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A Three-Party Case Study: Exploring the Value of Student Work in Co-creation in Teaching and Learning

ABSTRACT

In the context of a large first-year business course, we explore the value of student contributors, the former students from this course, working with faculty to improve the learning experience of the students enrolled in the course. By describing our study of the roles, impacts, benefits, and challenges of the student contributors' involvement in creating supplemental resources, such as videos and practice problems, intended to augment the teaching process of the faculty and the learning process of the student learners, we contribute to the understanding of this three-party experience. Our study included interviews, survey questions, and resource-engagement analytics. We found that because student contributors can provide unique perspectives, greater inclusivity, and diverse approaches to teaching, there are benefits to the instructors, the student contributors, and the student learners.

KEYWORDS

student work, students helping students, resource development, three-party experience, teaching and learning

INTRODUCTION

Our article focuses on the value of student work within the context of an academic development project for a mandatory undergraduate course (Introduction to Quantitative Decision Making) in the business school of the University of British Columbia, a public university in Canada. This quantitatively-focused first-year course is taught in multiple sections (typically four per year) of 200–250 students per section in large classroom settings. Many students struggle to adapt to learning in this rigorous course where, if a student falls behind for any reason, it is challenging to catch up. Even though regular peer-assisted study sessions, based on the supplemental instructional model, are available for students, there is substantial variability among students in terms of their exposure and understanding of the curriculum content. In particular, the large classroom environment makes it different for students to ask questions and interact with the material.

In 2018, the two instructors applied to the university's Teaching and Learning Enhancement Fund to create supplemental course resources to ameliorate the difficulties of the learning experience of future students. The objective of the project was to enhance personalized learning with increased flexibility, diversity, and student engagement with the course content by generating resources for the

students' learning needs. When applying for the funds, the instructors planned to recruit former students ("student contributors") for the development of supplemental resources to empower future students ("student learners"). Over four months of the summer of 2018, a team of 12 student contributors produced a large library of supplemental resources: 52 five- to ten-minute course videos, more than 100 problems to accompany the videos, and 100 end-of-module practice problems with immediate and detailed feedback.

Under the vision and guidance of the two instructors and the professional staff ("the faculty") of the university, the project became predominantly student-run: the student contributors championed the entire production of the resources and management of the project, with the faculty largely providing high-level guidance. The project embraced the idea of *students helping students*.

The supplemental resources were piloted in September 2018. As part of the project evaluation, surveys were administered to the first section ($N = 205$) of the course. Students were asked about their experiences with the supplemental resources and the impact of the resources on their learning. The richness of the feedback from the student learners inspired us to further explore the value of the student contributors' work relating to all the involved parties in the teaching and learning process—including the student contributors, the student learners, and the faculty—within the context of the project. The primary intent of the evaluation was to inform the experiences of students and faculty in co-creating supplemental resources and to advance the value of student contributors in academic development in the area of student learning support.

We call this article a *case study* on the understanding that a "case study is not a methodological choice but a choice of what is to be studied" (Stake 2000, 435). Stake explains that a case study is the study of the particularity and complexity of a single case. Because our article focuses on our project for the enhancement of teaching and learning and explores the value of the student contributors' work through the various perspectives of all parties involved in the teaching and learning processes, we think that a "case study" is well-suited to describe our situational qualitative-dominant inquiry.

LITERATURE REVIEW

Students and their learning are at the heart of the scholarship of teaching and learning. Historically, students have been viewed as consumers or objects in teaching and learning (Astin [1984] 1999; Snare 1997). However, they have been repositioned as essential actors and agents in academic development (Healey, Flint, and Harrington 2016; Matthews 2016). Catherine Bovill, Alison Cook-Sather, and Peter Felten (2011) reconsider students' roles in education as producers (Cook-Sather et al. 2017; Marquis et al. 2016), partners (Coombe et al. 2018), co-inquirers (Bell 2016; Werder et al. 2016), and co-creators (Felten et al. 2019; Samson 2019) of teaching approaches and course design, where student-faculty relationships should be based on respect, reciprocity, and shared responsibilities. Student partnership can be defined as "a process of student engagement, understood as staff and students learning and working together to foster engaged student learning and engaging learning and teaching enhancement . . . in which all participants are actively engaged in and stand to gain from the process of learning and working together" (Healey, Flint, and Harrington 2014, 7).

