

Assignment 5: Communicate a scientific concept to a special-needs learner

Learning disability

Autism spectrum disorder (ASD) encompasses a myriad of developmental disabilities that challenge an individual's communication, social, and behavioral skills (CDC). ASD includes conditions such as Asperger syndrome, pervasive developmental disorder-not otherwise specified (PDD-NOS), and autistic disorder. While ASD affects each individual differently, from mild to severe, many individuals may repeat certain behaviors and have unique ways of learning and reacting to things. Some may have sensitivities to light, noise, or touch. Some may want to be alone or avoid eye contact. Some may have difficulty understanding feelings or have trouble expressing their needs. And some may be interested in people, but not know how to relate to them. People with ASD impose special learning needs because individuals may have a hard time paying attention, communicating their thoughts, and understanding perspectives. Some may also have difficulty seeing the 'big picture' of concepts because they get lost in synthesizing details. Individuals with ASD may need more attention and time to ensure that they comprehend the information that is presented to them.

According to the CDC, autism currently affects 1 in 54 children in the United States (2021). While there is no cure for ASD, there are programs that could help individuals improve their social skills. Individuals with ASD can engage in these services; however, our society needs to understand that people with this disability are normal and educational institutions need to accommodate their needs so that this group is not left out in academia. Because of the variety in which ASD may affect individuals, there are various ways we, as science communicators, can adapt our teaching methods to include this group.

Scientific concept

Climate change refers to the changes in global temperatures, precipitation, wind patterns, and other climate parameters over several decades or longer. Earth's climate is constantly changing from cold to warm states; however, humans are perpetrating a rapid and intense global warming that has never been seen before. The effects of climate change are affecting people in various ways, and how we handle the increase in global temperatures will be observed in the years to come.

Anthropogenic climate change refers to the overall trend in warming global temperatures, due to excess human inputs of greenhouse gases. The science behind increasing temperatures due to the increase in fossil fuel emissions can be explained by the greenhouse effect. The greenhouse effect is a process in which greenhouse gases, such as carbon dioxide, methane, and nitrous oxide, in the atmosphere trap the sun's heat (NASA,). This is what helps maintain the Earth's temperature. During the day, the sun's radiation enters Earth's atmosphere to keep the surface warm. At nighttime, some of the heat escapes back out to space and some is trapped by the greenhouse gases to keep Earth warm. Since the industrial revolution, humans have altered Earth's natural greenhouse effect by burning fossil fuels and emitting more greenhouse gases into our atmosphere. This process is creating a feedback loop in which our climate is going to continue trapping more heat and increase Earth's temperatures unless we limit the amount of fossil fuels emitted.

An individual with ASD may have trouble understanding the overarching concept of the world warming, as a result of excess greenhouse gases. The learner may be fixated on the idea that humans are emitting fossil fuels or that the sun is emitting radiation. This learner may also

have a short attention span and get distracted, so a teacher must develop an interactive visual to focus the learner.

Learning strategy and method

Overcoming the learner's limitations include using visual aids, repetition of phrases, and interactive visuals. Because a student with ASD may have a short attention span, have difficulty understanding larger concepts, and have sensitivities to overstimulating things, the lesson plan described below incorporates a video about the greenhouse effect and an interactive workbook that students can play with while the teacher explains each cutout piece. Having both modes of teaching maintain the student's attention and accommodates a student that may be better at learning one way or the other. Repetition of ideas is also crucial in teaching students with ASD, so having two activities will help reiterate concepts and help the student better understand the greenhouse effect. During this activity, the student will watch the video first and then play with the cutout pieces in the workbook. The video is an engaging visual that could help the student familiarize themselves with discussing the world we live in. The workbook will have repeating cutout pieces, which will allow the student to familiarize themselves with the Earth, sun, heat arrows, atmosphere, and greenhouse gas molecules. This will allow the student to focus their attention to each piece at a time, since the student may be detail-oriented. The student will match the cutout pieces to the page's image, which will help them recreate the image.

To ensure that the student understands the larger picture of the greenhouse effect warming the earth, the teacher will ask the student questions like "will more greenhouse gases make the earth warmer or cooler?" Before moving on to each page, the teacher should summarize what was learned on the current page. To measure the learning outcomes of this lesson plan, we can test the individual to recreate the pages of the workbook and have them explain the greenhouse effect by themselves, if they can formulate words. If they can't we can simply have them recreate the pages in the workbook.

There are no safety concerns with this lesson plan. Ensuring that the teacher has a soothing voice, no loud sounds or lights, and no distracting objects in the room is crucial for teaching this individual. Below is the described lesson plan.

