Blended Learning And Lab Reform: Self-Paced Sotl And Reflecting On Student Learning

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As part of a large exercise physiology laboratory (lab) reform project, we used blended learning to support graduate teaching assistants and lab technicians in developing their pedagogical knowledge and create an entry point to reflective conversations about teaching and learning. Because self-paced asynchronous online modules can enable reflective and self-determined learning, this asynchronous professional development course is punctuated with reflective questions for the instructional team preparing to teach reformed exercise physiology labs. Asynchronous course content was shared via short videos, podcasts, and readings. We debriefed this self-paced, SoTL-informed course together, in-person. This social debriefing kicked off our weekly synchronous reflective conversations about teaching and learning in a community of practice. Developing a shared language for talking about teaching, enabling student learning, practicing effective teaching, and beginning to contemplate teaching philosophies were described by graduate teaching assistants as notable aspects of this blended learning journey. Lab technicians described discovering SoTL and discussing learning challenges as helpful to their teaching.

Our experiences discovering and learning about the Scholarship of Teaching and Learning (SoTL) and SoTL-informed teaching practice specifically, focus us sharply on teaching that improves student learning (Felten, 2013). We developed our teaching practices while becoming academics through attending developmental workshops and programs at teaching and learning centers in different parts of Canada. Understanding SoTL-informed teaching and the dearth of it in exercise physiology labs drove the vision, development, and implementation of our educational leadership project reforming teaching and learning in exercise physiology labs.

Miller-Young and Yeo (2015) remind us that when we do SoTL, we should be aware of and describe our assumptions and beliefs about student learning. We believe students learn through doing and that students actively learn through the experiences we create for them in labs (Ambrose et al., 2010). We believe that student curiosity (Eyler, 2018) and an environment of

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psychological safety (Edmondson, 2019) are key influences on whether students can learn in science labs. Feeling psychologically safe means believing we will not be humiliated in a group for trying something new, using mistakes to learn, and feeling accepted while being a novice (Edmondson, 2019). Specifically, we wrote an educational leadership grant to completely reform and renew traditional exercise physiology labs in our faculty based on our SoTL learning and beliefs.

The purpose of this paper is to describe the professional development intervention we created and implemented with graduate teaching assistants (GTAs) who were teaching undergraduate exercise physiology labs as part of a large, multi-faceted lab reform project. The asynchronous micro-course we created shared content that we believed would help GTAs teach in ways that strengthen and improve student learning. We followed the pre-term micro-course, which will be described in detail later in this paper, with a weekly community of practice (CoP) meeting where GTAs reflected on their teaching in community with both of us. We know reflection on our teaching allows us to explore and scrutinize our influence on student learning in higher education (Felten, 2013). Reflection helps us stretch our perspective, bolster our commitment to strengthening student learning (Rodgers, 2000), and improve our teaching (Hubball et al., 2005). This 30-minute meeting enabled each participant to reflect and think out loud together on their teaching strengths and opportunities each week. For a detailed account of seven GTAs' experiences with our professional development intervention, please see Camarao & Din, 2023.

Our Educational Leadership Foundations

We have been supported in our lab reform work, which is truly culture change work, by the Vice Provost, Teaching and Learning, a Teaching Scholars program grant, and a cohort of peers, leading different change projects across five faculties at the University of Calgary (Din et al., 2022). In reflecting on and sharing the professional development chapter of our lab reform story, we are beginning to see ourselves as leaders in our faculty, enacting educational leadership when we empower and inspire the graduate teaching assistants (GTAs) to enable rich experiential learning in reformed labs. Specifically, we wrote an educational leadership grant to completely reform and renew traditional exercise physiology labs in our faculty based on our beliefs and SoTL learning. Educational leadership is embedded in our work as Teaching Scholars. Our capacity to practice educational leadership throughout our lab reform work enabled the GTAs to learn about and take ownership of their role in supporting learning through SoTL-informed teaching in reformed labs. Our professional development intervention supported lab technicians in discovering SoTL in the micro-course and seeing how the weekly 30-minute reflection on teaching we added influenced the ways the GTAs taught, and the students learned. Prior to our reform work, lab technicians ran a weekly lab meeting that did not include reflection on teaching.

