Undergraduate Learning Assistants Foster Students’ Resilience During Transition to Online Learning in a Large Microbiology Classroom

By Kathleen Hefferon and Esther Angert

The COVID-19 pandemic led to a series of emergency transitions to online learning for academic institutions around the world. Previous studies have shown that undergraduate Learning Assistants (LAs) improve student engagement in classroom activities and learning outcomes. In this article, we describe the design and implementation of an LA program to support students in a large microbiology course during the transition to remote learning. We demonstrate that students were more likely to engage with LAs and participate in LA-led classroom activities. LAs promoted more help-seeking behavior from the students and, as a result, contributed to improvements in learning gains. Incorporating LAs into the classroom can thus foster students’ resilience in the face of the current and possible future pandemics.

The COVID-19 pandemic has affected all aspects of society, including our education institutions. The response to escalating cases of COVID-19 infection in the northeastern United States in spring 2020 resulted in the simultaneous closure of most college campuses and public schools. Universities went through an emergency shift to remote learning. All classes, associated learning activities, and assessments rapidly transitioned to an online environment. Instructors underwent rigorous training to structure their courses as best as they could using a digital format. Students encountered various difficulties, ranging from limited internet capacity to mental health issues brought on by the pandemic. Instructors who were concerned for their students’ welfare often took on the role of social worker, thus adding to their own stress levels and changing the relationship between teacher and student.

A strategy used prior to the pandemic to improve students’ learning experiences and sense of well-being in the classroom is the incorporation of peer-based learning through the use of Learning Assistants (LAs). LAs are undergraduates who, following guidance they receive in weekly preparation sessions and pedagogy classes, facilitate discussions among groups of students in a variety of classroom settings. Based on an LA model developed by the Learning Assistant Alliance (LAA) based at the University of Colorado at Boulder, LAs support courses’ transformation into active student learning environments. The LA model functions as an agent of change among faculty, departments, and institutions by providing infrastructure to support and reward instructional innovation. The LA experience can also provide exposure for, and generate interest among, undergraduates who had not previously considered teaching for a future career.

Learning Assistants participate in three main activities: interacting with groups of students, engaging with faculty members in weekly preparation meetings, and participating in the pedagogy course specifically designed for new LAs. LAs interact with students by facilitating discussions about conceptual problems within the discipline, focusing mainly on eliciting student thinking and helping students participate in developing a shared understanding of course content. Every LA should facilitate group discussions by promoting supportive spaces that encourage interaction and collaboration among students (Stoll et al., 2019a). The presence of LAs who are trained in applying various pedagogical topics in the math or science classroom helps more students have their thinking challenged so they can develop a deeper understanding of the content.

Many universities have LAs, who are particularly helpful in large undergraduate classrooms. Learning Assistants can fulfill multiple roles, such as assisting instructors with managing active-learning activities in large classrooms. Ruder and Stanford (2018) demonstrated that LAs can act as facilitators alongside the instructor and form multiple smaller classlike environments during lectures. In other instances, LAs can help teach laboratory sections or manage study or recitation sessions, often in the role of peer leader.

Incorporating LAs into the teach-
ing team has demonstrable positive outcomes for students, LAs, and instructors (Schussler et al., 2015). Research has shown that LAs help improve grades and make the course more enjoyable for students (Huffmyer & Lemus, 2019). The experience also has several positive outcomes for the LAs, including improvements in their communication and leadership skills, content knowledge, and self-confidence (Otero et al., 2010). Instructors benefit as well by receiving feedback on the classroom environment from LAs that they can use to make informed decisions about their own style of instruction (Hockings et al., 2008; Tien et al., 2002). LAs can offer input and help instructors test new teaching strategies that can then be modified before instructors use the strategies with actual students (Goertzen et al., 2011; Knight et al., 2015; Kulatunga et al., 2013).

Other studies have also demonstrated Learning Assistants’ value. Philipp and colleagues (2016) used surveys and open-ended reflections to better understand LAs’ experience, with their results showing that the LA experience led to improved self-confidence and communication skills, deeper content knowledge, and more defined career goals. Interestingly, DeChenne and colleagues (2015) found that students’ motivation increased in an LA-led environment. Tien and colleagues (2002) determined that students’ social interactions improved as well. A study by Hockings and colleagues (2008) found that students who were facilitated by LAs generally outperformed their peers. Lewis (2011) found a higher level of course completion and retention in LA-led classes. Similarly, Kulatunga and colleagues (2013) found that LAs had a positive impact on critical thinking and course performance. Finally, having LAs work with small groups during lecture time has been shown to enhance students’ understanding (Hughes & Ellefson, 2013).

