

An investigation of laboratory activities for non-STEM-majors during the COVID-19 pandemic

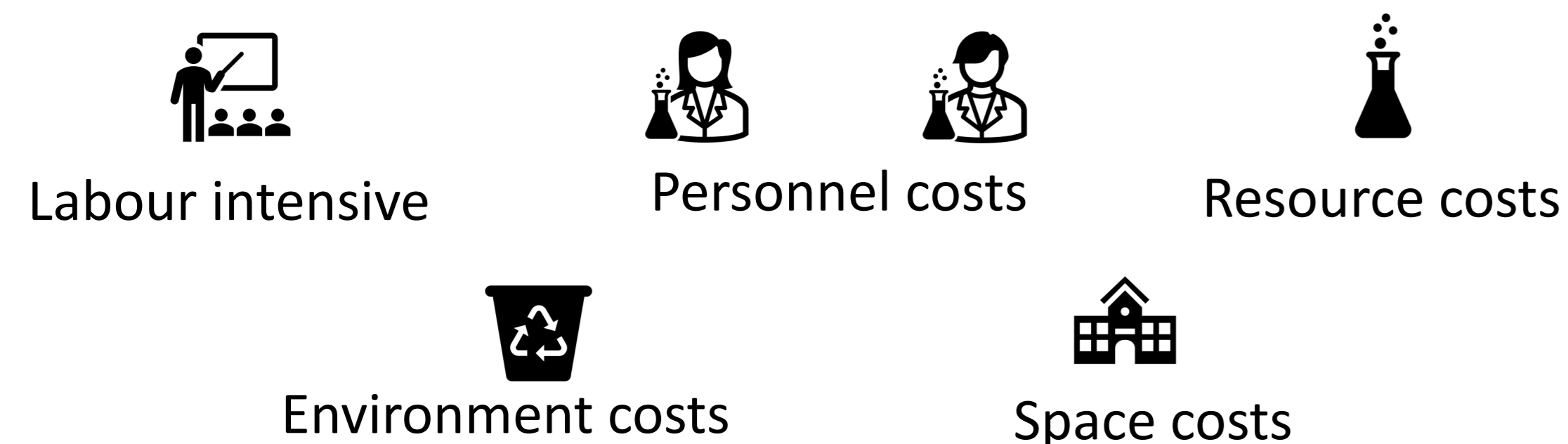
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Research Need

“Chemists can no longer afford to believe that the importance of teaching laboratories is a truth we hold to be self-evident.” (Bretz, 2019)