In their study of 11 educational leaders that participated in an earlier cohort of the same Teaching Scholars program as us, Fields et al. (2019) found educational leadership involves

affective, mentoring, and empowering behaviors as well as an action-orientation, teaching excellence, and research and scholarship. Carefully assessing our own specific application of all six of these leadership constructs is a project for another scholarly paper; however, over four years, working to design and implement change in exercise physiology labs at the graduate and undergraduate level, we have focused on empowering and supporting the instructional teams to develop their understanding and practice of evidence-based teaching. We have supported and mentored GTAs teaching reformed labs at the undergraduate level and early survey responses from undergraduate students suggest our educational leadership positively influenced students' experiences in reformed exercise physiology labs in a required course in our faculty.

Who we are and our beliefs about teaching and learning impact how we practice and embody educational leadership in this project. Our beliefs inform the purpose of our four-year lab reform project. As faculty members, we (Cari and Martin) are striving for excellent teaching that enables rich learning, student-centered active learning, and mentoring instructors who are open to both.

Throughout our reform project, Martin actively advocates for the instructional team's professional teaching development and SoTL learning. Prior to our project, the instructional team had not heard of nor explored SoTL. They had not been exposed to the evidence and scholarship that underpins the teaching and learning changes we made to labs in this context. Martin is the exercise physiologist and the person with the most positional power in our reform work (that is, he is the course instructor in the courses of interest and supervisor to some of the graduate students teaching the new labs), Martin is also the director of the course-based graduate program in exercise physiology in the Faculty of Kinesiology at the University of Calgary.

Cari is a leadership and coaching scholar in Kinesiology. She has a liberal arts undergraduate degree and has not experienced the labs pre-reform (or any science lab in higher education). She cares about and advocates for student agency and project-based learning. Cari believes inquiry-based learning should be included in all courses (from preschool to PhD). Inquiry-based learning lacks one single definition (Archer-Kuhn & MacKinnon, 2022); however, in our project, we focused on adding learning to labs where students lead the inquiry process through identifying a question they are curious about, selecting the methods they will use to answer it, troubleshooting, making decisions, and actively critiquing the process while it unfolds and at the end of their inquiry (Archer-Kuhn & MacKinnon, 2022). In higher education science courses specifically, traditional labs where students confirm a known result and following a series of steps determined by their instructor to find this pre-determined outcome are ineffective in developing student's critical thinking and scientific skills (Smith & Holmes, 2021). Across multiple studies in higher education, scholars investigating science learning have found inquiry-based labs are more positive, engaging, and effective in developing the skills of a scientist when they are inquiry-based (Smith & Holmes, 2021).

Cari also believes reflection on experience is mandatory for meaningful experiential learning across contexts (Tormey et al., 2022). Experiential learning, which is connected to inquiry-based learning through inviting students to learn actively, dive deeply into an experience

and make sense of it through reflection on this experience (Halpin et al., 2020). In a biology context, Halpin et al. (2020) suggest students must reflect on experience through "intentional metacognitive processes" (p. 99), which affords students the opportunity to connect their previous knowledge with their experience and increase their knowledge. Although not the focus of this paper, we added low-stakes post-lab reflections to each lab during this project.

Together, we discovered the power and positive influence of walking meetings during our educational leadership project (Kling et al., 2021) and schedule them any time we can. The bulk of this lab reform project ideation was developed outside walking a familiar tree-lined loop on our campus -- with Martin slowing down for Cari. Specifically, we have changed the way lab teaching and learning happen in the required undergraduate exercise physiology course, in our faculty.

Self-paced, Blended Learning SoTL Course

In this section, we describe the genesis of the self-paced SoTL and blended learning portion of the large-scale exercise physiology lab reform project we have been leading over the last four years.