With the proliferation of the concept of students as partners, there has also been a similar proliferation of studies on the benefits, impacts, challenges, and implementation of students as partners in academic institutions.

Benefits of students as partners

When students and faculty bring their respective perspectives to the partnership (Cook-Sather, Bovill, and Felten 2014; Mercer-Mapstone and Marie 2019), the expected result is that each party can learn from the other, with the ultimate impact being that the symbiotic partnership, as a whole, is able to achieve teaching and learning practices beyond that of the sum of its parts (Coombe et al. 2018). Common benefits to students include enhanced motivation, stronger sense of belonging, and deepened understanding of pedagogical practices (Barrineau et al. 2016; Goff and Knorr 2018; Matthews et al. 2018; Peets et al. 2009). Faculty members and academic developers benefit from incorporating student perspectives from authentic student sources into pedagogical practices (Cook-Sather et al. 2017; Kligyte et al. 2019; Marquis et al. 2016). Even in non-western contexts, the student-faculty partnership positively contributes to student engagement, development, and academic functioning (Kaur, Awang-Hashim, and Kaur 2019). Overall, student-faculty partnerships have the potential to achieve shared respect and trust, more inclusive educational practices (Matthews et al. 2018), and enriched learning from one another within collaborative learning communities (Lubicz-Nawrocka 2018).

Challenges of students as partners

As a relatively novel concept to the field of academic development, student-faculty partnerships have not come without their challenges. While Mercer-Mapstone, Dvorakova, Matthews, Abbot, Cheng, Felten, Knorr, Marquis, Shammass, and Swaim (2017) note that 74 percent of articles neglect to report any challenges in partnerships, common themes surrounding the challenges of incorporating students as partners include time management, communication, power imbalances, and differing levels of expertise within partnerships (Barrineau et al. 2016; Coombe et al. 2018). There is a general consensus that authentic partnerships, where students and faculty are entirely equal in all aspects, are true in theory but far from being attainable in practice (Coombe et al., 2018; de Brie and Raaper 2019; Felten 2013; Marquis et al. 2016; Mercer-Mapstone et al. 2017). Authentic partnerships require an immense amount of time and effort from both parties, and without strong institutional support for programs that dedicate resources to nurture them, these partnerships can easily become superficial and purposeless actions for the sake of saying that one participated in a partnership. Felten, Abbot, Kirkwood, Long, Lubicz-Nawrocka, Mercer-Mapstone, and Verwood (2019, 195) emphasize that “we as a field must fundamentally reimagine not only the roles of students in but also the purposes, practices, practitioners, and outcomes of our work.” Therefore, while the concept of students as partners has become an increasingly prevalent theory in academic development literature, the challenges of putting theory into practice continue, among them the definition of such a partnership and the feasibility of “true” partnerships in light of the reality of student-faculty power dynamics and broader institutional policies.

Supplemental instruction

Another area of the literature explores teaching and learning enhancement in the context of supplemental instruction. Supplemental instruction, another stream of student-faculty working relationships, is described by Hoi Kwan Ning and Kevin Downing (2010, 922) as “a peer-assisted learning model for enhancing students’ understanding of course material, and for improving students’ overall learning skills. Out-of-class supplemental instruction sessions are facilitated by senior students (peers) who have successfully completed the target course, and students are encouraged to work cooperatively on materials that supplement and enrich course material.”

Much like with partnerships, supplemental instruction provides opportunities for learning that cannot be offered by traditional teaching methods. The cooperative, flexible, and personal manner of supplemental instruction allows student learners to experience greater cognitive development (Foot and Howe 1998) and improved academic performance (Congos and Schoeps 2003; Stone and Jacobs 2008) in a less intimidating learning environment (Ladyshevsky and Ryan 2006), as the student learners feel that the senior students (student contributors) have a better understanding of their typical challenges (Glynn et al. 2006; Lockspeiser et al. 2008; Weidner and Popp 2007; Weyrich et al. 2008).

