

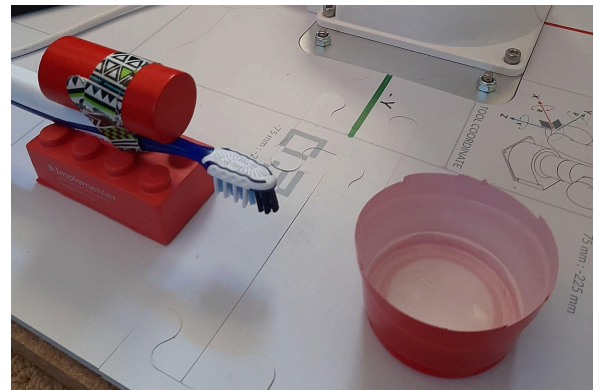
Robot Dentistry

Teacher Tips

The lesson challenge will have students using a pencil attached to a red, wooden cylinder to be used as a dental pick, a toothbrush also attached to a red, wooden cylinder, and a set of cardboard teeth in a bowl mold. For the example solution code, the bowl used is approximately 8.5 cm tall, and the teeth are approximately 13 cm tall. You can choose to have students make their own teeth (instructions in the Explain section) or you can provide the teeth for them. Below are examples of these items, as well as the block used to elevate the toothbrush.



Example Pick Device



Example Toothbrush and Fluoride Cup

Example Cardboard Teeth



Vocabulary

Dentistry- the treatment of diseases and other conditions that affect the teeth and gums, especially the repair and extraction of teeth and the insertion of artificial ones.

Dental Cleaning - the removal of bacteria, plaque, and tartar buildup from the tooth surfaces. It may also include other preventive services, including sealants and fluoride treatments.

Job Outlook - the likelihood that the selected occupation will be available and hiring in the future

Lesson Plan 4: Robot Dentistry

Direct Instruction

Engage with High-Tech Teeth Cleaning!

Start the Engage section by presenting the students with the lesson challenge. Tell students:

"For this challenge, you will assume the role of Dental Robotics Engineers at ORA Mechatronics. Jackson Dental, a local dental office, has hired your team to investigate the feasibility of using ORA as a Robotic Dental Assistant. If you can successfully program ORA to clean teeth, Jackson Dental is willing to invest in ORA Mechatronics for future dental endeavors!

Have the students spend a few minutes thinking about their dental experiences and answering the questions in the Engage section of the Student Activity Sheet. Then tell the students:

"Before we can solve this challenge, we need to learn more about robotic arms in dentistry and the careers related to them!"

Next, show the Lesson 4 video.

Explore Dental Hygienist Career Connections

Students will do a brief guided virtual scavenger hunt related to the Dental Hygienist career connection. Individually or in small groups, have them complete the Explore section on the Student Activity Sheet. If students are struggling with the job outlook section, have them go to the [US Department of Labor and Statistics Occupational Outlook Handbook](#). In this tool, you can find information about thousands of jobs. On the Index page, search for your career (Use Ctrl+F on a Windows machine or Chromebook). When you click on the career of your choice, there is a short video about the career as well as several key pieces of information.

Explain the uses of robotic arms in dentistry.

Start the Explain section by asking the students, "How are robotic arms used in dentistry?" Students should be able to recall from the video different aspects of dentistry, such as implanting crowns and bridges, assisting in surgeries, or even performing cleanings.

As discussed in the video, dental robotics is a relatively new area of medical applications of robotic arms. This means that this technology is not as widely available and may take several years until your local dental office adopts the use of robotic arms. These things take time, training, and money.



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In areas where dental robotic arms are in use, it has reduced the time that dental procedures take, which means more people can be served in the same amount of time.

Ask the students, "The last time you had a dental cleaning, what did the dentist or dental hygienist do during the cleaning?" Students will likely mention picks or other tools scraping at plaque/tartar/calculus, jets of water, the suction tool, polishing, flossing, etc. Let the students know that in this lesson, we are going to focus on removing the plaque buildup and brushing on the fluoride treatment.