In the first year of our lab reform project, Martin observed the current iterations of the undergraduate exercise physiology course of focus and figured out what was working and what needed reform to enable rich experiential learning for students (Tormey et al., 2022). In the past, the undergraduate exercise physiology labs that we reformed during this project "had a negative reputation among undergraduate students in our faculty due to punitive marking practices, and GTAs had no pedagogical training or ongoing support for developing their teaching practices" (Camarao & Din, 2023, p. 4). Martin reimagined and rewrote the learning outcomes, activities, and assessment for all weekly 3-hour labs in year two of our project, with Cari's support as sounding board and SoTL-advocate. Pre-reform, lab assessments emphasized formatting while reformed labs reward student engagement (Birt et al., 2019). For example, students are assessed on their depth and breadth of reflective thinking in their post-lab reflections and graded on their critical thinking and problem solving at the end of their inquiry projects. Learning activities used to focus on technical skills only such as measuring oxygen uptake, measuring running speed on a treadmill, or collecting output data from a stationary bicycle. Our reformed labs encourage and enable scientific thinking (Wieman, 2017), which includes making predictions, asking questions, troubleshooting, making decisions, and experimenting. Student metacognition and reflection was not part of the lab activities nor assessment in the past, while low-stakes reflection was added each week after the 3-hour hands-on experience in both graduate and undergraduate courses (Schenck & Cruickshank, 2015). For a description of our lab reform vision and additional resources supporting our changes, please read our blog post, Reworking the recipe: Adding experimentation and reflection to exercise physiology labs, which is linked to here: https://osf.io/preprints/edarxiv/9svkf

New, SoTL-informed lab learning outcomes, assessments, and activities precipitated the need for changing and improving the teaching behaviours that facilitate all three. Cari drafted

and then worked with Martin to pin down what was essential for the GTAs to learn before embarking on teaching the reformed undergraduate labs. Martin wanted the team to be exposed to SoTL-informed teaching practices, which he had learned about in a course at a teaching and learning centre while doing his post-doctoral work at the University of British Columbia. Cari created an asynchronous, SoTL-informed micro-course introducing GTAs, who are solely responsible for the learning experiences undergraduates have in these labs, to evidence-informed teaching topics and practices using blended learning. We believed this course would create a foundation for understanding and practicing effective teaching in the reformed labs first by giving GTAs the opportunity to do self-paced learning prior to the start of the course. The nine modules in the micro-course are listed in Table 1.

Table 1

The Asynchronous Micro-Course Modules

Module	Content Summary
1. Teaching philosophies	Defining and reading examples of teaching philosophies.
2. A bit of learning theory	Contrasting behaviorist and constructivist learning theories.
3. Backwards design	Using Bloom's Taxonomy to design effective learning outcomes, learning activities, learning assessments and rubrics
4. Active learning	Defining and exploring examples of learning activities.
5. Psychological safety	Discovering and remembering instances of experiencing this construct as an undergraduate STEM student.
6. Debriefing a learning activity	Using frameworks for processing learning activities (e.g., Rolfe's (2002) What, So What, Now What scaffold).
7. Experiential learning	Introducing critical reflection as a necessary step of connecting hands-on experience to learner knowledge and practice.
8. Asynchronous learning	Outlining simple ideas to enrich digital content (e.g., pre-lab videos)
9. Feedback	Describing elements of effective feedback and linking them to learner's own lived experiences.

The micro-course is shared with instructional team members a few weeks before the semester begins (Shamir-Inbal & Blau, 2020). Our self-paced course takes between 6-9 hours to complete. The nine modules include an intentional mix of short videos, podcasts, and readings compiled in a digital workbook (Microsoft Word document) and punctuated by reflective questions for the learner to address as they complete each module. For example, at the start of the Feedback module, learners are asked to remember a time when they were an undergraduate student and received very useful feedback as well as a time when they did not. In the Psychological Safety module, learners are invited to brainstorm ways they could help students feel they will not be embarrassed for asking questions or coming up with incorrect answers during labs. In all nine modules, learning activities rely heavily on reflective questions (Howard, 2021) to encourage the solitary learner to actively connect the material, their personal experiences, and their future lab teaching practices.

Instructional team members complete the course on their own and bring their reflective responses and questions to the two-hour learning debrief, which happens roughly one week prior to their first lab teaching experience of the term. During this in-person group debrief, instructional team members are asked to discuss and ask questions about how the micro-course content could be applied in their lab teaching. During this debrief of the asynchronous course, the blended learning begins. Blended learning is most simply defined as a mix of contexts, media, methods, technologies combined to maximize learning (Cronje, 2020). In our pedagogical intervention, we decided to begin learning with a self-paced SoTL-course to allow each new GTA (and in the first iteration of this project, the lab technicians – please note, the lab technicians completed the micro-course once while new GTAs each term complete the micro-course for the first time) to be exposed to and personalize the SoTL-informed content included in our asynchronous course.

