Robots In Autistic Support Education and Beyond: Implications and Applications For 21st Century Students In Middle and Secondary Autistic Support Services Programs

Cheryl Padgett

Abstract

To summarize, this curriculum unit offers a five part project based learning experience highlighting the employment of robots in educational, recreational, and vocational/post-secondary education domains in the supplemental middle or secondary grades autistic support classroom. This curriculum unit is intended to expose middle and secondary grades students with autism to the use of robots in education and how they may be used specifically to 1) support students in K-2 Autistic Support (AS) classrooms through socialization and education enhancement and/or 2) the development of 21st century skills which can be transferred into a post-secondary education and/or employment scenario. In this unit, the students are in the role of "design thinkers as well as in the role of "robotics/robotics test engineers." The students carry out this role given a choice of project based learning modules employed through the use of the "design thinking (DT)" model. The student robotics/robotics test engineers (hereto referred to as (RTE) will increase their problem solving skills by building a project to support students in a K-2 AS class via the project suggested in this unit. The other project option enables the students to become authentic innovators/problem solvers as they employ the design thinking framework to create a solution for a problem in their classroom or school. Both options call for the students to use robots as tools of engagement. The students in the role of RTE have the opportunity to benefit from instruction using robots that will allow them to transfer abstract academic content into concrete examples, enhance communications skills, and write code and/or program robots.

Rationale

The overall goal of this unit is to facilitate learning for middle grades (6-8) and secondary (9-12) students with autism regarding how robots may be used as a problem-solving tool and to further enhance and build on the technological and academic skills of student participants as they assume the role of robotics/robotics test engineers (RTE). Students may choose to explore how the robots may be employed in elementary (K-2) autistic support classrooms as a resource for social and educational skills development. Another option is for the students to consider themselves as potential consumers/users of robotic intelligence, lab practitioners/designers of robotic structures, and members of communities applying moral compasses to make decisions regarding ethical and equitable use of robots in order to benefit their classroom/school communities. Throughout the background section of this curriculum unit, I will discuss how teams consisting of teachers, paraprofessionals, and service providers (hereto referred to as facilitators of learning--- FOL) have already used robots to collect data relative to academic and social skills objectives as well as engage/enhance/support social /academic skills instruction. Furthermore, I contend that an affective learning outcome of this unit is that it will facilitate the development of 21st century technology based skills for students with Autism Spectrum Disorders (ASD).

Yet, there is another more affective learning outcome embedded in this unit which is specifically targeted to FOL of what is termed Low Incidence Special Education Programming. As a FOL of students with autism, I intentionally engage my students in learning experiences that are transferable to the home, community, and workplace settings. For example, I currently expose my students to authentic 21st century learning opportunities offered in the general education community such as technology and science fairs. As a result of exposure to technology fairs and STEM events offered by the School Ditrict of Philadelphia and intentional embedding of the International Society for Technology in Education (ISTE) standards in lessons, I am witnessing my students flourish in their strengths and exceed the boundaries of the label or diagnosis of having an ASD. Therefore, I hope for this unit to serve as a platform and a spring-board for even more special educators of students in Low Incidence programs to meaningfully access STEM content and develop world-class projects in both classroom and competitive spheres as well. In doing so, our students become collaborators, researchers, and members of a diverse learning community. I expect for the outcomes of this unit to advance the cause of students with disabilities so they are able to access meaningful STEM learning opportunities that can serve as a segue into high school CTE programs and/or other post-secondary transition experiences.

In order for this to happen, it is imperative for users of this curriculum to develop relationships with educators and community partners outside of the Autistic Support classroom. For example, many schools have at least one science teacher involved in STEM activities or even a robotics club. I suggest we as FOL for students with special needs engage in planning or opportunities for our students to benefit from instructional classes with these educators from the general education community. Other options include reaching out to nearby universities or professional organizations to request classroom visits or demonstrations. In many instances, the traditional Commmunity Based Instruction model can be revisited to include site visits to a robotics lab, engineering site, or university location in order to facilitate experiential learning opportunities. Examples of low to no cost suggestions, and other ideas are included throughout this curriculum unit as well as in the appendix of this unit in order to spark ideas and provide a starting place to generate this type of support.

Nevertheless, the following excerpt summarizes my mindset as I hope to serve as a change agent in my own classroom. My experience in the traditional school year as well as in summer based Extended School Year (ESY) summer programs teaching students in middle grades has supported the contention that several students in autistic support classrooms appreciate and value their interaction with technology. This interaction can be in the form of playing video games, computer based reading and math interventions/instruction, and even common everyday 21st century uses of technology such as composing emails and the like. However, " ...just offering kids the latest-model laptop isn't enough. Instead, what distinguishes the most innovative schools is what students and teachers do with the technology they have... teaching and learning with technology should look (like): "Computational thinking," "human-centered design," "innovation mindset— ... (Herold, 2017)." This quote challenges me to grow in my instructional practices by developing new expectations regarding what outcomes I am aspiring for as I embed the use of technology in my lessons.

For example, a professional partnership with Ms. Dianne McGuire, a Technology Integration Specialists (TISs) from the School District of Philadelphia (SDP) Office of Educational Technology (OET) has enabled me to expand my own students experiences with technology beyond what my level of expertise can do. Her support exemplifies what I mean when I suggest AS teachers with a limited STEM background reach out to other community and teaching partners for training and resources to assist in helping students with disabilities grow in the context of their 21st century learning skills. The SDP has technology integration specialists available to support our AS classes as well as general education classes in learning new technology skills and applications. The School District of Philadelphia also offers Tech Tuesdays several weeks during the academic year in order to support both novices and experienced teachers in using technology and state of the art practices. Most of these innovative ISTE supported practices and activities can be turned around the next day in the classroom. Attending these events is also an excellent way to network and/or request additional support in our classrooms via demonstration lessons and the like. The SDP's Office of Educational Technology also offers information about myriads of opportunities, events, and professional developments to advance technology according to world-class standards on the SDP website.

In sum, I hope this unit will serve as an opportunity for students to engage in an opportunity that can introduce them to an accessible and rewarding post-secondary/education employment option - computer programing. In the short-term, as students apply to high schools in the eighth grade, they will be able to include the fact that they have written code or had an experience designing/programming a robot. Most importantly, students can gain the skills that transform them from not only "watching movies about robots but into a role of RTE observing how the robots they built are making a difference."

Background

The focus of this unit is derived from the seminar topic Robots in Healthcare: yet, this unit specifically addresses the employment of robots in the education, recreation/socialization, and post-secondary considerations of students with autism. As I present some background information relative to this topic, I aim to present FOL with multiple yet inter-connected components of this issue. I aim to inform and inspire FOL to action as they consider the roles their students will play in the near future as robots become key components in "human welfare/service" based solutions. In order for this to happen, our students need exposure to quality STEM education experiences required during the pre-K, elementary, middle, and high-school years.