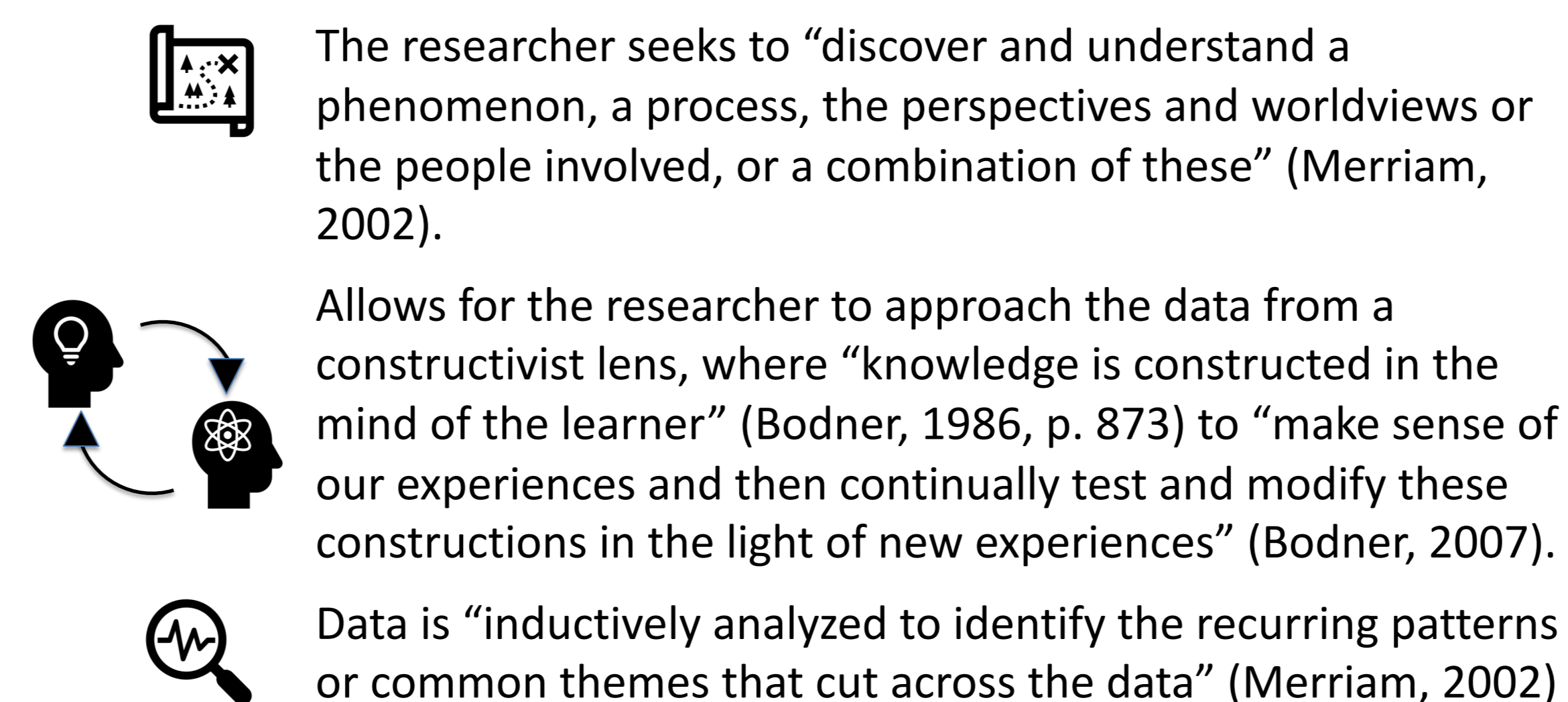


Non-Majors in Chemistry Labs

- “The non-major presumably studies chemistry in order to gain a better understanding of the universe, the earth, its ecosystem, and the mechanisms of life. The available evidence fails to show that this is enhanced by hands-on laboratory instruction.” (Hawkes, 2004)
- “Laboratory classes do not help students to understand how chemical principles affect their universe... Non-majors have no use for the manipulative skills that they may learn in a chemistry laboratory.” (Hawkes, 2004)

Methodology

This study was conducted through the form of a basic interpretive qualitative study (Merriam, 2002, 2009):



Research Question

Do introductory chemistry labs foster the development of science identity in non-STEM-majors?



Research Design

Participants:

- One student (Maureen) and three instructors (Teresa, Clarissa, & Vivian)

Recruitment Site:

- Three introductory chemistry courses (CHEMISTRY 201, CHEMISTRY 203, and CHEMISTRY 301) at the University of Calgary.

Student Interview Guiding Concepts:

- Reason for taking introductory chemistry
- How they would define something as being scientific
- What being a scientist means personally, and
- How any of the prior answers have changed through taking introductory chemistry as a non-STEM major.

Instructor Interview Guiding Concepts:

- Perspectives on the importance of laboratory activities
- What STEM and non-STEM majors were expected to learn through laboratory activities, and
- How labs might be redesigned to facilitate these changes.

Findings

Disciplinary Skills

- ...it's one thing to lay out the materials, but it's another thing to say “how am I actually going to get this liquid into this container?” and that's a nontrivial thing. It's something you have to learn how to do ... We have to give them time to develop [those skills, and] I think those are worthwhile skills (Teresa)
- ...look at COVID-19 now, people going around with their visors and whatnot to prevent stuff from getting in the eye. So, yeah, I think that [laboratory skills] stick with people a long time (Clarissa)

Soft Skills

- One of the things [my] dance teacher used to say [was] “Dance is 90% above the shoulders” and what he meant was not just that you're always smiling, but rather “are you mentally prepared?”, “did you remember the dance from week to week?”, “are you showing up properly?”, “are you remembering corrections?”, all these things that apply to the lab and to chemistry and to any area of study (Clarissa)
- They picked up more about the aspect of planning your time and time management and, you know, preparing and working with a partner. So those were a lot of the things that they pulled out [as] the valuable things that they took away from doing the lab (Teresa)

Being a Good Audience

- ...my grandma said to the teacher something along the lines of, you know, “It's pretty clear that some of those girls will not be professional dancers” and my dance teacher, right away, said “you're right, but they'll make a better audience.” (Clarissa)



Considerations for the Future of Chemistry Laboratory Activities

When you're sitting around with a bunch of chemistry educators, everyone talks about how they got sucked in and it's only ever because of the lab (Teresa)

Student-Led Laboratory Designs

- You're not necessarily doing [laboratory activities at] exactly the right most opportune pedagogical moment for every student, you know? Ideally, you'd let them wander into the lab, do it when they were thinking about that course material (Teresa)
- I feel like I felt more like a scientist, I guess, in university because we actually got to draw the conclusions for ourselves based on what we saw (Maureen)

Accessibility

- ...if we [do] go back to face-to-face, then, when students can't come, the students who are physically in the classroom will find a way to make those people be able to participate remotely (Teresa)
- If you had a more flexible environment, it would be more accessible to everyone, right? Because then you don't need the accommodations. You just have designed it so that everyone can experience it, regardless of their situation. (Teresa)

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