The asynchronous micro-course acts as an entry point and gateway to weekly in-person reflective conversations about teaching between instructional team members and us, the lab reform leaders (Donaldson, 2020), once each week. The micro-course also serves as an opportunity to develop a shared or common language, grounded in SoTL content, to use at times when we were reflecting together in our CoP each week. We designated and protected the first 30 minutes of Friday afternoon lab meetings, where traditionally, the GTAs met with the lab technicians to go over technical details from the week and learn about what needs to be done in the coming week.

Weekly In-Person Teaching Reflection

Actively reflecting on our teaching helps us explore and scrutinize our influence on student learning, develop our teaching identity, stretch our perspectives, and increase our accountability to teaching in ways that enable student learning (Felten, 2013; Hubball et al., 2005; Rogers, 2002). We spent 30 minutes each Friday reflecting out loud and in community together. We worked to develop a true community of practice (CoP) in these weekly meetings. A CoP forms when a group of practitioners come together and reflect on their shared practice with

the aim of improving what they do in the field. Healthy CoPs help members develop their practical skills and strategies (Wenger-Trayner & Wenger-Trayner, 2020). We were the CoP leaders, encouraging all CoP members to reflect on, make sense of, ask each other questions about, and intentionally improve their teaching each week (Pyrko et al., 2017). We participated, even though we were teaching different courses/topics from the GTAs, in the open-ended questions with which we started each CoP meeting: What went well in your teaching this week? What was a struggle or something you would like help from this group in figuring out? GTAs told the researcher studying this professional development intervention that they felt psychologically safe in the teaching focused CoP, that they were supported in trying new teaching practices in their labs, that they felt they were becoming autonomous and confident teachers (Camarao & Din, 2023). One recommendation for future practice and translating this professional development intervention to diverse teaching and learning contexts, is for the CoP leaders to "model what they seek and go first" (Camarao & Din, 2023). This means the GTAs appreciated that Cari and Martin began each weekly reflection with their own example of teaching they believed went well and followed with a struggle they were having or a moment they were not proud of from their teaching that week. This approach opened the reflection on teaching time and increased GTAs' comfort being honest in their teaching reflections (Camarao & Din, 2023).

Based on the research and publication of a paper, where Joy Camarao interviewed seven GTAs who participated in the complete professional development experience that included the asynchronous micro-course and weekly CoP teaching reflections across a semester while they were teaching reformed exercise physiology labs, we learned GTAs felt psychologically safe in our weekly CoP meetings and found reflecting each week on their teaching to be a novel experience (Camarao & Din, 2023). GTAs in this study described feeling yet also appreciating the positional power Martin held in our CoP, they began thinking about their own teaching philosophies, tried new teaching and learning strategies in their labs, and became more confident as teachers across the semester. For a complete description of this research and findings, please see Camarao and Din (2023). Currently, the two lab technicians who participated in three iterations of the professional development intervention are practicing facilitating their own weekly CoP meetings with 30 minutes protected for and focused on reflecting on teaching which enables learning.

Concluding Questions to Consider

The purpose of this paper was to describe the professional development intervention we created and implemented with graduate teaching assistants (GTAs) teaching undergraduate exercise physiology labs as part of a large, multi-faceted lab reform project. This is a SoTL-informed professional development intervention we created as part of a large lab reform project in undergraduate exercise physiology labs in our faculty. To close this paper, we invite readers to pause with a warm tea or schedule a walk outside to reflect on and draft their own unique answers to the questions we have found over the last four years in our teaching and learning reform work to have been grounding, supportive, and more vital than we could have imagined

before we began: When are you reflecting on your teaching practices? Could you carve out 30 minutes each week to consider (and discuss) what went well in your teaching and what needs work? Who are you talking to about teaching and learning in your context? What are the small yet significant conversations you are having about teaching and learning in your context (Mårtensson & Roxå, 2016)? What ones ~~would you like to~~ *will you* initiate this year?

References

Ambrose, S. A., Bridges, M. W., DiPietro, M., Lovett, M. C., & Norman, M. K. (2010). *How learning works: seven research-based principles for smart teaching.* Jossey-Bass.

