Developing Transferable Skills: Does Disciplinary Topic Matter?

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Abstract

Transferable skills are essential for student success beyond graduation, yet they are not often explicitly taught or assessed in postsecondary education. This study evaluated the effectiveness of a 50-minute workshop designed to explicitly teach scientific inquiry as a transferable skill to first-year undergraduate students in a biodiversity course. The workshop, delivered in either a biology-specific or general context, emphasized active, experiential learning.

A mixed-methods post-workshop survey assessed student perceptions through Likert-scale items, open-ended responses, and knowledge-based questions. Students in both contexts reported high satisfaction, perceived the workshop as beneficial for their skill development, and recognized the relevance of scientific inquiry beyond the course. Students in the general-context workshop outperformed those in the biology-context on knowledge-based questions, suggesting general contexts may better support initial understanding through relatable examples. However, more biology-context students agreed that the skill learned is applicable beyond formal education. Students identified peer collaboration as a strength but noted challenges with the virtual format—particularly Zoom breakout rooms—highlighting the importance of thoughtful online learning design. This research contributes to ongoing discussions about how best to teach transferable skills in higher education. We recommend introducing these skills early in general contexts, then reinforcing them across disciplinary and interdisciplinary courses, with explicit integration into learning outcomes and assessments. These findings offer practical guidance for designing inclusive and intentional skill development in undergraduate education. The research presented here explores the topic at a single point in time – an undergraduate student's first year of higher education. Further research is needed to examine how students' perceptions of skill development in different instructional contexts evolve across stages of their academic careers.

Keywords: transferable skills, disciplinary identity

1. Introduction

New challenges have redefined the purpose of higher education, especially with the advent of the fourth industrial revolution (Kovacs & Vamosi Zarandne, 2022; Schwab, 2017; World Economic Forum, 2016). Society now requires post-secondary graduates who are not only knowledgeable and intellectually capable but also committed to lifelong learning and capable of contributing holistically to their communities (Chan, 2016; Mishra et al 2025). Traditionally, higher education aimed to prepare students for public service and to foster research and knowledge advancement (Williamson et al., 1949). Today, universities must equip students with the knowledge, skills, and attitudes necessary to navigate an uncertain future and actively participate in the global economy (Spellings, 2006; Balestreri et al 2023). It is this pervasive uncertainty that drives the shift in higher education's purpose.

The Canadian workforce is undergoing rapid change, with an increasing demand for transferable skills such as critical thinking, problem-solving, and creativity (Bennett, 2002; Express Employment Professionals, 2020; Royal Bank of Canada, 2018; Weingarten et al., 2019; Summerlee et al., 2022). The gap between what is taught in post-secondary programs and the skills required for success after graduation is growing (e.g., OECD 2025. This shift in the workforce is not yet reflected in higher education, as shown by many unanswered calls from employers, graduates, and governments urging improvements in developing transferable skills in post-secondary programs.

(Express Employment Professionals, 2020; Hurrell, 2016; Royal Bank of Canada, 2018; Stuckey & Munro, 2013; Weingarten et al., 2019). Some universities have responded by designing and implementing opportunities to learn transferable skills in undergraduate curricula (e.g., Chemistry; Taber, 2016; Canelas et al., 2017; Araujo et al., 2022; Møgelvang & Nyléhn, 2023). However, effective methods for integrating transferable skill development into the undergraduate curriculum is not well understood (Olesen et al., 2021), and there is debate over how it should be done (Billing, 2007; Clanchy & Ballard, 1995; Washer, 2007; Caeiro-Rodriguez et al., 2021).

Some universities, like the University of Luton in the UK, have integrated transferable skills into their curricula by incorporating skill-based learning outcomes into existing courses (Atlay & Harris, 2000). Embedding skills into current courses can help students make connections between core knowledge and skill development (Fieldhouse, 1998). However, students tend to achieve higher levels of transferable skill development when these skills are taught explicitly rather than implicitly embedded in coursework (Beletzan et al., 2017; Oelsen et al., 2021).

Other proposed methods for incorporating transferable skill education into undergraduate degrees involve explicitly integrating these skills into the curriculum, making students aware that they are learning and developing them alongside core disciplinary courses. (Chadha, 2006). Explicit transferable skill development is argued to be most effective because it significantly improves students' abilities (John, 2009), awareness, attitude, motivation, and engagement (Hill et al., 2019). The current debate is whether transferable skills should be taught within the disciplinary curriculum or in stand-alone skills courses (Billing, 2007; Clanchy & Ballard, 1995; Washer, 2007). Offering transferable skills in standalone courses can boost engagement with these skills (e.g. Hill et al., 2020; Jacobs et al, 2021; Burke and Stewart, 2024) and promote more advanced skill development (Billing, 2007). Alternatively, integrating transferable skills into the disciplinary curriculum helps students develop them within a familiar context, thereby supporting their disciplinary identity (e.g. Aschbacher et al., 2010; Robertson et al., 2021; Chichekian et al., 2022; Babb et al., 2025).