Both approaches—incorporating students as partners and providing supplemental instruction—involve collaborative, peer-assisted, or peer-led learning schemes. Peer learning has an important role in learning; however, the main purpose of supplemental instruction is to target historically difficult courses, while the purpose of incorporating students as partners is to enhance learning across all courses or programs, not just the difficult courses. The underlying premise of supplemental instruction is to provide inexperienced learners with learning opportunities that are facilitated by experienced students. On the other hand, incorporating students as partners is “typified by joint responsibility for teaching and learning” (Sambell, Brown, and Graham 2017, 104). Approaches involving students as partners include active student-staff collaboration in initiatives that share responsibility for the development, implementation, and revision of teaching and learning practices. Our project for the challenging and quantitatively-focused first-year course was rooted in the field of supplemental instruction and inspired by approaches that involve students as partners.

Video as supplemental instruction

Concomitant with the remarkable growth in learning videos due to the influx of YouTube, Khan Academy, and massive online open courses, many researchers have studied the impact of academic videos on student learning. Edwin Etter, Sandra Burmeister, and Randal Elder (2000) and Jefferson Jones and Kent Fields (2001) note that YouTube videos serve as a form of supplemental instruction and likely enhance the students’ learning experiences. Traditionally difficult courses have high demand for supplemental instruction to enhance student learning.

Students believe instructor-generated videos have significant learning value (Draus, Curran, and Trempus 2014) and help them to be more prepared (D’Aquila, Wang, and Mattia 2019; Kohli, Lancellotti, and Thomas 2017). The academic videos empower and motivate students (Bonk 2011), maintain their attention, and provide learning satisfaction (Choi and Johnson 2007). Henry Greene and Cheryl Crespi (2012) investigated the perceived value of college student-created videos as a tool for enhancing the students’ learning experiences. Adeel Khalid (2014) explored how student-generated content is used to help increase students’ participation, engagement, excitement, and learning. More generally, supplementary curriculum resources are used to provide the students with the opportunity to improve learning and performance by overcoming difficult concepts (Birch and Williams 2012; McGillicuddy and McGloin 2018).

The significant benefits of videos as a learning tool involve heightened accessibility and flexibility, as students can easily access the resource and can selectively watch (stop, skip, or rewind) material whenever they desire (Hajhashemi, Caltabiano, and Anderson 2016; Laugerman and Saunders 2019). Benefits of videos also include reinforcement of concepts and increased student motivation and confidence (Lancellotti, Thomas, and Kohli 2016). Overall, the literature is in consensus regarding the

use of the instructor-generated videos and student-created videos in achieving positive effects on the student learning experience.

Gaps in the literature

Most of the benefits and challenges of incorporating students as partners are elaborated through the perspective of students, in the context of enrolling in a course or program, where the students are partnered with a faculty member who leads the course or program. However, few studies in the current literature examine partnerships where the student partners are, instead, working to improve the academic experiences *with* the faculty *for* other students. Although there are some case studies that describe the contribution of student partners for the benefit of other students, such as in the student-faculty co-investigation of Leanne Coombe, Jasmine Huang, Stuart Russell, Karen Sheppard, and Hassan Khosravi (2018), the evidence for the teaching and learning experiences of the student contributors, student learners, and the faculty are still scarce.

More recently, we see more discussions from the instructor perspective on the value of student contribution in enhancing teaching and learning, such as in Sarah Bunnell and Dan Bernstein's (2014) "multi-level case," where graduate students took on a "partnership" role, while undergraduate students from the course acted like consultants in providing in-depth and collaborative feedback in improving the course design. Bunnell and Bernstein describe how "including undergraduates in the design conversation . . . illuminated aspects of the learning experience that were not visible to faculty members or even to graduate students" and how "hearing perceptions of the course from students across preparation levels contributed to a more inclusive and engaging environment for all" (2014, 6). However, even in cases where student contributors acted as consultants in student-faculty partnerships to provide an authentic learner's perspective, the experiences of the student learners were often left unexplored (Bunnell and Bernstein 2014; Cook-Sather et al. 2017).

Even in the literature on supplemental instruction, much of the benefits are largely explored from the perspective of the student learners who benefit from the peer-assisted program, with far less emphasis on the experiences of the student tutors or the "traditional" instructors. We imagine that when students (contributors) work for the benefit of other students (learners), this context affects the teaching and learning experiences, and thus the benefits and challenges, of the student-empowered project. By describing the findings of our study, we hope to contribute to this under-represented perspective of the *three-party experiences*.

