The World Around Us: Physical and Chemical Changes

Erica Carpenter
Old Dominion University

Follow this and additional works at: https://digitalcommons.odu.edu/inclusivestrategies

Part of the Curriculum and Instruction Commons, Science and Mathematics Education Commons, and the Secondary Education Commons

Repository Citation
https://digitalcommons.odu.edu/inclusivestrategies/3

This Chapter is brought to you for free and open access by the Sciences at ODU Digital Commons. It has been accepted for inclusion in Inclusive Strategies for Teaching Secondary Mathematics and Science by an authorized administrator of ODU Digital Commons. For more information, please contact digitalcommons@odu.edu.
By Erica Carpenter

**ABSTRACT**
The following article describes a lesson that provides students with a better understanding of the world around them. Specifically, the students investigate real-life examples to expand their learning about physical and chemical changes. This lesson is appropriate for middle school students. Within the lesson, the teacher provides readers with resources and activities that can be used to cultivate a culturally relevant pedagogy. Students are provided with a variety of activities to spark their interest in science.

**INTRODUCTION**
Incorporating a culturally conscious learning environment engages students and promotes respect and understanding among diverse individuals. The idea of diversity and a diverse classroom starts by having individuals from diverse backgrounds (Goethe & Colina, 2018). Educators should then be able to use the different perspectives to facilitate instruction. The idea of culturally relevant pedagogy is used by teachers to incorporate the students’ experiences and connect those experiences to the material that students will be learning (Goethe & Colina, 2018). Throughout the lesson described below, the teacher incorporated the general interests and/or cultures of students. Students are more likely to be engaged with the content that a teacher is presenting when the teacher includes the student’s general interests and cultures.

By focusing on a teaching approach that looks at accommodating the needs and abilities of all learners, the teacher can provide a classroom for all students. This approach is the universal design for learning. One of the main aspects of the universal design for learning is the idea of multiple. This is in terms of multiple means of representation, multiple means of engagement, and multiple means of expression (Baurhoo & Asghar, 2014). The teacher provides students with the opportunity to incorporate these multiple means in a variety of different ways. The teacher also included multimodal instructions to implement universal design for learning in the classroom. As stated by aurhoo and Asghar (2014) students who are provided with differentiated supports and activities allow students to capitalize on their strengths.
This emphasizes that every student is a different learner and the way of learning that is best for them.

This lesson allowed students to develop an understanding of physical and chemical changes and properties. Students should have prior knowledge about physical and chemical changes, but it is important to reinforce this topic. Matter is all around us, so students need to have an understanding of the objects around them. This lesson provides students with the opportunity to discuss and explore real-world examples to better understand physical and chemical changes. This lesson is for students in 8th grade physical science. The lesson addresses the PS.3 Virginia Standard of Learning Objective (Figure 1).

**Figure 1.** The Virginia SOL that was addressed in the lesson.

Before the lesson began, the teacher presented the students with lesson objectives (Figure 2).

**Figure 2.** Lesson objectives that students were provided before the lesson began.

**Students will be able to...**
- distinguish between physical and chemical changes.
- use evidence and scientific reasoning to differentiate between chemical and physical property.
- analyze and interpret data on the properties of substances before and after the substances to determine if a chemical change has occurred.

In order to complete the lesson as described below the necessary materials are needed (Figure 3).

**Figure 3.** Materials needed including resources, supplies, and technology.

- Lab Simulation
- Chromebooks (1 per student)
- Physical Change vs Chemical Change Video [https://www.youtube.com/watch?v=VITt-kOPhKk](https://www.youtube.com/watch?v=VITt-kOPhKk)

**PS.3** The student will investigate and understand that matter has properties and is conserved in chemical and physical processes. Key ideas include

a) pure substances can be identified based on their chemical and physical properties;

b) pure substances can undergo physical and chemical changes that may result in a change of properties;
ENgage

At the beginning of the class, the teacher sparked the interest of students by performing a laboratory demonstration. Students were asked to participate in the demonstration by assisting the teacher. The teacher and two students showed the class the reaction between Mentos and Coca-Cola. The demonstration was completed two times to allow both students to put Mentos in the soda bottle. The quick reaction was used to increase the engagement and curiosity of students. The idea of a culturally conscious environment started with the laboratory demonstration.