University is a time for identity construction and exploration (Booker et al., 2021; Davis & Wagner, 2019; Palmer et al., 2015). A student's disciplinary identity will change throughout their education and life, as identity is not static and is influenced by many factors (Flum & Kaplan, 2006; Goldie, 2012; Grotevant, 1987; Bahnson et al., 2021; Wong et al., 2023; Gonzalez et al., 2021). Disciplinary identity develops through an exploratory, problem-solving process in which students engage in discipline-specific activities and gather information, investing time and energy in that identity (Aschbacher et al., 2010; Flum & Kaplan, 2006; Goldie, 2012; Grotevant, 1987). Participating in high-quality learning experiences contributes to the development of students' disciplinary identities (Aschbacher et al., 2010; Williams et al., 2021; McCartney et al., 2022). The development of a disciplinary identity in students is important as it affects their sense of belonging during their education and in their careers after graduation (Davis & Wagner, 2019). Due to the importance of disciplinary identity, developing transferable skills in the context of a student's discipline may be beneficial because it caters to their identity, allowing them to develop challenging skills in a familiar context. Conversely, while developing a disciplinary identity is important for undergraduate students, focusing on their own disciplinary skills and content may impede the development of transferable skills (Hill et al., 2019). This impediment may also be due to the lack of explicit transferable skill development in discipline-specific courses (Hill et al., 2020). Whether transferable skills are developed within the disciplinary curriculum or in stand-alone courses is also a relevant question, though at a slightly broader scale. To improve transferable skill education, it is important to investigate the effectiveness of teaching transferable skills in discipline-specific versus general contexts and contextualize student perceptions and engagement in each context (Coates, 2005). It is currently unknown in which context students wish to develop transferable skills. To better understand the development of transferable skills, this study seeks to achieve three research aims:

(1) Develop and deliver a transferable skill workshop in discipline-specific and general contexts.

(2) Determine how context influences students' perceptions of learning transferable skills within existing courses.

(3) Determine how context influences the learning of transferable skills.

2. Methods

This study used a mixed-methods design to explore undergraduate students' views and perceptions on developing transferable skills in both discipline-specific and general situations. We developed two versions of a transferable skills learning module: one with discipline-specific content and the other with more general content. We used a survey tool to assess attitudes, opinions, and learning. The participants were students enrolled in the first-year biodiversity course, Discovering Biodiversity, at the University of Guelph in Canada. All protocols followed the University of Guelph's Research Ethics guidelines under certificate number 22-03-017.

2.1 Workshop Creation and Delivery

At the time of this research, Discovering Biodiversity already included two explicit transferable skill development workshops (Numeracy and Scientific Inquiry). The workshops are virtual, asynchronous units on the course's Learning Management System that students complete at their own pace during the assigned week. Students are required to complete a quiz to assess their learning from each workshop. We redesigned the Scientific Inquiry workshop because it was already closely aligned with teaching students problem-solving skills. We collaborated with the course staff to adapt the scientific inquiry workshop into a problem-solving workshop to be delivered synchronously.

To assess whether students prefer explicitly learning and developing transferable skills within the context of their discipline or more generally, we created two versions of the 50-minute workshop: one version with biology-based examples and activities, and another with more general examples and activities. The biology (discipline-specific) workshop had students consider the observation of worms emerging to the ground's surface when it rains, and tasked them with learning about the steps of the scientific method in relation to this phenomenon. The general workshop followed the same activity, except that the observation focused on sorting waste using multiple bins. There were also slight differences in the wording used to describe scientific inquiry. The biology workshop focused more on scientific inquiry within biology, while the general workshop focused more on scientific inquiry as a practice you could use every day. Otherwise, the two workshops were identical in the types of activities and knowledge discussed.

The workshops were offered in the Winter 2023 semester when students taking the Discovering Biodiversity course could register for either in-person or virtual sections. Only students from the virtual section were included in the study to ensure the workshop instructor would be the same across all workshops. The virtual section held one workshop per day, Monday through Thursday, during the second week of the semester. The workshop consisted of a 50-minute synchronous Zoom meeting, alternating between biology and general workshops, which offered two sections of each, for a total of four workshops.

2.2 Data Collection

A mixed-methods survey was created using Qualtrics (2002) and distributed to students (Table 1). Specifically, a link to the survey was provided at the end of the online quiz for the workshop, which students could complete after the workshop. Students were not required to complete the survey to finish the quiz, nor were they required to complete the survey to receive a grade.

Table 1. Survey tool questions

Section	Question Type	Survey Question
Open-ended	Open-ended	Do you think more courses should incorporate skills-based workshops like this? Explain your answer.
	Open-ended	What would you say were the strengths of the scientific inquiry workshop and its design?
	Open-ended	What would you say were the weaknesses of the scientific inquiry workshop and its design? Any improvements you would suggest?
	Open-ended	Do you have anything else to share about this workshop specifically or the development of scientific inquiry in [this course] generally?
Likert Scale (1 = strongly disagree; 7 = strongly agree)	Statement	Overall, I am satisfied with the scientific inquiry workshop.
	Statement	I found this workshop helpful towards my skill development.
	Statement	I did not learn anything that will have value beyond this class.
	Statement	What I learned will be applicable to me outside my education.
	Statement	Given the opportunity, I would participate in another skill workshop such as this one.
Skill/Knowledge Items	Open-ended	What comes to mind when you think of 'scientific inquiry'?
	Ordering	Order the steps of the scientific method.
	Multiple-choice	Select the statement that is a hypothesis.

2.3 Data Preparation and Analysis

In accordance with Research Ethics Board standards, respondents were not required to complete all survey questions to be included in the research. At the end of the survey collection period, 2 weeks after the workshops were delivered, 76 student responses were collected. Responses where students did not answer any of the questions beyond the classifying information were deleted. The analysis included 69 survey responses, but participants with missing data were automatically removed from those sections of the survey. Quantitative and qualitative data were then separated into separate csv files, with both containing classifying variables.

