the science section of the day or during reading through informational text.

Objective: Students will identify and describe one cause of muscle weakness, cerebral palsy.

Materials:

- Computer and way to project the screen.

- Cerebral Palsy Powerpoint

(<https://docs.google.com/presentation/d/1ZdwrG5ix0Z-WJe5ITbDSyOMsilqkrCKDsQpD8Z4S8E/edit?usp=sharing>)

Procedure:

- Create a KWL chart about disabilities (this chart can be used during this and subsequent lesson on strokes) with students and discuss what students already know about disabilities.
- Present Powerpoint on cerebral palsy pausing to add and/or subtract from the KWL chart.
- Show YouTube video Tegan's Story (<youtu.be/VFNDSFWBYTM>) pausing to add and/or subtract from the KWL chart.
- As an assessment, have students fill out a 321 graphic organizer
 - On this organizer students fill out three things they learned two things they still want to learn and one thing that surprised them.

Lesson Two: In this next lesson students learn about stroke and stroke survivors.

There is a Google slides presentation included in this unit as well as a YouTube video that will help illustrate the brain during a stroke. This continues the background information they need to understand the case study that will come later.

Objective: Students will identify and describe one cause of muscle weakness, stroke.

Materials:

- Computer and way to project the screen.
- Stroke Powerpoint

Procedure

- Ask students what they know about stroke and what they want to know
- Add this information to the previously used KWL chart
- Present Powerpoint on stroke pausing to add/subtract from the KWL chart
- Show YouTube video displaying what happens to the brain during a stroke (<https://youtu.be/ryIGnzodxDs> :36 to :55 minutes in the video shows a 3D demo of the brain) pausing to add/subtract from the KWL chart
- Go over the KWL chart as a class to compare the two
 - Take this time to clear up any misconceptions or questions before moving on

Lesson Three: During this lesson students will learn about robots and how they help people. The teacher will use a YouTube video

Objective: Students will identify and explain how robots help people.

Materials:

- Computer and way of projecting

Procedure:

- Start with a discussion about what students know about robots
 - By this time students should be used to the KWL process, but this can be substituted for any other way of getting students to discuss what they think they know and what they still want to know.
- Show the YouTube video “How Robots Help People” (<https://youtu.be/UfD6CShaMW8>) pausing to discuss and/or add to the KWL chart
- Lead discussion with students after about how robots could help people with the disabilities previously discussed. This conversation might lead to some early ideas on how to approach the case studies.
 - Students could also record these ideas in small groups or individually

Lesson Four: This is the follow up lesson about how robots help people. Teachers will use a read aloud to discuss how robots help people do things. The book used for the read aloud could also be used as a shared reading text depending on the level of students. This lesson could also be taught through an evaluating nonfiction lens with asking and answering questions and finding evidence in the text.

Objective: Students will identify and explain how robots help people.

Materials:

- Copy of Robots All Around

- This book was accessed on the Reading A to Z website. Any other book about how robots help people can be substituted if the teacher does not have access to this site.
- If teachers have access to Reading A to Z, a copy can be printed for each student.
- Document camera or projector
 - This is not necessary for the read aloud but it can be helpful.

Procedure:

- If using this text during shared reading make sure that every student can see the text or has their own copy.
- Discuss the title, cover, and take a short picture walk
- Develop a leading question such as “How do robots help people?”
- Read the text to or with the students looking for answers in the text and modeling how to cite evidence to answer the question.
- This information can be added to a KWL chart if it wasn’t covered by the video.

Lesson Five: This lesson will need to be split into two as students get comfortable with using the Sphero SPRK robots.

Objective: Students will operate Sphero SPRK robots and navigate them through a maze.

Materials:

- Painter's tape
- One Sphero SPRK per small group of students (no more than four)
- One Chromebook for each small group of students

Procedure:

- Before beginning the lesson, create a maze for each small group of students
 - These mazes can be as simple or as complicated as you want. I suggest varying the amount of complexity so that students can try out each other's mazes when they finish their maze.
- Each small group also needs a Chromebook that has the Sphero Edu app installed. This will allow the students to connect with the Sphero SPRK robots.
- The app has several introduction lessons that can be used to help students get used to using the robots, but I suggest opening a new draw program, demonstrating the basics, and letting the students use trial and error to get used to it.
- Allow students to get used to adjusting the distance and speed of the robots and navigating through the mazes.
- Discuss with students how using these robots are the same or different from the robots they have learned about.