Purpose and value of the study

In our project, while the student contributors were empowered to work alongside the faculty in the academic development process, and while the student contributors saw themselves as "teachers," a power imbalance between the faculty and student contributors still existed. This is evident in the project's framework: while the student contributors had discretion over the production of the supplemental resources, they were still subject to the supervision and quality-control feedback of the faculty. As the faculty provided guidance on the overall vision of the project and the final stamp-of-approval on all the materials, the power imbalance, while narrower than traditional student-faculty employment structures, is nonetheless evident.

Our framework of the three-party experience in the project is aligned with the literature on supplemental instruction, as the student-created resources were intended to be used as a supplement to

the course's rigorous lectures. However, the resources were developed in such a way as to empower the students in a "teacher"-like role (Healey, Flint, and Harrington 2016).

Below, we explore the authentic experiences of the three parties involved in the project. With the purpose of shedding light on and bridging the gaps in the literature, we describe (1) the experiences—such as the roles, benefits, challenges, and lessons—of *all* the parties of a student-faculty relationship; (2) the *value* of students as contributors to academic development; and (3) the experiences of the parties of a student-faculty relationship within the context of a project where the student contributors are not the end users of the products of the joint academic development.

In doing so, we seek to address the three key gaps we identified in the literature. By affirming the benefits to each party involved in the teaching and learning processes and by highlighting the unique value proposition of the student perspective in academic development, we hope to attract greater support from faculty and higher education institutions for initiating and sustaining authentic student-faculty relationships (Coombe et al. 2018).

In the evaluation, our study of the project, we explored four questions:

1. ***How do student contributors and faculty perceive their roles in the project?***
2. ***What are the key values and benefits that the student contributors gained through the project?***
3. ***How does the student contributors' work affect teaching for the faculty and learning for the student learners?***
4. ***What are the challenges and lessons encountered by the student contributors and faculty?***

METHODOLOGY

The four guiding questions drove the design for our study. To provide a better understanding of the value of the student contributors' work in teaching and learning, we employed a mixed-methods approach that offered multiple perspectives on the impact of the student contributors' work. Specifically, we employed a qualitative-dominant mixed-methods approach, as it emphasizes the perceptions of the three parties, their meanings, and how these emerge and change. For qualitative inquiry, we generated semi-structured prompts and conducted focus group interviews with the student contributors and instructors. We also embedded an exploratory, sequential, mixed-methods design (Creswell 2009) to explore the student learners' experiences with the supplemental resources, the quality of the resources, and the impact of the resources on their learning. We began with a qualitative phase to explore their general experiences with the supplemental resources. Next, we used their open-ended comments to inform a follow-up quantitative phase on the quality of the supplemental resources and the impact on learning.

Participants

Eighty-nine students who utilized the supplemental resources responded to a survey with four open-ended questions on their general experiences with the supplemental resources. Ten of the 89 students completed a follow-up close-ended survey on the quality of the supplemental resources and the impact on their learning. Seven of the 12 student contributors volunteered to participate in this study. Further, two co-authors (the two instructors) were also interviewees, inhabiting dual roles. Additionally, one student contributor is also a co-author. The insider status of the co-authors offers deep and

thorough insights of their experiences with the project. However, to enhance the trustworthiness of the study and compensate for the lack of objectivity from the insider stance, one of the co-authors, who was not involved in the development of the project, conducted the interviews with the student contributors and the instructors and analyzed these interviews.

The student contributors' backgrounds and characteristics are summarized in table 1.

Table 1. Student contributors' profiles

Student contributor (pseudonym)	Year of study	Relevant experience with course	Work expected from the job description
Harry	PhD graduate student	None	Co-applicant in project proposal, including analysis of past student data for empirical evidence of need for supplemental resources.
Jordan	MBA graduate student	Took MBA-equivalent course taught by course instructors	Project coordination and oversight; create videos (write script, film, and edit); write practice problems; edit and review others' content; liaise between student contributors and faculty.
Adrina	Completed the business undergraduate program, first year master's student	Took course; teaching assistant for the course twice; peer tutor for the course once	Project coordination and oversight; create videos (write script, film, and edit); write practice problems; edit and review others' content; liaise between student contributors and faculty.
Gabby	Fourth-year undergraduate (international student)	Took course; teaching assistant for the course once	Create videos (write script, film, and edit).
Sabrina	Fourth-year undergraduate	Took course; teaching assistant for the course once	Create videos (write script, film, and edit); write practice problems.
Marcia	Third-year undergraduate	Took course; peer tutor for the course once	Create videos (write script, film, and edit); write practice problems.
Alana	Third-year undergraduate	Took course; teaching assistant for the course once	Create videos (write script, film, and edit); write practice problems; present experiences in an institutional showcase event; participate in this case study as a research assistant (co-author)