2.4 Quantitative

All quantitative statistical analyses were conducted in R (version 4.2.1; R Core Team, 2022) and RStudio (version 2022.07.1+554; RStudio Team, 2022). Figures were produced using both Excel and RStudio. One of the five Likert items was reverse coded, so before analysis was conducted, the responses to the one statement were flipped, meaning a response of 1 became 7, 2 became 6, etc. The survey data were Likert-type data and not Likert scale data (Boone & Boone, 2012; Clason & Dormody, 1994), so the mode was calculated as a summary statistic, and Fisher's exact test was calculated for each Likert statement, comparing between delivery context (biology and general). Two knowledge-testing questions were included in the survey, for which students were given a score out of seven (1 for selecting the correct hypothesis and 1 for ordering each step of the scientific method correctly). Knowledge scores were compared across delivery contexts by comparing means with a t-test.

2.5 Qualitative

All qualitative analyses were conducted using NVivo 13 (Lumivero, 2020), and figures were produced using Excel and NVivo. The data file was imported into NVivo statistical software where students' responses to the four open-ended questions (Table 1) were analyzed. Students' responses were thematically analyzed, following coding procedures outlined in Gibbs (2012). Codes were based on recurring themes within the answers to open-ended questions. Word frequency analyses and matrix coding queries were conducted in NVivo to ascertain the frequency of themes overall and within delivery contexts.

3. Results

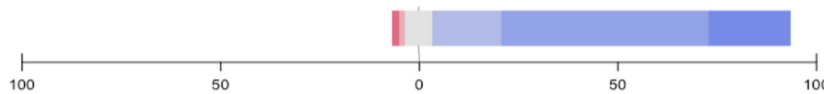
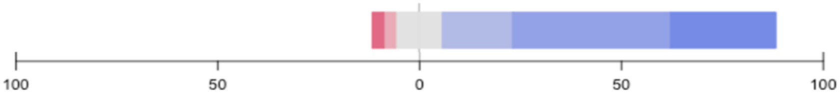
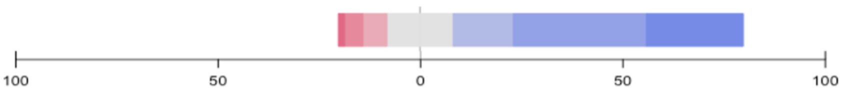
A total of 69 students participated in the virtual workshops and completed the survey at least partially. Of these 69 respondents, 34 participated in the general workshop, and 35 participated in the biology workshop. For the qualitative analysis, 32 students from the general workshop and 34 from the biology workshop participated by answering open-ended questions.

Overall, students in both contexts had a positive view of the workshop and its value. Most students (90%) agreed they were satisfied with the workshop and that it would have value beyond the course (Table 2). Further, 90% of students found the workshop helpful for skill development, with 85.5% agreeing and only 2.9% disagreeing. While 82.6% of students agreed that what was learned in the scientific inquiry workshop would have value beyond the course, 72% agreed that their learning would be applicable after graduation. Additionally, 73% of students said they would participate in another skill workshop.

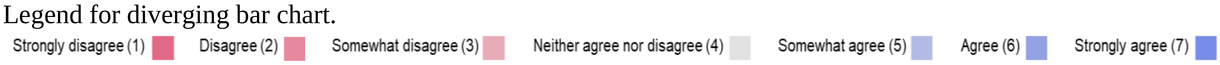
Generally, first-year undergraduate students are open to explicit transferable skills workshops in their courses. Most students (80%) thought transferable skills workshops should be included in other undergraduate courses. A small portion of students (8%) thought that other courses should not have skills workshops, and an equal number of students (8%) thought that only some courses should include them. A few students (3%) suggested that workshops should be optional, and fewer (1.5%) were indifferent.

The length of each bar represents the percentage of respondents who selected that option. The bars for each response category are centered around a neutral midpoint, Neither Agree nor Disagree, with negative responses (Somewhat disagree, Disagree, Strongly disagree) extending to the left and positive responses (Somewhat agree, Agree, Strongly agree) extending to the right. Responses were reversed for one item (I did not learn anything that will have value beyond this class) so that an agree response indicates a positive perception of the workshop. n = 69.

Table 2. Response distribution (%) and mode of participant responses to post-workshop survey Likert items

Likert Statement	Response Distribution (%)	Mode
Overall, I am satisfied with the scientific inquiry workshop.		6
I found this workshop helpful towards my skill development.		6
I did not learn anything that will have value beyond this class. R		6
What I learned will be applicable to me outside my education.		6
Given the opportunity I would participate in another skill workshop such as this one.		6

Legend for diverging bar chart.



R Item was reverse coded, responses were reversed so that an agree response indicates a positive view of the workshop.