Following the Colorado LA model, Luckie and colleagues (2020) used LAs with physics backgrounds to improve undergraduate lecture structures. Students found it helpful that the LAs were relatable, as they were often in similar degree programs, had taken the same courses previously, and thus acted as role models. Similarly, Otero and colleagues (2010) employed LAs to facilitate group discussion and debate in large lecture settings. In an adapted LA model, student performance improvement was statistically significant. Students commented that LAs brought a wealth of knowledge from having recently taken the course themselves, so they were more familiar with the sorts of challenges that students face.

Romm and colleagues (2010) found that the LA model helped students who were actively seeking a mentor-mentee relationship and space to try out the practice of teaching. Students experienced and enjoyed a personalized education process in large classroom settings, LAs’ advocacy on their behalf with course instructors and administrators, and the course’s improved cohesiveness.

A significant component of the Learning Assistant Alliance model is pedagogical training. Student teaching assistants often have little experience with presenting or explaining material to students. Furthermore, the facilitation of active-learning activities in a large-enrollment class can be particularly challenging for student teaching assistants unless they receive training beforehand (Lee, 2019; Tanner & Allen, 2006). Casem (2006) demonstrated that quality of learning is enhanced when students employed as teachers receive specific training, especially in parallel with their work in the classroom. In addition, having training in pedagogy may strengthen LAs’ ambitions to pursue professor or college instructor positions in their careers (Romm et al., 2010).

**Objectives**

Undergraduate LAs have been shown to improve student learning outcomes (Huffmyer & Lemus, 2019; Luckie et al., 2020; Stoll et al., 2019b). We used the Learning Assistant Alliance model based at the University of Colorado, Boulder, to introduce an LA program to Introductory Microbiology (BioMi2900), an undergraduate course of approximately 200 students at Cornell University. This course transitioned to a remote version of the face-to-face class for spring 2020 and spring 2021 due to the COVID-19 pandemic. LAs continued to support student learning during this time.

We wanted to determine whether LAs could contribute to a course’s success during the transition to online learning and to elucidate whether the LAs themselves could benefit from the experience in terms of their content knowledge, their teaching skills, and their professional goals. Because the course under study, Introductory Microbiology, was held during the emergency transition to online learning, we wanted to assess whether LAs supported students’ learning outcomes and sense of belonging during this time.

**Methods**

LAs were recruited in fall 2019, prior to the global pandemic. A description of LA duties is provided in Figure 1. All of the duties were listed as part of a special studies course requirement rather than as a paid internship. The LAs met with faculty and graduate teaching assistants (TAs) as part of a teaching team at least once per week to prepare for future classes, develop deeper content understanding, and exchange information about how students were progressing in the course. The LAs also took a weekly pedagogy course that introduced them to educational research and active-learning strategies that support student engagement. LAs had roles...
in discussion sections and study groups as well as private tutoring for students who sought extra help. The study groups were run solely by the LAs, who answered student questions with course content and offered practice test questions from previous semesters. LAs ran study groups on their own in 2020 but worked in pairs in 2021. The discussion sections were run by faculty and graduate student TAs; LAs were present to help students navigate the material. To determine the effectiveness of LAs during the transition to online learning, we conducted a series of surveys of students, LAs, and the teaching team, respectively. The surveys included both Likert-scale and open-ended question formats and explored student-reported interactions with LAs. LAs also completed pre- and postsemester surveys that detailed their own sense of confidence and satisfaction with the experience of working with students.

The pedagogy course syllabus is shown in Table 1, with information about the week when the transition to online learning took place (Week 6) in bold and underlined. Cornell University underwent a complete lockdown on March 13, 2020, in response to the COVID-19 pandemic, and students were expected to leave campus as quickly as possible for the remainder of the semester. Courses were halted for 3 weeks to provide the faculty with time to restructure their courses for emergency remote learning. Courses resumed in their new online formats during the week of April 6, 2020. For the spring 2021 semester, courses began a week later than usual, and the week of spring break was replaced with two shorter stretches of wellness days throughout the semester to help students cope with pandemic stress. Courses remained online for the duration of 2021. LAs used a poster project as a final reflection on the topics in their pedagogy course that resonated the

FIGURE 1
Schematic overview of LA responsibilities.