As shown, most of the student contributors had prior experience with the course. Because they had previously taken the course and had served as teaching assistants or peer tutors, they were already

familiar with the course content. Some graduate students were involved in the project to perform particular tasks, such as developing the project proposal and coordinating the project.

Data collection

The qualitative data include semi-structured interviews with the instructors on their experiences working with the student contributors. Focus group and individual interviews with the student contributors were also used to collect data on their experiences of developing the supplemental resources. At the end of the semester in which the supplemental resources were piloted, as part of the project evaluation, the student learners completed an initial survey with four open-ended questions about their learning experience with the supplemental resources. A follow-up survey asked the student learners about the quality of the supplemental resources and the impact on their learning. Other existing records, such as the student learners' engagement data with the supplemental resources, email exchanges for the project, and presentation materials at an institutional showcase event were used, where appropriate. Qualitative data from the interviews and the open-ended survey were descriptive and narrative in nature. Another set of data included the student learners' engagement data with the supplemental resources, such as video views and problem set attempt timelines, and a survey with Likert-type questions on the quality of the supplemental resources. Each survey question provided five answer choices: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. All procedures were approved by the university's Institutional Ethics Review Board prior to the beginning of the evaluation.

Data analysis

The interviews, which were audio-recorded and transcribed, averaged an hour each. Notes were made immediately after the interviews, during transcription, and appended to the transcripts. The first reading of the interviews defined the unit of analysis based on common themes across the interviews. The second reading looked into the content within the context of each open-ended question. We adopted Yan Zhang and Barbara Wildemuth's approach in our analysis by paying attention to "themes that illustrate the range of the meanings of the phenomenon, rather than the frequency of occurrence of particular text or concepts" (2009, 319). We manually identified themes from the interview data and the open-ended surveys on general experiences with the supplemental resources. The follow-up survey on the quality of the supplemental resources and their impact on student learning was automatically analyzed by the online survey tool. Data on student engagement with the supplemental resources were extracted from Canvas, a learning management platform, and analyzed through Tableau, an analytics tool that allows for detailed summaries of the student learners' engagement data. To build respondent validation, we employed member checking to ensure accuracy of the student contributors' reflections and conducted triangulation in identifying the themes of the qualitative data.

FINDINGS

Below we detail the findings for each of our four research questions.

Q1: How do student contributors and faculty perceive their roles in the project?

The student contributors' descriptions of their roles reflected the wide spectrum of roles they took on in the project, with the most significant being their self-perceived identities as student teachers,

highlighting the duality of their positions as both student contributors and instructor-like figures. The two instructors described themselves as educators, which suggests a broader role that incorporates aspects of guidance and mentorship for the student contributors.

Student contributors' roles

In exploring how the student contributors saw their diverse contributions to the project, we discovered that students described their roles differently than did the objective descriptions in table 1.

For example, six of the student contributors worked on creating the supplemental resources (see table 1), and thus referred to themselves as *content curators* who write scripts and work with technological equipment to curate the videos, as *content developers* who communicate course content and develop practice problems, and even as *teachers* who present difficult concepts to future student learners. Jordan and Adrina, who had tasks in project coordination, described themselves as *student leaders* who were responsible for managing deadlines and responding to inquiries from the other student contributors. In one of the interviews, Jordan responded, “There is no one word that can explain [my role], because of the interwoven practices we had to do. I don’t think one word can capture it.”

Overall, the student contributors identified themselves as students, but as students who are able to *act as teachers* to help their peers and future students. As co-creators, the student contributors shared responsibilities of teaching as other academics have noted (Felten et al., 2019; Samson, 2019).