In their open-ended responses, participants mentioned a variety of strengths. Students reported feeling engaged during the workshops. Surprisingly, they reported the opportunity to work in groups as a strength. Many students found the explanations of scientific inquiry, the scientific method, hypotheses and predictions helpful, and the examples used. A few students mentioned that the quiz was a helpful way to reinforce the concepts discussed and practiced in the workshop. The strengths students mentioned could be summarized into six main themes:

3.1 Engagement and Participation (38% of all Open-ended Responses)

"I really liked the interactiveness"

"The fact that there were times that students could actively participate by brainstorming ideas, asking questions"

"Being able to interact during the workshop such as by allowing us to annotate or asking us questions which would keep us engaged"

"I found the interactive sections of the workshop were engaging when we were asked to answer questions and see others answers as well"

"The amount of interaction in the workshops as we don't find that as much in the 300+ person lectures."

"It was very interactive and gave us students the opportunity to answer questions and offer opinions but also learn from getting questions wrong"

"The way we are able to collaborate and engage for further understanding"

3.2 Groupwork (24% of all Open-ended Responses)

"Talking to classmates in breakout rooms is a strength."

"I liked using the jam boards in groups"

'It gives a good opportunity to work with class members and create connections with people who you can reach out to if you ever need help in the course"

"Doing an example in groups was helpful"

"The way we are able to collaborate and engage for further understanding. Hands-on and collaborative work"

"It helped to work together and solve problems using the scientific inquiry process"

3.3 Explanation (17.5% of all Open-ended Responses)

"Started off with the basics and did not begin with the assumption that the students had pre-existing knowledge"

"Taking time to explain the process of scientific inquiry"

"It explained the foundation of the scientific method, and the process in detail"

"The information that helped clarify the concepts so that students fully understand the ideas and info shared within the workshop"

"The broken down approach of the scientific method"

3.4 Examples (9.5% of all Open-ended Responses)

"The examples were very useful and allowed for real life applications"

"Examples through experiences within the course to apply to overall general scientific methods"

"The strengths were the various examples presented to help better understand the concepts"

"I liked being given examples of each part of the scientific inquiry"

3.5 Quiz (6.3% of all Open-ended Responses)

"The follow-up quiz to cement the ideas into your brain"

"I found that the quiz assignment was strong, it tested application and comprehension skills well"

"The quiz truly put understanding and direct application of the content to the test"

3.6 Teaching Staff (4.8% of all Open-ended Responses)

"The TA was very upbeat and enthusiastic"

"The instructor spoke clearly and was attentive to the needs and queries of students."

"The TA made sure to talk with the group answering questions and clarifying concepts as well as developing our ideas and understanding."

In response to the open-ended question about the workshop's weaknesses, students commented on the workshop's format. Many students disliked the virtual format, with many expressing a preference for an in-person workshop. While group work was one of the workshop's most commonly mentioned strengths, some students disliked using Zoom breakout rooms to work with their peers. Some students found the workshop topic, scientific inquiry, to be too simple and something they already understood. There were also students suggesting that the workshop could be more engaging, requesting more examples and opportunities for participation. A few students also commented that the workshop could have been longer to cover more content. However, in response to the question about weaknesses, many students (17.8% of open-ended responses) stated they could not identify a weakness or suggest improvements.

Of all the weaknesses mentioned by students, they were grouped into seven themes:

3.7 Virtual (20% of all Open-ended Responses)

"I feel I would have gotten more out of an in-person workshop"

"The weakness of this workshop was that it was online"

"I, admittedly, doomed myself when signing up for a virtual workshop"

"The online format did not really work well as some people simply didn't talk."

"The only weakness for me was that my workshop was online, and I think that workshops should only be in person."

3.8 Breakout Rooms (17.8% of all Open-ended Responses)

"The breakout room session didn't feel like it benefitted me"

"Breakout rooms. Typically most students will not participate"

"Breakout rooms are commonly disliked among students including myself"

"I didn't like the breakout rooms, personally."

"The people in my break room didn't interact with each other"

3.9 Topic (15.5% of all Open-ended Responses)

"The topics covered were already known and may have felt like a chore for people to do"

"I feel that a lot of what was taught was already known since it is covered in even most elementary classes at this point in time"

3.10 Boring (8.9% of all Open-ended Responses)

"It was very boring"

"The workshop seemed a bit boring to me"

3.11 Examples (6.7% of all Open-ended Responses)

"I would suggest maybe giving some more examples of scientific inquiries or real life examples"

"There were too many written points, and not enough examples"

3.12 Participation (6.7% of all Open-ended Responses)

"Very repetitive and not a lot of involvement"

"Participating more"

"The engaging nature of the workshop definitely lends value to the experience, which is why I think more opportunities to work on specific mock problems while applying the skill discussed"

3.13 Timing (6.7% of all Open-ended Responses)

"I found the discussion time was too long and could have been split between a few different questions"