Lesson Six: In this lesson students will learn about the Block coding language that Sphero Edu uses. This lesson can also be split into two different lessons as students get used to operating the robots using the Block language.

Objectives: Students will use the Block language from the Sphero Edu app to operate Sphero SPRK robots through a maze.

Materials

- One Sphero SPRK per small group of students (no more than four)
- One Chromebook for each small group of students
- Same mazes from the previous lesson

Procedure:

- Introduce coding language as a set of directions given by a person to a computer.
- Start small by demonstrating just the roll tab to students. Students starting out can use just this command to control which direction the robot goes, how fast, and for how long.
- Give students time to use the roll tab to navigate the mazes. Be ready to assist students in remembering how to program each part of the command.
- If students catch on quickly you can show them the lights and sounds tab which adds entertainment.

- Discuss with students the differences between using the drawing tab and using the language.

Lesson Seven: In this lesson students are presented with the case studies. The case studies are presented through a Google Drawing and are brief enough for first grade students. This lesson will likely span several days as students choose the case study team they would like to be on, plan and create an exercise for their subject, and present their ideas to the class.

Objective: Students will evaluate a case study and create a program for their Sphero SPRK to suit the subject's needs.

Materials:

- One Sphero SPRK per small group of students (no more than four)
- One Chromebook for each small group of students
- Copies of the case studies

Procedure:

- Introduce each case study and ask students to choose which subject they would like to work with.
 - You could also sort your students yourself into groups and give them the case studies, but I suggest giving them a choice
- Group students who made the same choice into small groups (around four each)

- Direct students to create a program using Block language that will give their subject exercise.
- Be ready to speak to each group about whether they are taking into account the subject's likes, dislikes, and problem.
 - For example, students might not want to add a lot of noises to the one for the grandma since she doesn't like noise. They might want to add noise and color to the one for the little boy though because he likes video games.
 - When students have a program, they should try it out several times to check how effectively it works and if it fits with what their subject needs
 - You can assign someone to be the test subject or you could be the test subject yourself.
 - When students are sure that their program is ready they should present it to the class.

Assessment

There are multiple sources of assessment for this unit. Teachers will need to assess the students for understanding of the information given as well as proficiency with coding. Students may also want to assess the effectiveness of their developed programs. Teacher can assess along the way with short quizzes on the

information. I suggest using Google Forms for this as it is quick and gather the information for you. Assessing the proficiency of the coding can happen during the teacher's conferences with the student groups. During this time each student has a chance to go through the lessons with the Sphero and show their proficiency. Students are also able to self-assess their proficiency as they try to create the desired result with the robots.

Self-assessment and peer assessment can also take place at the end of the unit as students have others try out their exercise programs they have created. The students are able to see how others interact with their programs as well as how this data can be evaluated. The Sphero program has this data gathering including in its programming, allowing students to see the results of their programs and if they are being used the way it is intended.

Standards

1.2 Reading Informational Text: Students read, understand, and respond to informational text- with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence.

1.5 Speaking and Listening: Students present appropriately in formal speaking situations, listen critically, and respond intelligently as individuals or in group discussions.

ISTE Standard 4: Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.

ISTE Standard 5: Computational Thinker: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.

Annotated Bibliography

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- Article with ideas on creating an effective curriculum for robotics and S.T.E.M. education.

“Cerebral Palsy.” *CYH Home - Home*, Kid's Health Network, 11 Sept. 2017, www.cyh.com/HealthTopics/HealthTopicDetailsKids.aspx?p.

- This is a website that delivers information about cerebral palsy in a simple way that students can understand. I used it to create a Google Slides presentation but students can be shown the website with a teacher reading it through with them.

Curto, B., & Moreno, V. (2016). Robotics in Education. *Journal of Intelligent & Robotic Systems*, 81(1), 3-4.

- Article on how robotics on how robotics should be included in education and why.

HealthSketch. *What Is a Stroke? What Is a Stroke?*, YouTube, 15 May 2015, youtu.be/ryIGnzodxDs.