> "The integration of robotics into the educational curriculum has been assumed or implied beneficial to students from Pre-K to college. This is because robotics can be applied or used in a multitude of ways. It can be used for recruiting students for STEM, teaching students about STEM, illustrating connections between various disciplines, or as a demonstration of the real-world application of various theoretical concepts. At the elementary level robotics can excite young people about science and math and it can also encourage them to pursue careers in STEM. At the high school level, robotics can be used to illustrate the application of design, math, science and engineering, and also recruit students to STEM fields. (Berry, Remy, and Rogers, 2016)."

Moreover, I contend that with exposure, education, and training starting in the supplemental autistic support classroom setting, students with disabilities can not only engage in STEM activities but design, create, and transfer STEM content into a more functional application of common core mathematics, interpersonal communications, and expository reading standards.

In order to process the significance of this statement, it is imperative to note that "... digital fluency should mean designing, creating, and remixing, not just browsing, chatting, and interacting" (Resnick, Maloney, Monroy-Hernandez, et al, 2009). This means that digital literacy can no longer be limited to everyday functions such as viewing webpages developed using code written by other people but our students need to be writing the code in order to develop their own webpages. This contention is supported by an opportunity I became aware of through a company called Coding Autism. “Coding Autism is building the first autism specialized coding academy, pairing online coding education, community, and an autism-savvy support team to help transition autistic talent into our technology workforce.” I have included this company in the Appendix under student resources as the company offers a free 50 hour online prep course.

In order to lay the groundwork required for the FOL to introduce the lessons and project based outcomes to their students, I will offer a brief review of literature to answer the following questions:

1. *How are robots currently being employed in the context of the 21st century autistic support (AS) classroom to support social skills instruction?*
2. *How are robots currently being employed in the context of the 21st century autistic support classroom (AS) and general education classrooms to support academic instruction?*
3. *How might we employ robotics in the context of the 21st century autistic support (AS) classroom to develop life-long learner qualities such as perseverance, grit, problem-solving and creativity? In doing so, how might these qualities be transferred into meaningful secondary and post-secondary options?*

ROBOTS USED IN AS CLASSROOMS TO SUPPORT SOCIAL SKILLS

First, robots are being used in the autistic support classroom to support social skills instruction in a variety of ways. For example, a review of the literature holds there are roles for robots in the autistic support classroom as stated in a document paper titled “Interactive Robotic Social Mediators as Companions (IROMEC).” “The article identifies “three different categories of robots can be used to set up rehabilitative and educational interventions”... They are as follows Toy Robots (with two main features: remote controlled and/or carry out autonomous behaviors; Educational robots (their aim is to propose, with a play based activity, important concepts regarding robotics and computer science; Dedicated Robots (devices specifically designed and built for children with disabilities (IST, 2010).” It should be noted that since this publication is available online, I strongly suggest any participating FOL in this unit access this clear and jargon free deliverable as the types, uses, and physical features and appearance of the robots. Furthermore, the robots choices featured in the lesson plans of this curriculum share similarities with the robots discussed in this document with one exception. They are either a toy and/or educational; however, they are not classified as dedicated robots although they offer features that enable them to serve the needs of users in that capacity.

Nevertheless, there is a dedicated robot currently in use in at least ten elementary grades Autistic Support classrooms in the SDP. “Autistic children struggle to pick up social clues that might help them make sense of the world. As a result, therapists must teach them things that other children pick up naturally. The expressive face of RoboKind's Milo robot helps teach autistic children to recognize emotions on the faces of people around them; … moreover, Therapy mechanics,... are a major cause of teacher and therapist burnout autism robots can manage these mechanics automatically they typically link with a tablet as the child chooses the cards the robot automatically record data more accurately than any human and immediately displays new cards when we tested the robot not only did the kids become but we got an unexpected result- it cut the time needed to complete the therapy in half... This is because the robot recorded the therapy data faster than the teacher could. It also freed the teacher to focus exclusively on the child (Brown, 2018)." In cases such as this, not only is the robotic tool supporting student growth and achievement but it is increasing the effectiveness of the educational team by allowing the human FOL to focus on the observation of the child's behaviors opposed to the process of collecting accurate data. The FOL is able to focus on reinforcing the child as well as consideration of new goals as the child reaches or exceeds the expected levels of achievement.

Robots Used In General Education Classes and Implications For Use In AS Classrooms

<u>Sphero</u>

The integration of the technology lends itself to the needs of visual, kinesthetic, and auditory learners as well as the need for the FOL to teach STEM content and the like. "...Sphero...a small hand-sized ball you can program easily to change colors, run a circuit, keep beat with a song, and may other fun ideas"...may also be used to advance core curriculum;... "for example, at least one science teacher uses Sphero to replicate the orbits of planets around the sun, with each Sphero planet programmed to make a circuit identical to a real planet. Kids see an abstract idea-- planets orbit around the Sun in different paths at different rates-- operate on the floor in front of them … (Slavin, 2015)." I propose we utilize, modify, and/or adapt objectives and activities currently utilized in general education settings in order to offer our students components of an authentic STEM experience in the classroom. These activities can support our transition objectives as well as vocational, interpersonal communications, and literacy, and math through the cross curricular integration of skills.

Another example illustrates how robotic technology supports traditional math content such as, "Learning to program a robot to follow a regular polygon presents an engaging experience that powerfully models number sense, space and shape, and measurement. While determining the distance the robot needs to travel and turn using wheel rotations, the children are grappling with interpreting the relationship between planar movements caused by circular motion. This is how any wheeled vehicle moves. Students are applying their understandings of numbers and arithmetic to a meaningful task. Connecting a polygon's equal sides and angles to programming loops affords another instantiation or metaphor for multiplication. Robotics encompasses all aspects of STEM and provides in-finite opportunities for making mathematics relevant. Francis, & Poscente (2017)."

I hope to offer a case for how we might employ robotics in the context of the 21st century autistic support (AS) classroom to develop life-long learner qualities such as perseverance, grit, problem-solving and creativity and transfer these into meaningful secondary and post-secondary extensions. This will be done through the project based learning modules via design thinking as the process. In sum, I have hoped to make the case for the purpose of employing robots in our autistic support classrooms; yet, there is some additional essential background knowledge for the FOL to become familiar with before beginning the curriculum unit. In this section, I offer foundational background knowledge about other robots in our 21st century especially for teachers like myself with no prior engineering or formal robotics training or background.

What Is A Robot?

It is imperative to have a solid working definition of robot and knowledge of the types in order to proceed with a discussion about their employment in the realm of a special education autistic support classroom. "In essence, a robot is a combination of computer technology and mechanical technology with the dual goals of manipulation and movement. Two key elements differentiate robots from other types of devices: first, they are reprogrammable, allowing functional changes to be made easily; secondly, a robot has controlled movement either by changing its location or by moving objects (Post, P., Howell, R., & Rakocy, L. 1988)."