TABLE 1
Pedagogy course syllabus, 2020 and 2021.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic 2020</th>
<th>Topic 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orientation</td>
<td>Orientation</td>
</tr>
<tr>
<td>2</td>
<td>How to stimulate learning through questioning, listening, waiting</td>
<td>Online learning, engaging with students in breakout rooms on Zoom</td>
</tr>
<tr>
<td>3</td>
<td>Students’ prior knowledge and formative assessment</td>
<td>How to stimulate learning through questioning, listening, waiting</td>
</tr>
<tr>
<td>4</td>
<td>Metacognitive strategies</td>
<td>Creating a sense of belonging</td>
</tr>
<tr>
<td>5</td>
<td>Motivating students</td>
<td>Metacognitive strategies</td>
</tr>
<tr>
<td>6</td>
<td><strong>Facilitating student interactions while transitioning online</strong></td>
<td>Students’ prior knowledge and formative assessment</td>
</tr>
<tr>
<td>7</td>
<td>The science behind how we learn</td>
<td><strong>Differentiated Instruction vs. Universal Design for Learning</strong></td>
</tr>
<tr>
<td>8</td>
<td>Promoting a growth mindset</td>
<td>Motivating students</td>
</tr>
<tr>
<td>9</td>
<td>Teaching as research, and identifying a teaching community</td>
<td>Promoting a growth mindset</td>
</tr>
<tr>
<td>10</td>
<td>Creating a sense of belonging</td>
<td><strong>Attributes of effective teachers: instructional values</strong></td>
</tr>
</tbody>
</table>

*Note.* Point of emergency transition to online learning took place during Week 6 of 2020. Course topics listed in italics were unique to their respective year.
most with their online teaching experiences over the semester.

Results

In 2020, five LAs enrolled in the program. By 2021, this number had increased to 13 LAs. The increase can be attributed to increased student awareness of the LA program. All of the LAs who were recruited had previously taken the introductory microbiology course. Students in microbiology illustrated their satisfaction with LAs on a final course survey (see data in Figure 2 and selected comments in Appendix A).

Because the course transitioned to an online environment, we wanted to determine whether LAs had more success than the instructors and graduate TAs with helping students engage in breakout rooms. Our online version of the discussion sections involved placing students in breakout rooms on Zoom. During the spring 2021 semester, we had enough LAs to include one in each breakout room to guide students during discussion section activities. The remainder of the breakout rooms were monitored by graduate TAs or instructors. LAs, TAs, and instructors shuffled between breakout rooms from one week to the next so that students experienced all three throughout the semester. The results of a survey given to undergraduate LAs, graduate TAs, and instructors are provided in Figure 3.

We wanted to determine how students in the class ranked LA-led study groups in comparison with other types of support available in the course. We asked this question on the end-of-semester survey (results shown in Figure 3). Students found the use of LA-led study groups to be more helpful than any of the other learning activities offered, including online versions of lectures (live or recorded), an online discussion board, or even study sessions with their friends. The results of this survey suggest that in an online setting, LA-led study groups are the most beneficial. We found that weekly participation in online study groups ranged from 12 to 50 students, with the greatest number of students seeking help immediately prior to a test. This contrasts significantly with previous semesters, when student attendance rates dwindled to between three and six students each week in study groups led by instructors or graduate TAs. One reason for this difference in attendance could result from the ease with which LAs could adjust their study session schedules to match student needs. Another reason could stem from inherent shyness that students reported around the older graduate TAs and instructors, which may have deterred their help-seeking behaviors in the past.

The LAs were asked to present posters at the end of the semester that described topics discussed in the pedagogy class that they found most helpful with their teaching experiences (Figure 5). The LAs selected “acquiring a growth mindset” as their most influential topic, followed by “online teaching and learning.” The growth mindset topic dealt with overcoming challenges in learning and helped LAs reflect on themselves as teachers during the pandemic.

We gave a final survey to the LAs...
FIGURE 3
Breakout room dynamics between LAs, TAs, and instructors.

Note. LA = Learning Assistant; TA = teaching assistant. TA $n = 3$; LA $n = 13$; instructor $n = 3$.

FIGURE 4
Student responses to prompt to rate how helpful different learning activities were for their learning ($n = 168$).

