Designing and Assessing DEI Learning Outcomes in a Chemistry Course

A study conducted in a small General Chemistry class at Front Range Community College

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Introduction

Inclusive teaching practices involve a student-centered approach that is responsive to all intersecting social identities and lived experiences of students in the classroom. These practices are designed to help students relate to the course material and engage with students and empowers student to make requests for support to share their unique perspectives.

Student learning outcomes describe the knowledge, skills, attitudes, behaviors and values that students should demonstrate by the end of a course or program of study. Identifying and clearly articulating learning objectives centered around diversity, equity, and inclusion (DEI) is critical in designing an in-depth learning experience, providing a critical lens through which students construct knowledge. When creating DEI learning outcomes, the instructor needs to make their learning outcomes transparent to students and connect to clearly measurable outcomes.

This study describes the design and assessment of two specific DEI learning outcomes in an introductory chemistry course. The class was offered in the spring semester, 2023, at Front Range Community College in Westminster. The class was a five-credit General Chemistry course and there were 20 students enrolled. It was my first time teaching for this institution. The students were all STEM majors, but only one student identified as an underrepresented major.

To design the two DEI learning outcomes, I examined the list as a guide which is included in Module 1 of the Faculty Institute for Inclusive Teaching (FIT) at the University of Denver. You can access any of the FIT modules through TalendU.

Challenging historical claims

Invite students to challenge claims presented as objective, neutral, and universal.

Design reflective questions about social perspective

Creating spaces for students to engage in critical self-exploration about their own social perspective and subjectivity.

Investigate identity development

Help students in developing skills to see themselves as knowledge producers in your discipline, by representing different social identities of accomplished scholars in your context.

Facilitate dialogues on points of view

Seek out an examination of their social-identity positions and the relationship between those positions and the knowledge that they have.

Teach students about “positionality”

Introduce students to positionality, which is a significant concept that emerged out of feminist scholarship that describes how essential aspects of identity such as gender, race, social class, and sexual orientation influence the knowledge that scholars construct (Mather & Tewksbury, 2007).

Applying knowledge on positionality to examine scholarly work

Use positionality to help students reveal the importance of identifying the positions and frames of reference from which scholars and writers present their data, interpretations and analyses (Anzaldúa, 1991).

Bring self-reflection to your work

Identify your scientific positionality as a researcher and how the normative aspects of your research shape your scholarship—connects with the empirical paradigm that has dominated Western science (Cook, 1991; Harding, 2001).

Assessment of DEI Learning Outcome #1

I used a word cloud to demonstrate the results of the surveys at the beginning of the semester and the end of the semester. In this type of graphic, the word size is determined by the frequency with which the word was associated with particular DEI learning outcomes. The word cloud uses size to reflect the frequency with which the word was used. While these words seem to have a positive association with science identity, there is also a possibility that these responses illustrate impostor phenomenon if they do relate to majority identities that look like them. I would start the next project by seeking a more direct question on a reflective assignment about whether students associate themselves with these words.

The pre-survey word cloud seems to have more words that make science sound challenging and difficult. I would see seeing words on the post-survey like “fun”, “cool”, and “bright”. The main iteration of this project, I would ask students to reflect on what feels fun to them about pursuing a career in science.

It is fascinating that “lab coat” persists, even though it has a superficial and sometimes very negative, without much sense of personal values aligning with this career.

The post-survey responses are more centered on the “human” aspects of a science career. They illustrate how someone does the work, in terms of their affect instead of the objects that they use/see.

It is helpful to see the difference in responses for individual students. I believe that it pulls out more evidence for the impact of this learning outcome.

The pre-survey responses are often clinical, superficial and sometimes very negative, without much sense of personal values aligning with this career.

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Design

After reviewing the FIT DEI learning outcomes, I designed the two DEI learning outcomes listed below, along with the class activities that we engaged in.

DEI Learning Outcome #1: In this class, we will work to broaden our ideas about what scientists look like and what they do.

Classroom Activities

- Administered accessibility survey before class started, including this prompt: “Please write three words that come to mind when you think about a professional scientist.”
- Offered six mini lectures during class to highlight global issues that involve chemistry. I offered six mini lectures during class to highlight global issues that involve chemistry.
- Students were asked to pick a molecule that felt important to them, where it connected with their curiosity, their values or a community issue. They were given a rubric to collect data on the molecule and then tell a story, led by three social justice resources.

Assessment of DEI Learning Outcome #2

At the end of the semester, the students were also given this prompt: “This semester, we worked to critically interrogate the discipline of study (Chemistry) and how this impacts real-world application. To do this, we learned about ocean acidification, the use of metric units in all but three countries, mining coal in Africa for electric vehicle batteries and we explored many stories about societal impact in our Molecular Projects. What did you learn through these activities?”

Sample responses:

- I learned that there are so many problems in this world that revolve around chemistry.
- I learned that it takes a help to these problems get better.
- I learned that there are a lot of ways to solve problems if we take time to understand the problem affects us.
- I learned how many chemicals and processes that are problematic to us and the environment, but we just ignored because they’re not a hotly political topic. There’s so much inefficiency and so little work to fix it.
- I learned how essential chemistry is in our everyday lives and what science is necessary to make some changes in our lives and create a sustainable environment for the future.

Take my Survey!

Take a moment to reflect on how you engage your students with your learning outcomes. Some questions that I usually ask people to reflect on: Are you aware of the learning outcomes for your course? Are any of your learning outcomes focused on issues related to diversity, equity and inclusion? Which ones from this poster and project might you use? Are you curious about what DEI learning outcomes that other DU faculty are using?