Types of Robots

Although service robots used and designed for use in the education realm are the main focus of the robots featured in this unit, the following excerpt describes the types of robots used in various contexts in the 21st century: "The expectation that robots will become a part of everyday life, working alongside humans as assistants, teammates, caretakers, and companions, has brought the discussion of societal consequences and reactions to robots to the forefront of robotics research. In these future-oriented discussions, social robots often represent "technological fixes" —applications of technology meant to solve social problems that are non-technical in nature—for a variety of pressing issues in contemporary society. Telepresence robots enable knowledge workers to be in multiple places at once; companion and care-taking robots provide supervision and social interaction for children and the elderly; robotic educational assistants assist teachers in busy classrooms; and socially assistive robots help patients follow their dietary and therapeutic regimens (Šabanović, 2010)."

Soft Robots

Soft robots have features that are advantageous to users in many respects such as the fact that soft robots are "capable of picking up objects, moving around the floor, or crawling up the wall. And, the robots can be built in within a matter of hours. ...prototype units have already demonstrated thousands of cycles (after days of continuous use) and have required very little repair over their lifespan, suggesting they could be used with little change as part of a commercial soft robotics kit," says Jamie Paik, Founder and Director of the Reconfigurable Robotics Lab (RRL) at the Swiss." (Soft Robots Run on Vacuum Power. (nd.)."

Collaborative Versus Traditional

"Advanced collaborative robots can sense if they require adjustment, and they reorient themselves accordingly. As a result, the robots can safely deal with variability on the factory floor and perform tasks like humans do. Traditional robots are presented with parts that are uniform and tasks that never change. Therefore, if the robot or a part is bumped out of position, the robot will continue to drive the task until completion, potentially damaging parts, machines, or other robots. This situation can cause a major disruption to the production line and operational schedules. Conversely, if a collaborative robot is bumped out of position, it has the capability of sensing that it is misaligned and will correct itself or pause its task until fixed (https://www.isa.org/intech/20161001/)."

Androids

"An android is a humanoid robot designed to be similar in form to humans. Some androids are built with the same basic physical structure and kinetic capabilities as humans but are not intended to really resemble people. They may have jointed arms and legs, for example, that are capable of moving in the same ways that human limbs do, but have plastic or metal exterior that in no way mimics human experience. (Rouse, M., nd)."

Animiloid Robot

An animaloid robot is a robot with shape built to resemble of animal … Animaloid companion robots represent a very interesting paradigm. An increasing number of studies on this topic has been carried out in the past, involving such robots and older users affected by some kind of cognitive disease, from mild cognitive impairment (MCI) to more severe stages of Alzheimer's disease and other types of dementia (Sayyu, C. T. ,2013)."

Robots In Healthcare

I strongly suggest readers and FOL implementing this unit will review curriculum written by my colleagues under the seminar heading titled "Robots In Healthcare.

The Three Laws of Robotics:

"These laws had a very influential role in subsequent science fiction works, and became also important with the emergence of robotics as a scientific discipline. These laws define a kind of set of ethical rules for robots (or for the human programmers of their artificial intelligence):

1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.

2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.

3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law."

(Iosa, M., Morone, G., Cherubini, A. et al, 2016)

Objectives

Affective Learning Outcomes: By the end of the project(s), students will be able to integrate computer programming and coding into their technology based schema in order to practice higher order skills in technology. The goal is for this project to help initiate the process of closing a "digital divide" which limits many technology education experiences for students with autism to emailing, surfing the web, using apps (opposed to creating apps) and other entry level interactions.

Functional Academics Outcomes: By the end of the project(s), students will collaborate with peers, facilitators, and members of the professional community in order to design and/or program a robot to solve a problem for designated users using acquired skills such as reading directions, sequencing, and making inferences.

Transition Post-Secondary Education and Employment Outcomes: By the end of the unit, students will be able to employ the Design Thinking Process in order to engage in a project -based learning module in order to use a robot in a K-2 setting to improve educational outcomes for students with special needs and/or solve a problem for students, staff, and/or community in the school setting.

It is imperative to note that virtually any IEP objective from almost every domain as well as Literacy and Math Common Core content is addressed as students engage in this unit. For example, students will engage in simplistic skills such as turn-taking when constructing a robot to citing text based evidence and inferencing upon explaining why they chose a specific function or feature of a robot to solve a certain type of problem. Furthermore, in the project with K-2 students, when teaching students to move a robot left or right, open and close hands, or move arms up or down, the position commands taught in the "language" research based intervention program are being reinforced, extended, transferred and/or generalized.

ESTABLISHED GOALS OF UNDERSTANDING FOR FOL AND SRE:

- THREE LAWS OF ROBOTICS: FOL will post these laws in a visible place in each blended learning station and/or in a highly visible location throughout the classroom for FOL, students, and visitors to see and refer to. These laws are to be consistently referred to throughout the design process in order to allow the students to be mindful of accountability and ethics in the course of creative role play with minimal constraints.

- APPLICATION OF BASIC COMPUTER CODING SKILLS: It is imperative for FOL employing this unit to introduce the students to the basic tenets of computer programming (coding) by accessing free resources such as Code.org, Khan Academy, and Tynker to name a few. I've found that the lessons at the basic level were intuitive for my students and not so intuitive for me. Again, I've enlisted support of School District of Philadelphia staff and other visitors to assist me in teaching students the basics of computer programming. As time goes on, I am developing my own skill set by investing in online trainings for educators using the SimpleK12 professional development platform and learning from free You Tube videos.

- DESIGN THINKING (DT): In order to effectively carry out this unit, it is imperative for the FOL to become familiar with the design thinking process. There are an abundance of resources available online as well as through the resources listed in the Annotated Bibliography. A great user friendly starting place for FOL on You Tube is: The Design Thinking Process; Sprouts, YouTube, Published on Oct 23, 2017.

- ESSENTIAL QUESTIONS FOR FOL AND STE:

1. What is a robot and how can we distinguish it from other types of hardware such as computers, toys, or even machines?

Best Practice Tip: The following webpage addresses this question with a clearly written response as well as with a video. This resource serves well for both FOL as well as students from accessing https://www.quora.com/What-is-the-difference-between-a-machine-and-a-robot
Prasanth Thangavel, Avid Robotics Learner

2. How can we use hardware and software in order to design, create, and build prefabricated and/or original robot?
The following is a FOL and student friendly resource available with clear, easy to comprehend explanations, instruction and video:
https://www.popularmechanics.com/technology/robots/a7388/build-your-first-robot/

3. How might we design or utilize a robot to solve a problem or create a solution for a K-2 Autistic Support classroom and/or create a solution for a problem experienced by students, staff, and/or visitors in our school community?

This is the focus of the lessons/activities of this unit. At this point, we begin our process of uncovering the project based learned using design thinking as our process.

Suggested Free Pre- Unit Exposure Lessons & Activities
In this section, I list a few resources and activities that will introduce and/or expose students to the foundation of robotics--- computer programming or coding. There are even activities which can be done offline as well.

1. Introductory coding and robotics via SPHERO labs from a school visit from a member of School District of Philadelphia Technology Team. Contact or visit the Office of Technology in order to request support.

