TEACHER QUEST TAMPA BAY PROGRAM

ACTION PLAN

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Summer Work Experience

While working at Sun Hydraulics I learned a variety of ways that engineers are stretching their capabilities and skills to be successful. I worked with the automation team on troubleshooting a variety of automated/robotic machines that assemble, create and test hydraulic components such as solenoids and valves. The test stations are completely designed, built and programmed by the engineers. I was able to help troubleshoot a robotic welding station and a solenoid test bed that was having problems with the flow of its hydraulic fluid. I also was responsible for running two of the robotic assembly machines that assembled o-rings onto a variety of valve products.

The first step to being successful at Sun Hydraulics is to understand the product and company culture. Any new employee goes through a 2-3 month tour, as they call it, where they visit and work with every department in the company, from the receptionist to the engineers. My first few days were spent on the production floor doing assembly work on check valves. These valves would eventually be put into a manifold block that was being made on the other side of the factory where I was working. The customer who ordered them may be using it to build a new hydraulic machine, a tractor, or robot. I was surprised to learn at how many machines use hydraulic systems, as my knowledge was limited prior to working at Sun.

My next stage of short employment was working directly with the automation engineers. Their jobs are to build machines that build and test a variety of products that are made at Sun Hydraulics. The most useful way a robot is used in the manufacturing process is to do those jobs that are repetitive and tedious. All of the robots that they build do such tasks as welding, assembly, laser engraving, testing, drilling and cutting. My last phase of work was to maintain two of the robotic assembly machines. The machines required constant troubleshooting as each error popped up on the screen. Since the machines were using flexible and movable parts this

happened more often than I had expected. Each problem that occurred allowed me to get more familiar with all of the components of the machines. The system is amazing using simple things like springs and gears but more complex features like rotating robotic arms, air tubes, conveyor belts, lasers, digital camera and the programming that runs the entire robotic machine. All of the machines work together to create a quick and efficient assembly process.

The skills and knowledge that are needed to be functional and competent as an automation engineer are amazing. I was surprised by the fact that the two people I worked with had a diverse background. One had a traditional degree from a four year university in computer programming and the other had a two year degree from a community college in automation technology. However their academic careers only scratched the surface of their knowledge. Each had a variety of skills and knowledge that they had picked up during their previous work experiences. Engineers at Sun Hydraulics have a large skill base that they are encouraged to exploit to create, explore and grow the companies' capabilities. My students will benefit greatly from my new outlook on what capabilities an engineer truly needs to have in order to be successful. I will also be able to look at many of my current projects and problems to see where they can be expanded to encourage students to look beyond the single topic or idea at hand connect that learning to other areas of study.

Lesson Plan

Objectives

Students will build, test and experiment with a hydraulic robot, to explore the four axis of the robots movement. They will work to use the robot to solve a variety of real world scenarios. They will design, test and collect data on the system that they create.

Sunshine State Standards (ITEA Standards)

Standard 1: Students will develop an understanding of the characteristics and scope of technology.
Standard 2: Students will develop an understanding of the core concepts of technology.
Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.
Standard 9: Students will develop an understanding of engineering design.
Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
Standard 19: Students will develop an understanding of and be able to select and use manufacturing technologies.

Materials

T-Bot II Hydraulic Arm, Lego's, rulers, pencils, protractor, cool melt hot glue guns, screwdrivers, wood glue, scissors and student worksheets.

Instructional Procedures

Students will work in groups of 2-3 students to first assemble their t-bot robot. When assembled they will work to discover its range of motion for all of its axis. The area in which a robot can perform work is called the work envelope. The T-Bot II has a work envelope that is shaped similar to one quarter of a globe.

Locate the T-Bot II's four different axes of motion. An axis is the point at which a body or a part rotates. The T-Bot II moves in four axes of motion:

- Axis 1 – where the swivel base connects to the platform
- Axis 2 – where the mid-arm connects to the swivel base
- Axis 3 – where the mid-arm connects to the forearm
- Axis 4 – where the end effectors (grippers) connects to the forearm

Determine the range of motion of the swivel base. The formula for figuring arc length is: Arc Length = Radius x Radians. Radians = Degree Measurement x (p/180). Repeat these steps for the mid-arm, the forearm, and the grippers. Record all measurements and determine the arc length for each.

After the range of motion is determined and students fully understand the capabilities of their robot arm they will choose a real world scenario that will require them to build additional machines using Lego components to solve their chosen problem.

Integration of Summer Work Experience/Follow-up Activities

This activity will be a direct correlation with the work I have completed this summer. The robotic equipment that I worked with and components I built during my summer employment period used hydraulics as the mechanical moving source.

Assessment Instrument

Student worksheets will be analyzed for completeness and a rubric will be used to assess the solving of the real world problem by looking at various components such as effectiveness of the solution, team work, completing design requirements and function during demonstration.