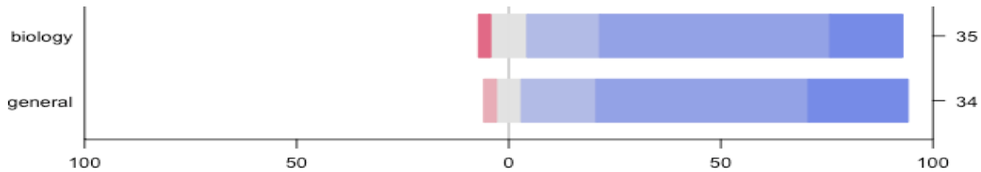
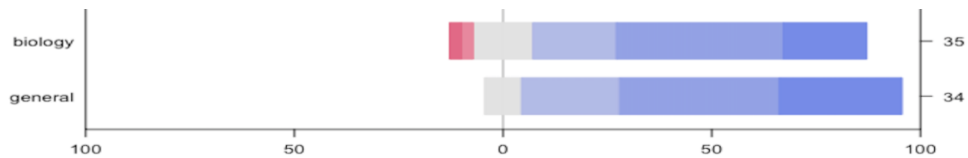
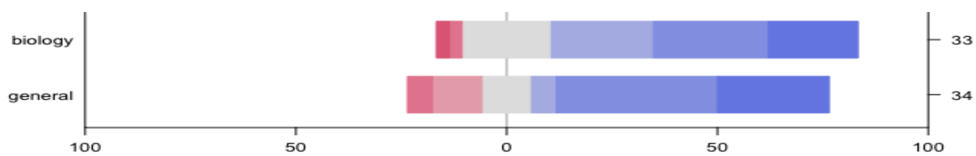
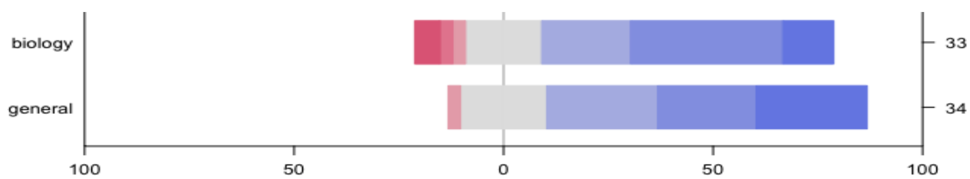
"Maybe more time would have been helpful to cover more ideas"

"Lack of time but I'd rather not extend the time slot."

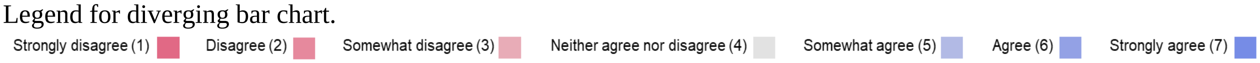
3.14 Comparison Across Discipline Delivery

Students in both delivery settings were satisfied with the scientific inquiry workshop and found it beneficial for developing their skills. Concerning the statement "I did not learn anything that will have value beyond this class," no students from the general workshop agreed, while 11% of those from the biology workshop did. This difference was not statistically significant. Surprisingly, regarding the statement "what I learned will be applicable to me outside my education," more students from the general workshop (18%) disagreed compared to those from the biology workshop (6%). However, this difference between the groups was also not significant. Participants in both settings expressed similar willingness to engage in other skill workshops. (Table 3)

Table 3. Response distribution (%) of participant responses to Likert survey items by delivery context and results of Fisher's Exact test

Likert Survey Item	Response Distribution by Delivery Context (%)	p-Value
Overall, I am satisfied with the scientific inquiry workshop.		0.93
I found this workshop helpful towards my skill development.		0.80
I did not learn anything that will have value beyond this class R		0.20
What I learned will be applicable to me outside my education.		0.08
Given the opportunity I would participate in another skill workshop such as this one.		0.43

Legend for diverging bar chart.



R Item was reverse coded; responses were reversed so that an agree response indicates a positive view of the workshop.

P-value of less than 0.05 indicates there is an association between participant responses and workshop context (general or specific), there is no significant difference found between the Likert responses of the different delivery contexts.

Students in both delivery contexts performed similarly on the knowledge-testing questions. Although no significant difference was found in students' knowledge scores across delivery contexts (t(df = 55.11) = -1.73, p = 0.08), students who participated in the biology workshop performed worse (on average) on the knowledge test questions. When ordering the steps of the scientific method, 96% of students from the general workshop correctly ordered all steps, while only 70% of students in the biology workshop did so. When asked to identify a hypothesis from a given list of statements correctly, 94% of students from the general workshop and 85% of students from the biology workshop were correct. Students who participated in the general workshop outperformed those from the biology workshop on average for each knowledge-testing question. (Figure 1)

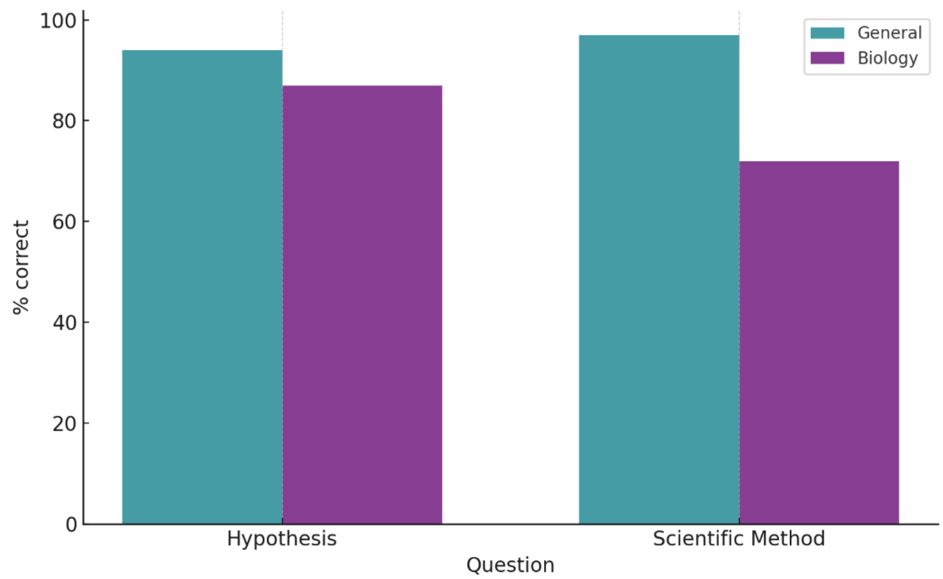


Figure 1. Percentage of correct responses to two knowledge-testing questions following a scientific inquiry workshop delivered in two different contexts: general (teal) and biology (purple)

The “Scientific Method” question required participants to correctly order the steps of the scientific method, while the “Hypothesis” question asked them to identify a complete hypothesis from a list of statements. Participants in the general context outperformed those in the biology context on both questions.