2. Code.org Modules/Join One Hour of Code)
"The **Hour of Code** takes place each year during Computer Science Education Week. The **2018** Computer Science Education Week will be December 3-9, but you can host an **Hour of Code** all year-round Hour of Code (https://hourofcode.com/)."

3. Scratch Activities/Lessons: "With Scratch, you can program your own interactive stories, games, and animations — and share your creations with others in the online community.
https://scratch.mit.edu/about)."

4: Introduction To Robots: Students learn what makes a robot a robot, types and uses of robots via multimedia presentations, flipped instruction, and site and/or virtual visits. Students can research robots as they appear in movies, sports, the workplace, and in healthcare. Students generate graphic organizers, illustrations, and 3D printed models of original robots used for any scenario of choice. Have student complete a KWL organizer to respond to these prompts:

1. What do I already know about robots?
2. What do I want to learn about robots?
3. What have I learned about robots? (Students will complete this section in the last part of the design thinking process).

Use chart paper to record what students already know about robots and what students want to learn about robots. Post in a visible place in the classroom workspace. Suggestion: For an emergent-verbal student, display a picture, video, or 3d model of a robot. Allow the student to interact with it. Next, if the student moves the robots arm, reinforce their participation by verbally noting and then recording that "robots can move their arms." This is just one example of how a FOL can engage participation from all students.

5: Introduction To Arduino Labs: If possible, you can purchase an Arduino Kit either through Donors Choose or personally as a tax write-off. These kits come with lessons and activities. Another option is to allow students to watch YouTube videos with demonstrations of what Arduino boards are and how they are used as part of a robotics toolkit.

6. Types of Robots: FOL can use the Google search engine to access You Tube videos, movie clips, and even student-friendly books about types of robots and what they do.

7. Illustrations: Students can illustrate a robot using crayons, markers, colored pencils and then write one to five sentences explaining features of the robot and the types of things it is able to do.

Essential Vocabulary for the FOL and Student RTE:
DESIGN THINKING TERMINOLOGY:
Empathize, Define, Ideate, Prototype, and Test (See Strategies Section For Definitions)
ROBOT: An automated machine dedicated to a life of service; has a brain operated by a computer program; can either be self-operating or with some computer control (Green, 2012)."
COMPUTER PROGRAMING: creating a sequence of instructions to enable the computer to do something
http://dictionary.kids.net.au/word/computer_programming
CODE:(computer science) the symbolic arrangement of data or instructions in a computer program or the set of such instructions
http://dictionary.kids.net.au/word/computer_code
ARDUINO KIT: "Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing." (https://www.arduino.cc/en/Guide/Introduction).
SENSORS: A device that responds to a physical stimulus and converts the stimulus into a signal conveyed to another device. For example, a sensor in a printer detects that the paper tray is empty and sends a signal to the digital display that the tray is out of paper. https://www.thefreedictionary.com/sensor; any device that receives a signal or stimulus (as heat or pressure or light or motion etc.) and responds to it in a distinctive manner http://dictionary.kids.net.au/word/sensor

Costs Required To Implement The Project Based Learning Unit:
I suggest using the Donors Choose platform to purchase the robotics kits, Arduino Kit, or any other technology such as Chromebooks you may need to implement this curriculum. Other items may be written into the Donors Chose proposal such as the ones listed in the Annotated Bibliography Student Resources..
Robotics Kits Used In This Unit:
KIKO.893 Artificial Intelligence Robot Kit Item #: 3156304; Evolution Robot Kit Item #: 3155876; Cyber Robot Item #: 3155635; Mio Robot Kit Item #: 3155257; ReCon 6.0 Programmable Rover Item #: 3152603; Smart Bot Item #: 3155774.
Suggested Vendor: Scientifics Direct 1-800-818-4955 ScientificsOnline.com
A comprehensive description of each robotic kit can be accessed online through the Scientifics Direct website along with the current cost of the kit. It should be noted that the most expensive kit I purchased at the time of publishing this curriculum unit was $104.95.

Strategies

Blended Learning Station Rotation Model

In all, the instructional sequences may be employed using the "blended learning station rotation model." This simply means organizing the classroom in three stations: 1) direct instruction station, 2) students working in a partnership/small group collaboratively, and 3) students working on a laptop in another station. (At other times, such as when a guest teacher or professional community member is facilitating a demonstration lesson or discussion, the whole group model may be most appropriate). For more information, there are myriads of websites and YouTube videos explaining and demonstrating the Blended Learning/Station Rotation model and the benefits.

Design Thinking Process:

1.EMPATHIZE: Students will understand what it feels like to be someone else with a specific type of problem.

2. DEFINE: Students will research, explore, and investigate to learn more about the problem identified in Step One.

3. IDEATE: Students will think of many different types of ideas about a soution for the problem and how their ideas will be used to help solve the problem for users. Please note that the term "users" are the people the students are creating a design solution for.

4.PROTOTYPE: Students will make illustrations and/or models of their ideas.

5.TESTING: Students share the design solution with users and test the solution out with the users. They collect data on the effectiveness of the solution and even get feedback from the users about the effectiveness of the solution and ways to make it better.

Sample Lesson Plans and Activities

The FOL may sect from one of two options or both for implementation of the unit. The first option is for the users of the robotic design solution to be students in a K-2 AS setting whereas the second option is for students to design a robotic solution for the users in the school environment.

OPTION A:

Description of Problem: Please use a scenario based on what your site visit to a K-2 class in your building or another school. You can reach out to a K-2 AS teacher using the AS Google Classroom platform and ask if you can arrange a visit to the classroom so your students can observe, interact, gather information and test the design solution. The goal is for you to be able to partner with that classroom in order to implement the project.

SAMPLE SCENARIOS:
Ms. Smith is a first grade teacher of students with Autism at the Y School. A few of her students are struggling with the concept of open, close, left, right, top, and bottom. These positional concepts are taught during their research based intervention program in language. One of Ms. Smith's students refuses to participate in games with other children during indoor recess. How might we use robotic technology to help Ms. Smith's students?

Time Frame: No less than 16 class periods or the equivalent of two ninety minute sessions per week for the minimum of a month. Teachers may opt to employ this unit during time allotted for Community Based Instruction (choosing to list a K-2) classroom as a site visit; on the other hand, this unit may be completed during the designated social studies or science block times. Site visits may occur under the title of "educational trips."

Materials: These are only suggested robotic choices I have selected based on their ease of use by novices, affordability, and quality:
KIKO.893 Artificial Intelligence Robot Kit Item #: 3156304; Evolution Robot Kit Item #: 3155876; Cyber Robot Item #: 3155635; Mio Robot Kit Item #: 3155257; ReCon 6.0 Programmable Rover Item #: 3152603; Smart Bot Item #: 3155774.