Following the demonstration, the class participated in a discussion about their observations. The discussion allowed the teacher to identify the extent of prior knowledge that the students had about chemical and physical changes and properties. Students were asked probing questions such as, “Was this an example of a chemical or physical change?” and “What are other examples of physical reactions?” Students shared examples of reactions that they have seen in their everyday lives. Some of these responses included mixing flour and sugar when baking, melting an ice cube, and crushing a can. The relatability and relevance of these examples help students see the practical applications of what they are learning in their own lives. Students provided simple examples as stated above, but others provided examples drawn from various cultures. This was the first example of implementing a culturally responsive pedagogy in the classroom. The demonstration of the Coca-Cola and Mentos reaction and the class discussion about other examples occurred over about ten minutes.

ExploRE

The teacher provided students the opportunity to participate in a demonstration and class discussion to introduce the lesson. This was the start for students to improve their understanding of the world around them. To further explore physical and chemical changes and properties the teacher introduced a laboratory simulation, Understanding Matter, to the students. The goal of the laboratory simulation was for students to observe real-life examples of physical and chemical changes. Students then had to determine if a physical or chemical change occurred. Students were asked probing questions such as, “What observations can you make while the different events are occurring?” and “Is the reaction between baking soda and vinegar a physical or chemical change?” The students answered these questions through discussion and in their digital
scrapbooks. Students also included observations of each event in their scrapbooks. The idea of a digital scrapbook and the online simulation created an interactive teaching media for the students to learn (Wusqo & Jatiningsih, 2022). The scrapbook breaks down a larger topic into subtopics in order to allow students to fully understand a topic. The teacher gave students thirty minutes to complete the laboratory simulation activity.

The teacher implemented academic differentiation in this activity for students with learning disabilities and English as a second language (ESL) students. The teacher paired a student with learning difficulties or ESL with a gifted student. The teacher explained to the pairs that one student could describe aloud what was occurring while the other wrote in the digital scrapbook. This student collaboration was a powerful way to promote inclusivity, diversity, and a supportive learning environment (Goethe & Colina, 2018). Connecting the students by pairing them together is another strategy to support culturally relevant pedagogy. The teacher intentionally created diverse partners that included students with various backgrounds. This approach encouraged collaboration and learning from peers with different perspectives and experiences. An important aspect of culturally relevant pedagogy is shared learning experiences. Collaborative activities also create shared learning experiences where students work together to achieve a common goal. This sense of shared accomplishment builds a positive and inclusive classroom culture.

EXPLAIN

Throughout the beginning of this lesson, the teacher provided students with many different examples of physical and chemical changes. In order to further students' understanding, the teacher played a video that explained the characteristics and properties of physical and chemical changes. Within the video, there is an embedded quiz that allowed students to reflect and improve on their level of understanding. The teacher used the quiz in the video to incorporate a call-and-response strategy. The following are examples of questions that students had to answer, “Is combining milk and cereal a physical or chemical change?” and “Is eating the cereal and milk a physical or chemical change?” The use of the call and response by the teacher was another example of implementing a culturally relevant pedagogy in the classroom. The teacher allowed time at the end of the video for students to express any thoughts or questions. This activity took ten minutes for students to complete.
This strategy is an interactive technique that has historical and cultural significance. Call and response is a strategy that encourages active participation from all students. It provides an opportunity for every student to contribute and fosters a sense of community, and shared ownership. The teacher implemented this strategy to maintain students' attention and engagement in the lesson. This interactive classroom atmosphere leads to a positive learning environment that meets the needs of students.

ELABORATE

After the video activity, the teacher introduced the next activity to the students. The teacher showed students the website, Powtoon, and provided them with a tutorial on how to use the website. The teacher explained to the students that they had to create an animated explainer, video, presentation, or screen recording to show the class. Within their creation students were expected to provide various examples of physical and chemical changes from their everyday life. The teacher allowed students to decide if they completed this alone or in pairs.

During this activity, the students had the opportunity to decide the technique that they used to present the information to the class (King-Sears et al., 2015). Students also decided whether they would complete this assignment by themselves or with a partner. Allowing students to make decisions about an assignment is a key aspect of culturally relevant pedagogy as it aligns with the principles of recognizing, respecting, and incorporating students' diverse backgrounds, experiences, and perspectives (King-Sears et al., 2015).