Survey Questions

1. I sit quietly in the background and say little unless a student in my breakout room asks for help.
2. My students are generally very quiet in my presence.
3. I need to keep my students focused or else they will chat in our breakout room instead of working on the problem.
4. One student tends to dominate the conversation.
5. Some of my students only use chat to communicate with others.
6. I am certain that my students leave the breakout room with a better understanding of the material than when they first entered.

1. Live online lectures
2. Recorded lectures
3. Textbook
4. Classroom polling
5. Discussion boards
6. Working with friends outside of class time
7. PowerPoint slides
8. Office hours
9. Learning Assistant–led study groups
10. Discussion sections
at the end of each semester to glean information about their experiences working in an online version of a face-to-face course environment, as well as to solicit their recommendations for how to improve training and experiences for future LAs (Appendix B). Many of the suggestions focused on community building for microbiology students.

**Discussion**

The COVID-19 pandemic resulted in university campuses closing and transitioning to an emergency online format of instruction within a narrow time period. Students struggled throughout the semester with an assortment of issues, such as stress and anxiety due to personal circumstances as well as the new academic demands created by remote learning. Many students also battled a loss of motivation brought on by the isolation that can accompany an online learning environment. Undergraduate LAs can function as peers and role models to improve and solidify students’ engagement and motivation to achieve their learning goals. In this article, we showed that the introduction of LAs into a large microbiology classroom helped both support student learning and establish a sense of belonging during the transition to online learning.

LAs supported the course throughout the transition to remote teaching, and their contributions were appreciated by both faculty and students. Students expressed their appreciation for LAs and the importance of their role as an additional course resource. LAs also provided novel insight and a student perspective to the teaching team. LAs used their experiences with other courses that they were concurrently taking to advise the teaching team about the design of online activities. These unique contributions enabled the instructors to quickly make changes to the course to create an online format of a face-to-face course that would be the most beneficial for the most students.

Students were more likely to engage with LAs in online Zoom breakout rooms than they were with graduate TAs or instructors; they also were more willing to attend LA-led study groups for extra help than to attend TA- or instructor-led study groups. Students ranked the LA-led study groups as the best help with their learning compared with other course resources, including instructor office hours, recorded lectures, and online discussion boards. Students commented that they were comfortable speaking with the LAs as peers but were intimidated by instructors and graduate TAs. Students also reported that they appreciated help from someone who could speak in relatable language and explain course content from a student perspective. These responses are supported by previous research on the use of undergraduate LAs. Luckie and colleagues (2020), for example, describe how highly motivated LAs can in turn motivate other students. LAs were reported to form comfortable interactions with the students and act as role models (McVey, 2018; Ruder & Stanford, 2018).

LAs presented posters that reflected on their learning gains over the past semester by connecting topics covered in the pedagogy course with their teaching experiences. The most cited topic, growth mindset, has also been a popular topic in pedagogy research, as described by Yeager and colleagues (2019). The second most cited topic concerned the transition to online learning that everyone experienced, followed by the topic of achieving a sense of belonging, which
could reflect the isolation students felt from both peers and instructors during the COVID-19 pandemic. These findings validate the role that LAs play as both teachers and students.

LAs reported that they benefited from the program and found it useful in multiple ways, a finding supported by previous studies. For example, Romm and colleagues (2010) found that LAs enjoyed their teaching role and the integration of pedagogical study of science education. LAs improved their communication skills, deepened their own knowledge of course content, and incorporated strategies they were learning in the pedagogy class to become better learners themselves. Similar acknowledgments were found by Romm and colleagues (2010), Philipp and colleagues (2016), and McVey (2018).

Conclusion

In this study, students found the LAs to be helpful. Luckie and colleagues (2020) discussed how LA programs have historically shown a positive relationship with academic performance as well as with the facilitation of higher retention rates and stronger critical thinking. Reported student satisfaction with the introduction of LAs in the current study adds support to this conclusion, and it appears that LAs could reach out to floundering students and help them strengthen their resilience during the pandemic. It is important, however, to remember that emergency online learning brought about rapid changes in course structure, so more data should be collected over additional semesters to determine the full contribution of LAs to learning outcomes (McVey, 2018). The LAs served as effective role models for their less experienced peers due to their recent success with the same course, coupled with the fact that they themselves were also going through an academic upheaval caused by the pandemic. The positive impact of LAs described in this study can offer a solution to future circumstances that could require an emergency transition to online teaching.

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References


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