Suggestion: I strongly suggest you enlist the support of someone in your building who is comfortable using basic tools to construct an item. I carefully selected robotic kits that our many of our middle grades and secondary students can complete independently with adult supervision; nevertheless, since many FOL such as myself are more comfortable with instructional manipulatives versus hardware tools, I am enlisting the support of designated staff during lunch times as well as a volunteering college students. In exchange, I am offering an invite to a pizza party as well as a letter of commendation for volunteer service for the college student.

Student Friendly Objectives: You will use the five step design thinking model in order to:
1. Design a solution for students in a K-2 classroom who need help learning direction words using robotic technology.
2. Role play as a robotics test engineer in order to see if your design solution helped the user.
3. Create and present a slideshow or poster board presentation that shares your design project from start to finish.

Directions:
Before Beginning the Lessons:
1. Secure Video and Photographic Consent release forms for every student involved in the project. (Be sure to get these releases completed for the students in the cooperating K-2 class as well).
2. Prepare Community Based Instruction Forms if you choose this option as a way to get to another school in order to partner with a K-2 AS class.
3. Select Rubrics from the Appendix and place in a binder (one per student). Set up the Excel Spreadsheet on your computer with student names. Be prepared to consistently record anecdotal notes regarding student participation, growth, and achievement. Have another or several FOL videotape and/or photograph each session. This will allow students to have visual content for their culminating slideshow or poster board presentations.
4. Gather all supplies for the robot construction and place in a plastic shoebox. If possible, secure multiple containers from a bargain store in order to secure and organize all robot parts.
5. Prepare sticky notes with the name of each part so students are able to identify and select the correct part during the construction process

Directions:

Student Friendly Objectives: You will use the five step design thinking model in order to

1.EMPATHIZE:
Station One: FOL will share YouTube videos with students about the characteristics of children with autism.
Marvelous Max - Autism Awareness for School Kids
Sesame Street & Autism: Highlight Reel
Sesame Street In Communities
Sesame Street Season 47: Meet Julia Clip (HBO Kids)
HBO Kids
These videos are children-friendly and offer a variety of perspectives of children with autism and will support the development of empathy. The videos highlight challenges that are typical for students with ASD in K-2 settings such as engaging in or initiating play, uncomfortable with loud noises, and difficulty initiating communication with peers and adults.

Station Two: Students rotate and complete simulations about what it is like living with autism.

Sample Autism simulation

"...one mother had a smart way of demonstrating the problems with sorting sensory input -- she turned on 6 radios, all set to a different station. You can get other autism simulation ideas through this link: http://www.autism-pdd.net/testdump/test15359.htm

Since getting six radios may be a challenge, attempt to set this station up using as many cell phones and/or computers as you possibly can. Set the phones up on a variety of different YouTube channels ranging from music to Ted Talks. Invite 3 children at a time to sit and listen at the station for up to ten minutes. Next, have students record responses about what it felt like. Students can also illustrate using emojis or other artwork.

Station Three: Online
Online excerpt of book titled: " What Autism Can Be"; Source:
http://books.google.no/books?i
d=r0TADwlMhYC&printsec=frontcover&dq=%22a+book+about+what+autism+can+be
+like%22&a

Although this book only allows you to read the first 13 pages for free, it does offer an excellent empathetic understanding of how challenging it can be for children with ASD to focus.
Students to begin the first section of their slideshow using their school district Gmail accounts and opening up Google slides. They can record notes about what they learned and experienced in each station.

2. DEFINE: Students will research, explore, and investigate to learn more about the problem identified in Step One.
The FOL needs to set up a site visit or trip to a K-2 classroom. At this point, students can interact with K-2 students by building structures with LEGOs or blocks, reading stories, and/or doing artwork. Have older students ask the K-2 teacher questions about the challenges in social skills and academics experienced by some of the students.
Responses and observations should be recorded on site or immediately upon return to the classroom so students retain all of the information.
Station 1: Students discuss findings with the FOL.
Station 2: Students discuss findings with peers. They create illustrations with captions depicting what they saw.
Station 3: Students will begin the second section of their slideshow using their school district Gmail accounts and opening up Google slides. They can record notes about what they learned and experienced on the site visit.

Whole Group: FOL elicits students to share out on all the problems they learned about experienced by students in the K-2 classroom. After discussion and voting, students come to a decision about what challenge they will focus in on in the K-2 classroom by designing a solution for.

3. IDEATE: Students will think of many different types of ideas about a solution for the problem and how their ideas will be used to help solve the problem for users. Please note that users are the people the students are creating a design solution for.

FOL will record student responses on chart paper using the following sentence starter:
Our robot could help solve the problem of ____________ by doing
____ or

How might we design or utilize a robot to solve a problem or create a solution for the K-2 Autistic Support students?
.

Each student should have multiple responses. At this point, the responses can range from realistic to outlandish. It's all about creativity and possibilities.

Station 1: FOL will showcase each robot in the box and discuss the features and what the robot can do in terms of helping to solve the problem.

Station 2: Students can research Milo and other robots that are used to facilitate socialization and instruction for students with autism using YouTube videos and the Google search engine.

Station 3: Students will begin the third section of their slideshow using their school district Gmail accounts and opening up Google slides. They can record notes about the ideas they generated as well as information about the robots currently used in autistic support education.

4. PROTOTYPE: Students will make illustrations and/or models of their ideas.

Station 1: Students begin construction of robots with FOL (and any other supporting adults as suggested earlier in this unit). FOL may want to break down tasks according to complexity level and intentionally place students in groups that match their ability levels.

Station 2: Students will illustrate and write a description of the 3D robot they selected.

Station 3: Students will begin the fourth section of their slideshow using their school district Gmail accounts and opening up Google slides. They can include notes and illustrations about the robot they selected as well as why they elected the robot.

5.TESTING: Students will share the design solution with users and test the solution out with the users. They collect data on the effectiveness of the solution and even get feedback from the users about the effectiveness of the solution and ways to make it better.

The FOL will set up another or ideally multiple site visits in order to for students in role of RTE to test out the effectiveness of the robotics design solution. Students will record their observations regarding the effectiveness of the design solution.

Station 1: FOL will work with students in order to discuss outcomes from testing phase and record those on chart paper.

Station 2: Students will record what they learned about robots as well as what they learned from the site visit.

Station 3: Students will begin the final section of their slideshow using their school district Gmail accounts and opening up Google slides. They can include notes and illustrations about the results of the testing phase.

Assessment:
1.Have Students complete the Project Form (See Appendix)
2. Have students complete a slide show illustrating each stage of the design thinking process.
3. FOL will complete the results on rubrics using the modifications you make to those listed in the Appendix as well as the FOL Rubric provided in the Appendix.
4. Invite service providers such as the Speech Therapist to include any data on the Interpersonal Communications rubric in the Appendix
5. Students will complete self-evaluations using the Student Rubric provided in the Appendix.

ASSESSMENT TOOLS (See Appendix):
FOL are expected to modify these rubrics and assessment tools according to the individualized needs of you and your students. I've already provided modified samples of resources I've found online; however, modifications need not be the same for every group of students. Students need to understand "perfection" is not the goal but rather the ability to "try different solutions and make adjustments" as needed. Mistakes should be seen as valuable and part of the learning/designing process.