Lesson Plan

To teach a high school student with medium-to-severe ASD about the greenhouse effect and climate change, the teacher must have access to a computer with audio and the workbook. On the computer, the teacher will show a video about the greenhouse effect and the workbook will have cutouts with Velcro for students to play with. A combination of the video and workbook activity will be necessary for following this lesson plan. Switching teaching modes will help keep the student's attention and accommodate their learning preferences of visual learning and repetition. The teacher must avoid distracting objects or sensory overload, use concrete and simplified language, mimic gestures, and repeat phrases when necessary. They must follow the lesson plan in chronological order and make sure to acknowledge the student when they do something correct!

1. Make a connection with the student by allowing them to be familiar with you and your voice. Engage with them to see what their interests are and to gauge what their learning needs are. Once identified, try to catch their attention and introduce the topic by saying the following phrase: "Today, we will be learning about the greenhouse effect."

2. Introduce the student to the topic by showing this Climate kids video:
 - a. <https://climatekids.nasa.gov/greenhouse-effect/>
3. Workbook Activity:
 - a. Take out the workbook and open to page 1. Take out the cutouts of the Earth, sun, and shining heat arrows one at a time. Introduce each piece to the student by repeating the names and holding it. If the student can formulate words, have them repeat the word. As you go through each cutout piece, have the student match the cutout with the Velcro pieces on the page to create an image of the earth receiving light from the sun. Tell them that the sun's sunshine makes Earth warm, similar to how they feel warm when they are exposed to the sun. The teacher can do a gesture that indicates the feeling of heat, such as using a fan as a hand to indicate that it's hot.
 - b. Turn to page 2 and pull out the cut outs of the Earth, moon, and heat arrows. Introduce each piece and have the student stick the item on the page. Explain to the student that at night, the Earth releases the heat into space to make it colder. Here, the teacher can cross their arms on their chest and do a burr gesture to indicate that it's cold.
 - c. Turn to page 3 and pull out the cut outs of the Earth, atmosphere, sun, and short heat arrows. Introduce the atmosphere and demonstrate that the atmosphere traps the heat on the surface of the Earth warm. The teacher can do this by showing that some of the heat arrows escape and some get re-emitted back to Earth to maintain heat.
 - d. Turn to page 4 and pull out the atmosphere and greenhouse gas molecules. Introduce the name of the provided greenhouse gas molecules: carbon dioxide, methane, and nitrous oxide. Have the student place the atmosphere onto the picture of Earth and have them stick the greenhouse gas molecules onto earth's atmosphere. Explain that the atmosphere has gases that help trap heat by placing the heat arrows in the image. Give the student more gas molecules to lay on and tell them that the more gases you have, the hotter the Earth gets. Additionally, each greenhouse gas is different and can trap more heat than others. Tell the student to take out gas molecules and some heat arrows. Explain that because there are less greenhouse gases to trap heat, the earth gets cooler.
 - e. Turn to page 5 and pull out the greenhouse gas molecules and car with smoke coming out of it. The page will also have a landscape image of a car driving with smoke coming out of it to indicate pollution. Have the student match the cutout with the page and then add more gas molecules around the car. Ask them whether they think this makes the Earth warmer or cooler?
 - f. Turn to page 6, which shows an image of the Earth with a lot of molecules trapped in the atmosphere and sun heat arrows entering. Tell the student that the Earth has a lot of greenhouse gases that are in the atmosphere. Take out more heat arrows and place some to show heat escaping into space and some getting re-emitted back into Earth because of the gas molecules blocking them from leaving. Explain that the gas molecules are trapping the heat and warming up the Earth. This is the greenhouse escape.
 - g. Reiterate that a lot of cars releasing greenhouse gas molecules are making heat harder to escape the atmosphere, thus, warming the Earth. If the student can

formulate words, ask them if they can explain the greenhouse effect. If not, have them redo page 6 while explaining the pieces.

- h. Congratulate the student for finishing!

Reflections

This assignment has challenged me to learn new ways of reaching all types of learners by encouraging me to devise a teaching strategy for disabled students. The lesson of patience, breaking ideas down, and simplifying concepts were emphasized through this exercise. To accommodate for a student with ASD, I created a workbook to allow the student to visualize and interact with the material. I believe that the skills learned for students with disabilities could be translated to teaching younger students too. The difference, though, is that children may have an easier time comprehending the material than students with ASD because they do not get as distracted and/or can communicate their thoughts better. As I continue improving my science communication skills, I will carry the knowledge of breaking ideas down and adapting to audiences so that more people are included in the scientific community.

Citations

Center for Disease Control (CDC). (2021, January 12). Autism spectrum disorder (asd).

Retrieved February 19, 2021, from <https://www.cdc.gov/ncbddd/autism/index.html>.

National Aeronautics and Space Administration (NASA). (n.d.). What is the greenhouse effect?

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