- This is video on YouTube that shows what a brain looks like when a person has a stroke.

Hopkins, T. E. (August 17). How I Survived a Stroke. *Essence*, 99-101.

- Article on two women who had a stroke and information about the types of strokes.

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- Article on the different uses for robots in everyday life now and in the future.

Landeros, Tom, director. *How Robots Help People*. FFL, YouTube, 13 Dec. 2014, youtu.be/UfD6CShaMW8.

- This is a YouTube video made by high schoolers about robots and how they help people. It has several examples and is easy to understand for first graders.

Max, D. (2016). *A whole new ball game*. New York: Conde Nast Publications, Inc.

- An article detailing the benefits and limitations of using the Sphero SPRK as well as ways it is being used in some schools.

Preschool Steam (n.d.) Coding Games for Preschoolers [Blog Post]

Retrieved from <https://preschoolsteam.com/coding-games-for-kids/>

- Blog created by preschool teacher with S.T.E.A.M and S.T.E.M. based activities.

Prevalence of Cerebral Palsy. (n.d.). Retrieved April 19, 2018, from

<http://www.cerebralpalsy.org/about-cerebral-palsy/prevalence-and-incidence>

- Website with information about cerebral palsy including statistics and case studies.

“Real Life Robots.” *SciShow*, YouTube, 26 Oct. 2015,

<youtu.be/8wHJjLMnikU>.

- This is a YouTube video from the kids show SciShow. It gives information about what robots are and what they do.

Salas, Laura P. *Robots All Around*. www.raz-plus.com/book.php?id=1616&lang=English.

- This is a shared reading book from the Reading A to Z website. It comes with a shared reading lesson and has information about how robots help people.

Stroke Facts. (2017, September 6). Retrieved April 19, 2018, from

<https://www.cdc.gov/stroke/facts.htm>

- CDC website with information about the prevalence of stroke across races and ages.

“Stroke Heroes Act Fast!” *Stop Stroke*, YouTube, 12 May. 2010,

<https://youtu.be/jxxsdrhu7T0>

- This YouTube video is an animated song with steps to help someone suffering from a stroke.

“Stroke.” Edited by Rupal Christine Gupta, *KidsHealth*, The Nemours Foundation, Mar. 2016, kidshealth.org/en/kids/stroke.html.

- This is a website that delivers information about strokes in a simple way that works well for first grade students. I used it to create a Google Slides presentation but it could also just be showed to the students.

Takacs, A., Eigner, G., Kovacs, L., Rudas, I. J., & Haidegger, T. (2016). Teacher's kit: Development, usability, and communities of modular robotic kits for classroom education. *IEEE Robotics & Automation Magazine*, 23(2), 30-39. doi:10.1109/MRA.2016.2548754

- Article with information on different types of robotics kits.

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- This is a YouTube animated video based on a little girl’s experience with cerebral palsy.

Vilorio, D. (2014). STEM 101: Intro to tomorrow's jobs. *Occupational Outlook Quarterly*, 58(1), 2-12.

Google Resources

Cerebral Palsy Google Slides presentation-

<https://docs.google.com/presentation/d/1ZdwrG5ix0Z-WJe5ITbDSyOMsilqkrCKDsqqPd8Z4S8E/edit?usp=sharing>

Stroke Google Slides presentation-

<https://docs.google.com/presentation/d/171HeqUKNtqWnZTwnhpUXXUNIIv8zqTnrnz8i-RdXDis/edit?usp=sharing>

Case Study 1- [https://docs.google.com/drawings/d/1djtVb-](https://docs.google.com/drawings/d/1djtVb-ZDRDzEhAur84pPID1zMKMjxiNumO4rUS9FVbE/edit?usp=sharing)

[ZDRDzEhAur84pPID1zMKMjxiNumO4rUS9FVbE/edit?usp=sharing](https://docs.google.com/drawings/d/1djtVb-ZDRDzEhAur84pPID1zMKMjxiNumO4rUS9FVbE/edit?usp=sharing)

Case Study 2-

https://docs.google.com/drawings/d/1MBNi0fYM0_kVyoo3zSyAhjJs0W-5HhBKRFyPYIw1xsM/edit?usp=sharing