Students from both delivery contexts used similar words when asked what comes to mind when they think about scientific inquiry, though some minor differences do exist. Students from the general workshops responded with more unique words than students from the general workshops. Students from the biology workshop focused their responses on the question and hypothesis aspects of scientific inquiry, as these were two of the more frequently used words. In contrast, students from the general workshop were more focused on the whole process (Figure 2). “Questions” was the most frequently mentioned word associated with scientific inquiry by students from the biology workshop. However, it was infrequently mentioned by students who participated in the general workshop. Students from the biology workshop also mentioned “Scientific” frequently, whereas students from the general workshop mentioned it only a few times. “Hypothesis” was commonly mentioned by students from both workshops (Figure 2).

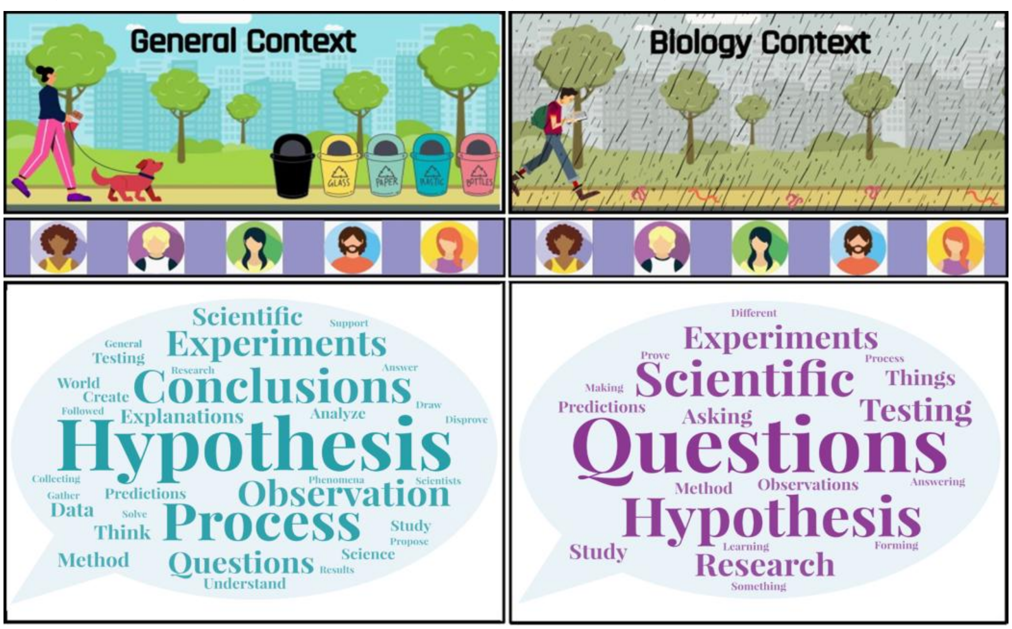


Figure 2. Word clouds illustrating participants' responses to the prompt “What comes to mind when you think of scientific inquiry?” following a workshop delivered in two different contexts: general (left) and biology (right)

Word size reflects the frequency of mention, with only terms mentioned more than twice included. Illustrations above each word cloud depict the example used for each context in which the workshop was delivered.

Students in the general and biology workshops think that other courses should include skill workshops. However, students from the general workshop reported this more frequently than students from the biology workshop. Students from the biology workshop were more likely to say that other courses should not include skill workshops, only some courses should, or that they should be optional.

Students from both delivery contexts mentioned similar strengths of the scientific inquiry workshops, though the frequency that each one was mentioned varies. The most frequently mentioned strength in both contexts was engagement (Figure 3). Students in both contexts mentioned working with their peers as a strength. While students in both contexts mentioned the explanations and examples as strengths, those in the general workshop did so more frequently than those in the biology workshop. Although the same individual taught all the workshops, only the students from the biology workshops mentioned the teaching staff as a strength. (Figure 3).