Sample Skills from Domains used in Life Skills Curriculum:
1.Interpersonal Communications: (include speech service providers if applicable in the evaluation of student) Verbal communication of ideas and/or information
2.Functional Academics (reading of instructional manuals, measuring, hypothesizing
3. Vocational: Following multi-step directions in the context of a real -world authentic scenario.

POST-EVALUATIVE CRITERIA:

1. Are my students able to distinguish between: a toy and a robot; a machine and a robot? a computer and a robot?
2. Are my students able to employ basic code in order to program a robot according to written and/or verbal directions?
3. Did my students design a solution for a K-2 AS classroom based on site visit by designing or creating a robot to meet that need according to the design thinking process?

OPTION B: This second option is for the users of the robotic design solution to be students, staff, and/or community in the school environment. The lesson format is the same with the exception being different scenarios. I've provided a sample; however, FOL will discover their own scenarios as they facilitate students through the steps.

Description of Problem: Please identify the problems you will investigate as you complete the project based on a site visit through your building or even your classroom.

SAMPLE SCENARIOS:

Ms. Smith is an eighth grade homeroom teacher at the Y School. Ms. Smith is frustrated when her students have to leave their seats to get a pencil from the share table during instruction. Many of Ms. Smith's students are frustrated when their expressive arts teachers (especially the gym and art teachers) are absent. The class must remain in the homeroom and they feel as if they're missing the only opportunity they have during the day to experience movement and creativity. How might we use robotic technology to help Ms. Smith's students?

Time Frame: No less than 16 class periods or the equivalent of two ninety minute sessions per week for the minimum of a month. Teachers may opt to employ this unit during time allotted for Community Based Instruction; on the other hand, this unit may be completed during the designated social studies or science block times. Site visits may occur to other classrooms with the cooperation of other teachers.

Materials: These are only suggested robotic choices I have selected based on their ease of use by novices, affordability, and quality:
KIKO.893 Artificial Intelligence Robot Kit Item #: 3156304; Evolution Robot Kit Item #: 3155876; Cyber Robot Item #: 3155635; Mio Robot Kit Item #: 3155257; ReCon 6.0 Programmable Rover Item #: 3152603; Smart Bot Item #: 3155774.

Before Beginning the Lessons:
1. Secure Video and Photographic Consent release forms for every student involved in the project. (Be sure to get these releases completed for the students in the cooperating classes as well).
2. Select Rubrics from the Appendix and place in a binder (one per student). Set up the Excel Spreadsheet on your computer with student names. Be prepared to consistently record anecdotal notes regarding student participation, growth, and achievement. Have another or several FOL videotape and/or photograph each session. This will allow students to have visual content for their culminating slideshow or poster board presentations.
3. Gather all supplies for the robot construction and place in a plastic shoebox. If possible, secure multiple containers from a bargain store in order to secure and organize all robot parts.
4. Prepare sticky notes with the name of each part so students are able to identify and select the correct part during the construction process.

Suggestion: I strongly suggest you enlist the support of someone in your building who is comfortable using basic tools to construct an item. I carefully selected robotic kits that our many of our middle grades and secondary students can complete independently with adult supervision; nevertheless, since many FOL such as myself are more comfortable with instructional manipulatives versus hardware tools, I am enlisting the support of designated staff during lunch times as well as a volunteering college students. In exchange, I am offering an invite to a pizza party as well as a letter of commendation for volunteer service for the college student.

Student Friendly Objectives:
You will use the five step design thinking model in order to:
1. Design a solution for students in a classroom who need help with a problem you identify.
2. Role play as a robotics test engineer in order to see if your design solution helped the user.
3. Create and present a slideshow or poster board presentation that shares your design project from start to finish.

Directions:

<u>1.EMPATHIZE</u>:
Station One: FOL will take a site walk or visit classrooms to determine problems.

Station Two: Students rotate and complete simulations about what it is like experiencing the problem.

Station Three: Online
Students use internet to research the problem and what it is like to experience the problem.

2. DEFINE: Students will research, explore, and investigate to learn more about the problem identified in Step One.
The FOL needs to set up an additional site visit to the cooperating classroom or site to arrange for students to conduct more observations and interviews. Responses and observations should be recorded on site or immediately upon return to the classroom so students retain all of the information.
Station 1: Students discuss findings with the FOL.
Station 2: Students discuss findings with peers. They create illustrations with captions depicting what they saw and heard.
Station 3: Students will begin the second section of their slideshow using their school district gmail accounts and opening up Google slides. They can record notes about what they learned and experienced on the site visit.

Whole Group: FOL elicits students to share out on all the problems they learned about experienced by students in the cooperating classroom or site. After discussion and voting, students come to a decision about what challenge they will focus in on in the classroom or site and design a solution for.

3. IDEATE: Students will think of many different types of ideas about a solution for the problem and how their ideas will be used to help solve the problem for users. Please note that users are the people the students are creating a design solution for.

FOL will record student responses on chart paper using the following sentence starter:
Our robot could help solve the problem of ______________________________ by doing ____ or

How might we design or utilize a robot to solve a problem or create a solution for a problem experienced by students, staff, and/or visitors in our school community?
.

Each student should have multiple responses. At this point, the responses can range from realistic to outlandish. It's all about creativity and possibilities.

Station 1: FOL will showcase each robot in the box and discuss the features and what the robot can do in terms of helping to solve the problem.

Station 2: Students can research uses of robots that are used to solve different types of problems by performing services or actions using YouTube videos and the Google search engine.

Station 3: Students will begin the third section of their slideshow using their school district gmail accounts and opening up Google slides. They can record notes about the ideas they generated as well as information about the robots currently used to solve problems.

4. PROTOTYPE: Students will make illustrations and/or models of their ideas.

Station 1: Students begin construction of robots with FOL (and any other supporting adults as suggested earlier in this unit). FOL may want to break down tasks acccording to complexity level and intentionally place students in groups that match their ability levels.

Station 2: Students will illustrate and write a description of the 3D robot they selected.

Station 3: Students will begin the fourth section of their slideshow using their school district gmail accounts and opening up Google slides. They can include notes and illustrations about the robot they selected as well as why they elected the robot.

5.TESTING: Students will share the design solution with users and test the solution out with the users. They collect data on the effectiveness of the solution and even get feedback from the users about the effectiveness of the solution and ways to make it better.

The FOL will set up another or ideally multiple site visits in order to for students in role of RTE to test out the effectiveness of the robotics design solution. Students will record their observations regarding the effectiveness of the design solution. In this option, student RTE will also elicit feedback about the design solution from users through conversations and interviews.

Station 1: FOL will work with students in order to discuss outcomes from testing phase and record those on chart paper.

Station 2: Students will record what they learned about robots as well as what they learned from the site visit.

Station 3: Students will begin the final section of their slideshow using their school district gmail accounts and opening up Google slides. They can include notes and illustrations about the results of the testing phase.