The teacher did not provide students with clear and comprehensive directions for this assignment. By not providing students with explicit directions, the teacher wanted to promote creativity and critical thinking, foster independence, and responsibility, and cultivate a growth mindset (King-Sears et al., 2015). While the teacher did not provide explicit directions, they did provide support and guidance to ensure that students had some expectations for the assignment. The classroom contained diverse learning styles, so this approach catered towards learning styles to allow for individual exploration and interpretation.

After students made their Powtoon assignment, the teacher had each student present to the class. Students received a grade for completing an honest and respectful peer review of each student's presentation.

The use of technology in combination with the student's background will lead to
a better understanding of the standard of learning. This approach is the culture-techno-contextual approach (Oladejo et al., 2022). This approach allows students to participate in a pre-lesson which was completed with the exploration and explanation activity. The next step is to participate in group work and presentations based on the pre-lesson (Oladejo et al., 2022). Web resources are encouraged to use which was implemented with the use of technology and the Powtoon assignment.

EVALUATION/CLOSURE

Each student presented their Powtoon assignment to the class. During each presentation, students in the audience completed a peer review. The teacher used the peer reviews to promote engagement in the classroom. Peer reviews also allow students to receive feedback from peers with diverse cultural backgrounds. The diversity of perspectives can offer the presenter with varied insights and ways of understanding the material. By incorporating peer reviews into the learning process the teacher can implement a culturally responsive pedagogy in their classroom by valuing diversity and collaboration.

The teacher used the Powtoon assignment to allow students to participate in the peer reviews and to show their creativity. Throughout the lesson, the teacher gave the students a variety of formative assessments to use as a reference for the student's level of understanding. The formative assessments included the video with the call and response quiz, the laboratory simulation, and the Powtoon assignment. To end the lesson, the teacher gave the students a summative assessment.

The teacher gave the students a summative assessment in the form of an exit ticket. The teacher accounted for the different types of learners in the class by providing different versions of the exit ticket. For the general class and students with no accommodations, the exit ticket had questions in a short answer format by providing reasoning. Students with disabilities and ESL students were given an exit ticket based on their IEP. One student had the exit ticket given to them in a multiple-choice format while another student was given the exit ticket via read-aloud. By the teacher providing students with different formats of the assessment, the teacher acknowledged the academic differentiations.

CONCLUDING THOUGHTS

The teacher used a variety of modes of instruction to further the student's level of understanding of physical and chemical changes and properties. Students were
given options for multiple ways to express what they know (King-Sears et al., 2015). This lesson provided activities that incorporated culturally relevant pedagogy. The engagement activity offered students an opportunity to participate in a laboratory demonstration. Due to the student's prior knowledge of physical and chemical changes, they could predict what was going to occur during the demonstration. This activity caused students to be excited for the lesson that was to come. This excitement was contained throughout the lesson by the activities that followed.

There were many opportunities for the teacher to uphold a culturally relevant classroom. The teacher created an environment that allowed for collaboration between the students. Collaboration provides students with the opportunity to learn from their peers. The pairing of students with diverse backgrounds leads to hearing different perspectives. Also, at times throughout instruction, students were given the freedom to make their own decisions. By allowing students to make decisions about their education they are more likely to incorporate their interests and background (Goethe & Colina, 2018). By including these students will engage more in the lesson and assignment.

The peer review for the Powtoon assignment was a major aspect of the lesson. These peer reviews led to students being able to work on skills that are needed within the community. The teacher provided students with the directions, “Comments should be respectful, appropriate, and constructive.” This allowed students to improve communication skills, collaboration skills, and critical thinking skills.

The teacher ended the lesson with a summative assessment and considered academic differentiation. This assessment was given in different formats to account for different learners. Throughout the lesson, cultural and academic differentiations need to be considered to ensure that every student feels that they can learn in the classroom. It is also important to ensure that teachers provide students with a positive and welcoming classroom where they can ask questions. This type of classroom allows students to feel comfortable and provides an environment that is best for learning.
REFERENCES