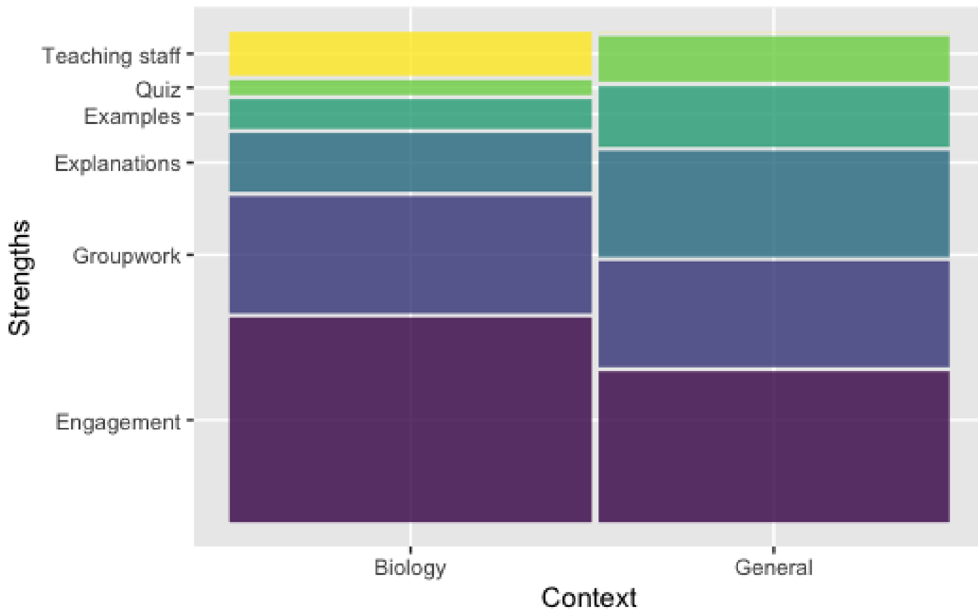


Figure 3. The distribution of responses to the open-ended question, "What would you say were the strengths of the scientific inquiry workshop and its design?"

The width of the bars corresponds to the proportion of the total number of strengths mentioned by students from each delivery context. The height corresponds to the proportion of students who mentioned the specified strength in each context.

Although students mentioned similar weaknesses in the scientific inquiry workshop, the frequency with which each was mentioned varied by context (Figure 4). Students in the biology workshop most frequently mentioned the virtual format as a weakness. In contrast, the most frequently mentioned weakness by students in the general workshop was the topic. Students in the biology workshop were more likely than students in the general workshop to state that there were no weaknesses. Students from the general workshop mentioned that the workshop would benefit from more examples, a weakness not mentioned by students from the biology workshop (Figure 4).

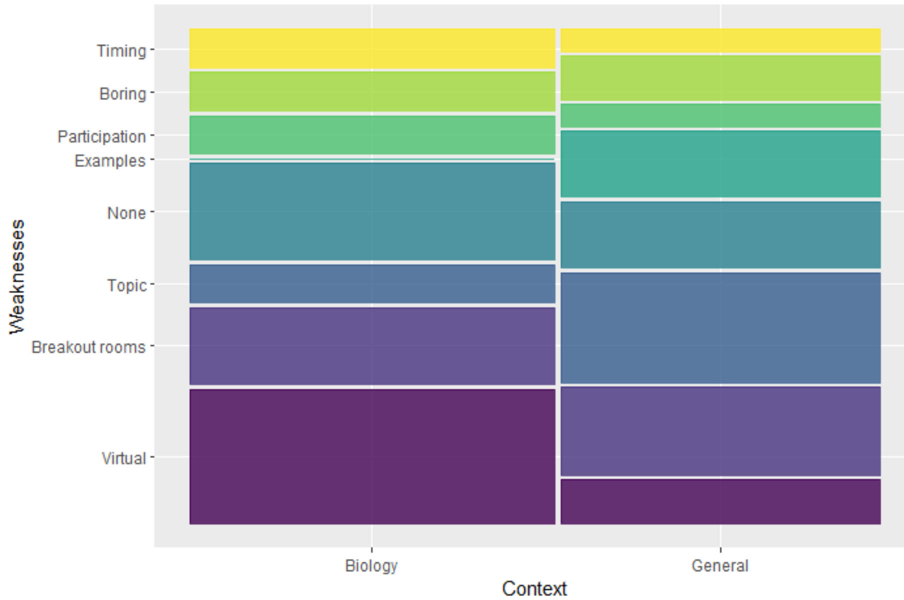


Figure 4. The distribution of responses to the open-ended question "What would you say were the weaknesses of the scientific inquiry workshop and its design? Any improvements you would suggest?"

The width of the bars corresponds to the proportion of the total number of weaknesses mentioned by students from each delivery context. The height corresponds to the proportion of students who mentioned the specified weakness in each context.

4. Discussion

This research demonstrates that a relatively short, 50-minute session can engage students in learning about a transferable skill in ways that help them see its value and relevance, develop an interest in it, and demonstrate knowledge of it. Students were satisfied with the scientific inquiry workshop in both biology and general contexts. They reported finding it helpful for their skill development and gained valuable knowledge and skills that extended beyond this course and their education. It is no surprise that students had a positive perception of the explicit skill development in scientific inquiry. While there are multiple ways to incorporate transferable skills into education (Chadha, 2006), more explicit opportunities enhance students' abilities (John, 2009) and their awareness, attitudes, motivation, and engagement (Hill et al., 2019). Conveniently, the pedagogical methods identified as highly impactful for student learning (e.g., active and experiential learning; Washer 2007; Kuh 2008) were also identified by students as strengths of the workshop.