Assessment:
Have Students complete the Project Form (See Appendix)
Have students complete a slide show illustrating each stage of the design thinking process.
FOL will complete the results on rubrics using the modifications you make to those listed in the Appendix as well as the FOL Rubric provided in the Appendix.
Invite service providers such as the Speech Therapist to include any data on the Interpersonal Communications rubric in the Appendix
Students will complete self-evaluations using the Student Rubric provided in the Appendix.

ASSESSMENT TOOLS (See Appendix):
FOL are expected to modify these rubrics and assessment tools according to the individualized needs of you and your students. I've already provided modified samples of resources I've found online; however, modifications need not be the same for every group of students. Students need to understand "perfection" is not the goal but rather the ability to "try different solutions and make adjustments" as needed. Mistakes should be seen as valuable and part of the learning/designing process.

Sample Skills from Domains used in Life Skills Curriculum:
1.Interpersonal Communications: (include speech service providers if applicable in the evaluation of student) Verbal communication of ideas and/or information
2.Functional Academics (reading of instructional manuals, measuring, hypothesizing
3. Vocational: Following multi-step directions in the context of a real -world authentic scenario.

POST-EVALUATIVE CRITERIA:
1. Are my students able to distinguish between: a toy and a robot; a machine and a robot; a computer and a robot?
2. Are my students able to employ basic code in order to program a robot according to written and/or verbal directions?
3. Did my students design a solution for a “real world” need by designing or creating a robot to meet that need according to the design thinking process?

Sources

Berry, C. A. (2016, June). Robotics For All Ages: A Standard Robotics Curriculum for K-16. *IEEE Robotics & Automation Magazine*, 40-46.

Brown, A. S. (2018, February). Face To Face With Autism. *Mechanical Engineering*, 35-40.

Francis, K. & Poscente, M. (2017). Building number sense with Lego Robots. *Teaching Children Mathematics*, *23*(5), 310-312. doi:10.5951/teacchilmath.23.5.0310"

Herold, B. (2017, June 15). Poor Students Face Digital Divide in How Teachers Learn to Use Tech. *Education Week*, *36*(35). Retrieved April 20, 2018 from https://www.edweek.org/ew/articles/2017/06/14/poor-students-face-digital-divide-in-teacher-technology-training.html

Interactive Robotic Social Mediators as Companions. (2010). *Guidelines For Using Robots In Education and Play Therapy Sessions For Children With Disabilities.* Originator: AOSTA.

Iosa, M., Morone, G., Cherubini, A. et al. Journal of. Medical Biological. Engineering. (2016) 36: 1. https://doi.org/10.1007/s40846-016-0115-2

Lawton, J. (2016,Sep-Oct) Collaborative robots:The next frontier of manufacturing *In-Tech Magazine*,. Retrieved from https://searchenterpriseai.techtarget.com/ definition/ android-humanoid-robot

Post, P., Howell, R., & Rakocy, L. (1988, January). Robot technology:Implications for education. *Educational Technology*, 39-45.

Resnick, M., Maloney, J., Monroy-Hernandez, A., Rusk, N. , Eastmond, E. , Brennan, K., Millner, A., Rosenbaum, E., silver, J., Silverman, B., Kafai, Y. (2009). Scratch: Programming For All. Communication of the ACM, 52(11), 62-67. doi:10.1145/1592761.1592779.

Rouse, M. Re: Androids:Academic Integrity [Online Post] Retrieved fom https://searchenterpriseai.techtarget.com/definition/android-humanoid-robot

Šabanović, S. Int J of Soc Robotics (2010) 2: 439. https://doi.org/10.1007/s12369-010-0066-7

Sayyu, C. T. (2013, August). Types of Robot [Random Stories and Thoughts]. Retrieved from http://ct-sayyu.blogspot.com/2013/08/types-of-robot.html

Slavin, T.: Coding with the Sphero SPRK Edition Robot." *Beanz,*. Retrieved from https://www.kidscodecs.com/coding-with-the-sphero-sprk-edition-robot/

Soft Robots Run on Vacuum Power. (n.d.).Chemical Engineering Progress News, 113(10), 10–12. Retrieved from https:// www. Aiche.org/ search/site /Soft%20Robots%20run% 20on%20vacuum%20power

Annotated Bibliography

Compete 360.org.
Compete 360 is described as:
"Compete 360 fosters a design thinking (DT) practice in city schools by training teachers and by facilitating student-led projects that address a problem in the classroom, school, or community. Compete 360 also hosts the DT Philly Challenge (grades 6-12) and the DT Philly Showcase (grades K-5), where students share their projects with professionals from the design and business communities (http://compete360.org/compete-360)."
Visiting the Middle and High School Teams link is a starting place to see how design thinking projects are created and implemented. Follow these steps:
1.Type Compete 360 in your browser
2. Click About link and read all sctions
3. Click DT Philly Challenge: Visit each sub-link titled Teams and LeaderBoard under High School then Middle School Divisions (you can also vist 3-5 and K-2 as well).
4. You will see team names. Click each team name to learn about how each participating school employed the design thinking (DT) process.
5. Click Get Involved if you are interested in getting your class involved in this type of 21st century learning experience. If you are an AS or Life Skills FOL, please do not let

that be a barrier. For the past four years, my middle grades class has successfully particpated in this meaningful experience. Thomas Edison has a Life Skills class that also participated **successfully. Our students are creative and innovative. They can engage with General Education peers in competetive and/or educational events.** Another excellent prerequisite FOL resource is http://www.spencerauthor.com/design-thinking/ This site offers a comprehensive overview of DT as a process and free introductory projects and materials.

Green, D.. (2012). *Technology: A Byte Sized World.* New York, NY: Kingfisher.
This book contains vocabulary and jargon typically used in the field of technology; however, it is written using sometimes humorous and witty descriptions after it offers a very novice friendly defionition of complex terms.

McComb, G. (nd). *Build Your First Robot*. Retrieved from https://www.popularmechanics.com/technology/robots/a7388/build-your-first-robot/

This is an engaging, detailed yet not overly complex task-analyzed step by step article complete with colorful photographs which allows a reader to learn the process of what is involved in building a robot. It is suitable for both the FOL as well as the students.

Sayyu, C. T. (2013, August). Types of Robot [Random Stories and Thoughts]. Retrieved from http://ct-sayyu.blogspot.com/2013/08/types-of-robot.html

A blog written by a student. This will serve as a representation of what a Station Two or Three project can look like as well as an child friendly informational resource about types of robots. It includes photographs of the types of robots as well with clearly written descriptive summaries.

SimpleK12.com: This professional development platform offers technology integration training and resources including computer programming for educators from basic to advanced. The cost may be written off on income taxes as well; however, SimpleK12 also offers at least three to five free trainings to educators weekly. Teachers may subscribe via email in order to receive free offers for online professional development.