For the plaque buildup, students will need to create a set of cardboard teeth. To create the teeth, get a piece of cardboard, approximately 12x4 inches, and cut slits about every half inch extending about one inch into the cardboard (see image, right).



Then, students will take little balls of play-doh and embed them around a few of the teeth. Do not let them forget that their teeth have fronts and backs and that they should add plaque buildup on the back of the teeth, too!

Finally, students can bend their cardboard around to give it the shape of a lower mandible. A bowl was used for the demo picture, but weighing down the bowl or taping the teeth in a curved shape to hold the teeth in place.

Elaborate: The ORA Pain-Free Dental Cleaning!

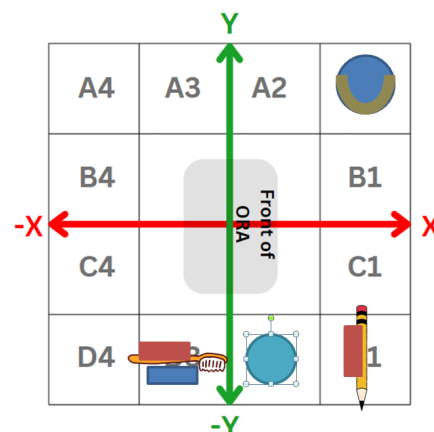
In this challenge, students will program ORA to perform a routine dental cleaning on a set of cardboard 'teeth.' This cleaning will involve removing built-up deposits on the teeth and then applying a fluoride treatment with a toothbrush.

Setup:

Have students place their cardboard teeth (secured to the table with tape or weights) in A1 and/or B1. Place the pencil/cleaning pick in D1, the 'fluoride cup' in D2 [empty], and the toothbrush in D3.

Task Requirements:

1. ORA must start in the initial position.
2. ORA must use the finger grippers to pick up the pencil by the attached red cylinder and use the pencil to remove plaque buildup from the teeth.



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3. After the teeth are cleaned, the pick will be replaced in D1.
4. The toothbrush will be picked up, dipped in the fluoride cup, and then used to brush the teeth.
5. After the teeth are treated with fluoride, place the brush back in D3.
6. ORA must finish in the Initial Position.

Direct students to plan this code in the Elaborate section of their Student Activity Sheet. After writing the pseudocode and drawing the code blocks, direct students to create the code on their devices in the Ozobot Editor. Ensure students are connected to your shared workspace.

As students complete their code, they will test their code. Click on a given student's or student group's tab on the Ozobot Editor. Click "Run" to execute their code. Reset the materials between each code run. Remember to follow the Safety Protocol established in ORA Essentials. [Example solution code](#).

If students are waiting for the ORA, they could:

- Complete the Evaluate section of the Activity Sheets.

Elaborate: Example solution

1. Setup

- a. Right is an image of the setup for the lesson challenge.

2. Designed Materials

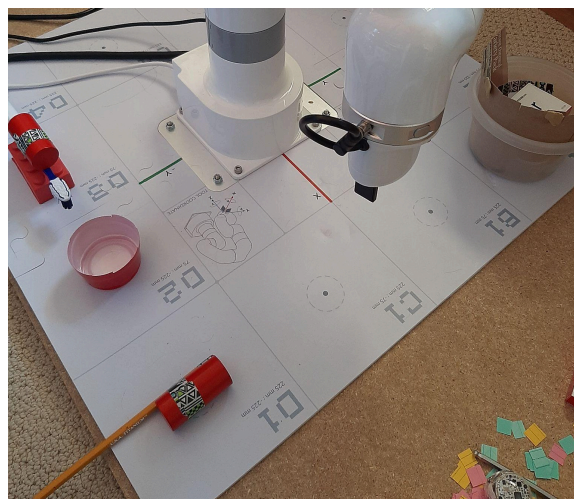
- a. For this challenge, the teacher has the option to have students create their own cardboard set of teeth (see the Explain section); otherwise, a teacher-created set of teeth can be provided.