From this research, we cannot conclude whether a discipline-specific or a general context is preferred for learning and developing transferable skills, as participants only experienced one context each. Still, there were some differences between contexts on a group level. Some of these differences suggest that the general context is preferable, while others favor the biological context. All students from the general context agreed/thought that what they learned would have value beyond the course, and more students from the general workshop, compared to students from the biology workshop, said that skill development workshops should be included in other courses. Students from the general workshops also mentioned the explanations and examples as a strength of the workshop, more so than students from the biology workshop, and this was where the two workshops differed. Students from the general workshops also performed better on the knowledge testing questions. When asked to identify a hypothesis from a list of statements, 94 percent of general-context participants answered correctly, compared with 85 percent of the biology group. Similarly, 96 percent of students in the general workshop correctly ordered the steps of the scientific method, compared to just 70 percent in the biology context. This pattern suggests that students' pre-existing familiarity with the concept of a hypothesis enables strong performance regardless of the context, whereas linking the procedural steps of the scientific method to concrete, everyday examples, as in the general context, may bolster understanding. The biology-specific framing may have been less familiar because this study was conducted in a first-year biology course. We predict that as students' disciplinary identities strengthen throughout their studies, any performance gap across contexts would diminish or even reverse as the discipline-specific context becomes familiar. However, some results suggest potential benefits of the biology context. A greater number of students from the biology workshops agreed that what they learned would be applicable beyond their education. They also expressed more difficulty identifying a weakness and were less likely to mention the workshop topic as a weakness.

The results reflect the disagreement in the literature, with some saying that a discipline-specific context is better (Clanchy & Ballard, 1995) and others that a general context is better (Billing, 2007; Hill et al., 2020). Considering that students in the general workshop performed better on the knowledge-based questions and that grades remain highly important to students; we recommend that transferable skills be first introduced and taught in general contexts and then scaffolded throughout the program in discipline-specific and general contexts. This varied-context approach is viewed as an effective method for learning transferable skills because developing and practicing them across contexts helps students use them flexibly across multiple situations (Billing, 2007; Drummond et al., 1998). Developing transferable skills in a general context before applying them in disciplinary contexts would also allow these skills to be taught in interdisciplinary courses, which have been shown to promote more effective development of essential skills (Elliot et al., 2001; Ivanitskaya et al., 2002).

Although students thought working with their peers during the workshop was a strength, they mentioned using Zoom breakout rooms as a weakness. Generally, students understand the importance and benefits of group work but may be reluctant due to negative experiences with group members (Chang & Brickman, 2018; Hassanien, 2006; Maiden & Perry, 2011). Based on students' comments about the breakout rooms in the scientific inquiry workshop, these issues persist or, in some cases, are even exacerbated when using Zoom breakout rooms. Zoom and its breakout room function have become extensive due to the COVID-19 pandemic (Agustina & Suharya, 2021; Lee, 2021; Singhal, 2020). Despite findings that breakout rooms did not affect students' assignment scores (Singhal, 2020), that students were satisfied with them (Lee, 2021), and that breakout rooms support active learning (Agustina & Suharya, 2021), we observed dissatisfaction with the tool. Some studies have found that lecturers and students experience more negative consequences when using Zoom than when meeting in person (Katz & Kedem-Yemini, 2021). Additionally, although students are generally satisfied with Zoom, they still discuss challenges with communication and peer participation (Lee, 2021). Furthermore, fewer students participate in breakout rooms than in-person discussions (Katz & Kedem-Yemini, 2021). It is also important to remember that the studies examining breakout rooms were conducted during the COVID-19 pandemic, when in-person teaching was often not an option, so the positive perceptions may be skewed. Based on students' general negative view of the virtual format for the skills workshop, future skills development opportunities should be offered in person, where possible. However, virtual learning is not without its advantages. With online skills workshops, more students can participate, making it easier to offer interdisciplinary skills courses. Online learning can also alleviate some barriers students face in in-person courses (Pittman & Heiselt, 2014). Care still needs to be taken when designing online learning opportunities to ensure they are accessible (Pittman & Heiselt, 2014; Roberts et al., 2011; Robertson et al 2021).

In higher education, the formal curriculum, as outlined by learning goals, often differs from what is learned, also known as the "hidden curriculum" (Gibbs et al., 2006; Rowntree, 1987; Sambell & McDowell, 1998). The hidden curriculum refers to the implicit messages and often unintended lessons students absorb, and it is primarily shaped by assessment (Gibbs et al., 2006). Assessment plays a significant role in shaping this hidden curriculum; it signals to students what is truly valued in a course, often more strongly than stated learning outcomes. When transferable skills are not formally assessed, students may perceive them as less important, even if instructors emphasize their value. Therefore, transferable skill learning must not become part of the hidden curriculum. These opportunities should be explicit, clearly included in course learning outcomes and assessments. This approach aligns with strategic learning, in which students manage their learning intentionally to meet their goals and maximize long-term benefits (Gibbs et al., 2006; Sambell & McDowell, 1998). Strategic learners often prioritize what is assessed and visible in the curriculum, so integrating transferable skills into assessment structures is essential to encourage their development. The success of the scientific inquiry workshops, alongside evidence supporting the explicit development and assessment of transferable skills, further reinforces the importance of deliberately incorporating these skills into undergraduate education.

Based on this research and previous findings, we recommend that required courses include explicit education on transferable skills that span all disciplines and year levels. When possible, transferable skills should be developed in interdisciplinary courses, where students can learn and apply these skills across various topics and situations. While further research is needed to better understand how students' strategic learning approaches interact with instructional context and assessment design to influence the development of transferable skills, especially given the possibility that students' preferences for disciplinary versus general contexts may differ depending on their year of study, we present a first step. The findings provide valuable guidance for educators on integrating transferable skill development into higher education in a way that is flexible, feasible, and meets students' needs and interests in becoming lifelong learners who can holistically contribute to their communities and feel prepared for life after graduation.

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