Sprouts. 2017, October 23. *The Design Thinking Process.* Retrieved from https://www.youtube.com/watch?v=_r0VX-aU_T8

This is a student a well as adult friendly video which teaches about th design thinking process using animation.

Thangavel, P. [Avid Robotics Learner](2017, November 8). What-is-the-difference-between-a-machine-and-a-robot. Message posted to https://www.quora.com/What-is-the-difference-between-a-machine-and-a-robot

This is a student a well as adult friendly video which teaches about the difference between a robot and a machine. It is jargon free.

https://dschool-old.stanford.edu/groups/k12/wiki/e04cb/HFLI_Rubric.htm
This site offers rubrics which may be modified as needed by the FOL.

https://www.apple.com/education/curriculum/
Apple Teacher is a free, self-paced professional learning program. Build skills on iPad and Mac that directly apply to activities with your students, and earn recognition for what you learn.

https://www.apple.com/retail/fieldtrip/
This is the Community Outing rebooted. Please contact me for ideas on suggested relevant IEP goals. Take your students or fellow teachers on an Apple Field Trip for an unforgettable learning experience. During the hands-on session, your group will take their imaginations to new heights using Apple products. And the work they create can complement existing classroom projects.

The following are card game activities that will serve as a way to prepare students for a rich and meaningful design thinking experience using scenarios, mini-design challenges, and skill based activities:

1. Ready, Set, Design: PublisherHewitt;
2. The Extraordinaire-PublisherCreativity Hub;
3. Maker Ed Card Game- Created by Jackie Gerstein

Appendices: Teaching Materials

Appendix A

ROBOTS IN AS EDUCATION STUDENT SELF-ASSESSMENT & DOCUMENTATION SHEET

STUDENT OR STUDENT TEAM NAME:

PROJECT NAME:

ROBOT ORIGINAL NAME:

ROBOT'S RENAME

PROJECT GOAL:

PROJECT OUTCOME:

PROBLEMS AND CHALLENGES:

WHAT I (WE) MIGHT DO DIFFERENTLY NEXT TIME:

SKILLS I LEARNED, SHARED, AND/OR COMPLETED TO COMPLETE THIS PROJECT:

HOW THESE SKILLS CAN HELP ME GET IN THE HIGH SCHOOL OF MY CHOICE OR IN A CAREER:

MY CULMINATING PROJECT IS:

A GOOGLE SLIDE SHOW

PROJECT POSTERBOARD

SLIDE SHOW WITH VERBAL PRESENTATION

COMPLETED

IN PROGESS

Appendix B

Collaboration/Interpersonal Communication Skills: It is left to individual FOL teams to determine what collaboration looks like for each group of students according to IEP objectives and consultation with the Speech Therapist

4	**Exceeds Expectation as demonstrated by engaging in…...**
3	**Meets Expectation as demonstrated by**
2	**Approaches Expectation as demonstrated by**
1	**Needs improvement as demonstrated bya need to….**

Appendix C

"The following rubrics are excerpts from user -friendly and easily modifiable documents available through the Foundations of Innovation course taught to all new 9th grade students in Henry Ford Academy network schools. They may be used to evaluate student growth and achievement for the project based learning design thinking lessons. The Excel Scoring Sheet * is by far the most simplified yet comprehensive document. I suggest each FOL share with the students in order to allow them to self-monitor. Please visit the website in order to find these rubrics and assessment tools and modify them according to your specifications Source: (https://dschool-old.stanford.edu/groups/k12/wiki/e04cb/HFLI_Rubric.html)."

Rubrics

Fondations_Of_Innovations_Teacher Guide v2.0 & Skill Grid.pdf

Design Thinking Basic Rubric 1.0

design thinking basic rubric 1 point 0.docx

dt basic rubric 1 point 0.ppt

dt basic rubric 1 point 0.pdf

Design Thinking Basic Summative Rubric 1.0

dt summative 1 dot 0.ppt

Excel Scoring Sheet*

dt summative 1 dot 0.xlsx

Design Thinking Skills

dt br 1 dot 0 skills.ppt

Concepts and Skills FOI.pdf

Appendix D

FOL Rubric

Level 0: No participation

Level 1: Minimal attempt is made. Student(s) engaged in 1/5 parts of the DT process.

Level 2: Partial attempts are made. Student(s) engaged in 2/5 parts of the DT processes.

Level 3: Attempts are made. Student(s) engaged in 3/5 parts of the DT processes.

Level 4: Meaningful attempts are made. Student(s) engaged in 4/5 parts of the DT process.

Level 5: Exemplary attempts are made in that the student(s) engaged in 5/5 parts of the DT process.

Appendix E

Student Rubric

Level 0: I did not participate at all.

Level 1: I made a minimal attempt. I engaged in 1/5 parts of the DT process.

Level 2: I made a partial attempts. I engaged in 2/5 parts of the DT processes.

Level 3: I made some attempts. I engaged in 3/5 parts of the DT processes.

Level 4: I made meaningful progress. I engaged in 4/5 parts of the DT process.

Level 5: I made exemplary progress because I engaged in 5/5 parts of the DT process.

Appendix: Content Standards

I have included the PA Alternate Eligible Content standards as they are appropriate indicators used to assess what students with disabilities should know and be able to do.

S8.A.2.1 Apply knowledge of scientific investigation or technological design in different contexts to make inferences to solve problems.
S8.A.2.1.5 Use evidence from investigations to clearly communicate and support conclusions.
S8.A2.1.6 Identify a design flaw in a simple technological system and devise possible working solutions.
S8.A.2.2 Apply appropriate instruments for a specific purpose and describe the information the instrument can provide.
S8.A.2.2.3 Describe ways technology ... extends and enhances human abilities for specific purposes.

ISTE STANDARDS FOR STUDENTS AND TEACHERS
Since this unit presumes that the FOL may be a novice in technology based education such as myself, I have also included the standards for FOL as well.

Students
1
Empowered Learner
Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences.
1c
Students use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.
1d
Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

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.
4a

Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.

4b

Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

4c

Students develop, test and refine prototypes as part of a cyclical design process.

4d

Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.

6

Creative Communicator

Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals.

6a

Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.

6b

Students create original works or responsibly repurpose or remix digital resources into new creations.

6c

Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

6d

Students publish or present content that customizes the message and medium for their intended audiences.

7

Global Collaborator

Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.

7a

Students use digital tools to connect with learners from a variety of backgrounds and cultures, engaging with them in ways that broaden mutual understanding and learning.

7b

Students use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints.

7c

Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.

7d

Students explore local and global issues and use collaborative technologies to work with others to investigate solutions.

Facilitator

Educators facilitate learning with technology to support student achievement of the ISTE Standards for Students. Educators:

6a

Foster a culture where students take ownership of their learning goals and outcomes in both independent and group settings.

6b

Manage the use of technology and student learning strategies in digital platforms, virtual environments, hands-on makerspaces or in the field.

6c

Create learning opportunities that challenge students to use a design process and computational thinking to innovate and solve problems.

6d

Model and nurture creativity and creative expression to communicate ideas, knowledge or connections.