3. Sample Code

- a. [Example Solution Code](#)

4. Code Description

- a. The code begins when ORA moves to pick up the Pick in D1. The pick is rotated and used to remove plaque/play-doh on the teeth. Then, the pick is set back in D1. ORA moves to D3 and picks up the brush. The brush is then dipped into the 'fluoride solution' in the cup in D2 and then moves to A1 to apply the fluoride treatment.



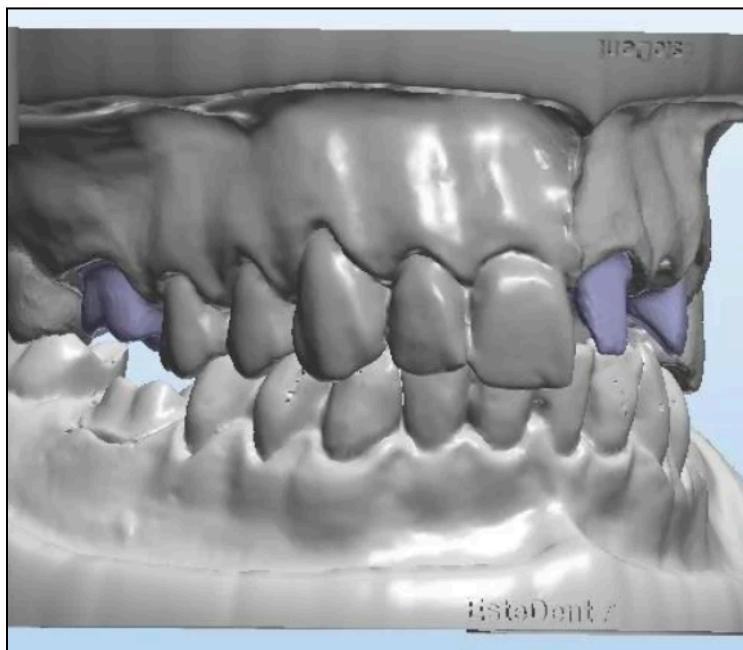
Evaluate: Exit Ticket

Students will fill out and submit their Exit Tickets (The last page of the Student Activity Sheet).

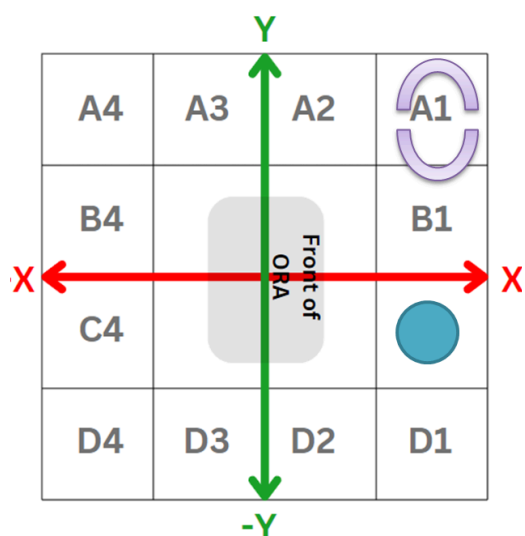
Lesson Plan 4: Robot Dentistry

Optional Extension: Robotic Arm Dental Extraction

In this activity, students will use ORA to perform an extraction on a [model set of teeth](#)! ORA's finger grippers are too clumsy to pull individual teeth. You also must find a way to attach [a set of pliers](#) to ORA's finger gripper to perform the extractions. Use existing pliers or design and 3D print your own smaller, more precise fingers.



Source: Thingiverse Creator Antowka



Setup: 3D print the above dental set and small pliers. Place the dental set, teeth up, in A1/B1. Place a cup in C1.

Task Requirements:

1. Students must devise a way to attach the pliers to ORA's finger grippers.
2. ORA must start in the initial position.
3. ORA must use the pliers to precisely extract ONLY the indicated teeth to pull.
4. ORA must place extracted teeth in the cup in C1.
5. ORA must finish in the Initial Position.