Archer-Kuhn, B. & MacKinnon, S. L. (2022). Eight fundamental principles of inquiry-based learning. In MacKinnon, S. L., & Archer-Kuhn, B. (Eds.), *Reigniting curiosity and inquiry in higher education: A realist's guide to getting started with inquiry-based learning* (pp. 11-27). Stylus Publishing.

Birt, J. A., Khajeloo, M., Rega-Brodsky, C. C., Siegel, M. A., Hancock, T. S., Cummings, K., & Nguyen, P. D. (2019). Fostering agency to overcome barriers in college science teaching: Going against the grain to enact reform-based ideas. *Science Education, 103*(4), 770–798. https://doi.org/10.1002/sce.21519

Camarao, J., & Din, C. (2022). Creating a Teaching Community with Graduate Teaching Assistants: A Scholarly Personal Narrative. *International Journal for the Scholarship of Teaching and Learning, 16*(2). https://doi.org/10.20429/ijsotl.2022.160203

Camarao, J. & Din, C. (2023). "A Group of People to Lean On and Learn From": Graduate Teaching Assistant Experiences in a Pedagogy-Focused Community of Practice. *Teaching and Learning Inquiry*, *11*. https://doi.org/10.20343/teachlearninqu.11.11

Din, C., Alharbi, H., MacInnis, M., Mardjetko, A., Archer-Kuhn, B., Jamniczky, H., & Jacobsen, M. (2022). Leadership, SoTL, and mentorship in a teaching scholars community of practice. *Papers on Postsecondary Learning and Teaching, 5*, 93-99.

Donaldson, J. (2020). Building a digitally enhanced community of practice. *Information and Learning Science, 121*(5/6), 241–250. https://doi.org/10.1108/ILS-04-2020-0066

Eyler, J. (2018). How humans learn: The science and stories behind effective college teaching.

Felten, P. (2013). Principles of good practice in SoTL. *Teaching and learning inquiry*, *1*(1), 121-125.

Halpin, P. A., Donahue, A. E., & Johnson, K. M. S. (2020). Undergraduate biological sciences and biotechnology students' reflective essays focus on descriptive details of experiential learning experiences. *Advances in Physiology Education*, *44*(1), 99–103. https://doi.org/10.1152/advan.00144.2019

Howard, J. (2021). Barriers and drivers in online micro-course professional development: Navigating issues of teacher identity and agency. *Teaching and Teacher Education, 105*, 103397. https://doi.org/10.1016/j.tate.2021.103397

Kling, H. Moore, K. J., Brannan, D., & Caban-Martinez, A. J. (2021). Walking meeting effects on productivity and mood among white-collar workers: Evidence from the walking

meeting pilot study. *Journal of Occupational and Environmental Medicine, 63*(2), e75–e79. https://doi.org/10.1097/JOM.0000000000002098

Mårtensson, K., & Roxå, T. (2016). Leadership at a local level–Enhancing educational development. *Educational Management Administration & Leadership, 44*(2), 247–262. https://DOI: 10.1177/1741143214549977

Miller-Young, J., & Yeo, M. (2015). Conceptualizing and communicating SoTL: A framework for the field. *Teaching and Learning Inquiry*, *3*(2), 37-53.

Pyrko, I., Dörfler, V., & Eden, C. (2017). Thinking together: What makes communities of practice work? *Human Relations, 70*(4), 389–409. https://doi.org/10.1177/0018726716661040

Rolfe, G. (2002). Reflective practice: where now? *Nurse Education in Practice, 2*(1), 21-29.

Schenck, J., & Cruickshank, J. (2015). Evolving Kolb: Experiential education in the age of neuroscience. *The Journal of Experiential Education, 38*(1), 73–95. https://doi.org/10.1177/1053825914547153

Smith, E. M., & Holmes, N. G. (2021). Best practice for instructional labs. *Nature Physics*, *17*(6), 662–663. https://doi.org/10.1038/s41567-021-01256-6

Tormey, R., Isaac, S. R., Hardebolle, C., & Le Duc, I. (2022). *Facilitating experiential learning in higher education: teaching and supervising in labs, fieldwork, studios and projects*. Routledge.

Wenger-Trayner, B. & Wenger-Trayner, E. (2020). *Learning to make a difference: Value creation in social learning spaces.* Cambridge University Press

Wieman, C. (2017). *Improving how universities teach science: Lessons from the science education initiative.* Harvard University Press.