Faculty's roles

Because our project was intended to be a student-led endeavor, the two instructors gave the student contributors the autonomy and creative freedom to develop the supplemental resources. Nonetheless, the instructors reviewed all the scripts and completed videos as a final quality assurance to guarantee consistency and content accuracy throughout the supplemental materials. The faculty was also responsible for hiring the 12 student contributors, ensuring that the student contributors aligned with the greater values and vision of the project—enhancing accessibility, inclusivity, and personalization in learning—while being knowledgeable in the course content.

The instructors perceived themselves as *teachers*, which “encompasses things like educator, mentor, and role model.” They also felt that their roles allowed them to provide an opportunity for not only the student learners to benefit from the supplemental resources, but also “an opportunity for [the] student contributors to experience being in the role of *instructor*” in creating the supplemental resources. One instructor describes the importance of providing “high level guidance and—where appropriate—more detailed feedback and directions” in mentoring the student contributors, while the other instructor notes, “The student contributors were mostly from the business school, and business students do not usually consider teaching as a possible career option . . . I think this opportunity made them consider both teaching and graduate school a possible option after graduation.”

While the instructors are obviously in the role of teaching others, such as the student learners who take the course, they have a broader role of being, as they called it, “educators,” which includes providing guidance, mentorship, and opportunities to both the student learners and the student contributors.

Q2: What are the key values and benefits that the student contributors gained through the project?

While describing their roles, the student contributors hinted at the skills they gained through creating the supplemental resources. Moreover, they all described how the project aligned well with their personal values, and how it provided them with a sense of pride in the final products.

Skills gained

In each of the interviews, the student contributors outlined how creating the supplemental resources provided an opportunity to sharpen important skills, and this general notion is summarized by the following comment from Alana, a student contributor and research assistant of this case study: “I had sharpened so many skills that I believe will be helpful in my future career. I was like a mini-professor for that one topic I was taking on . . . Through this, I not only sharpened my existing skills in communication and teaching, but also learned a whole new set of skills like video editing, which I had never done before!”

Many of the student contributors also expressed that the project pushed them to have greater self-discipline when working independently. As the project was predominantly student-led, the student contributors found that their abilities to work with high autonomy and discretion were tested. Despite the initial learning curve of navigating the resource production process, the teaching technologies, and the freedom to create the resources, the autonomy eventually allowed the student contributors to feel a sense of *pride* in the final products. The student contributors who recounted on this feeling of ownership described the high levels of independence, discretion, and creative freedom to be some of the most valuable experiences from the project.

Value alignment

While some of the student contributors felt that the most valuable experience from the project was the development of new skills, other student contributors expressed that the most valuable experience was the opportunity to contribute to a project that spoke to their personal values. Many of the student contributors felt personally connected to this project because, as a student, they understood the importance of creating supplemental resources to *empower their future peers*. Sabrina, one of the student contributors who developed the supplemental videos, described “how important it is for a student to see another student explain things to them. Seeing someone like yourself being competent makes it feel you can do that. So, I guess it is important to have more students teaching other students.”

It was not only important for the student contributors to help the student learners who would ultimately engage with the supplemental resources, but also, many of the student contributors mentioned in their interviews the meaningfulness of expanding the *inclusivity* among those in teaching positions, whether that be *diversity* in ages, experiences, races, or backgrounds. Gabby, an international student contributor, explained, “Specially since English is my second language, [the instructor] was very supportive for me to set an example for other international students.”

Sabrina also shared similar values: “I think each person who was involved in this project brought different ways of thinking and presenting the information . . . For example, just being able to see me as a person of colour talk to you through the video will have a different experience for black students sitting in the class.”

This theme of representation in teaching and learning goes hand in hand with the values of the project, which is to empower the future students in the course to have equal opportunity to succeed through having access to the supplemental resources.

Q3: How does the student contributors' work affect teaching for the faculty and learning for the student learners?

By developing the supplemental resources, the student contributors were able to offer diverse teaching styles with their fresh, student perspective. Their work freed up time for the instructors and provided insights on the student learners' engagement with the course concepts. The student learners also benefited from the student contributors' development of the supplemental resources, gaining a sense of empowerment and control over how they engaged with the course concepts.

Impact on teaching for the faculty

The instructors' choice of diversity among the student contributors was no accident. Both instructors recognized that a more diverse team of student contributors would have the effect of creating a more inclusive learning environment for the student learners, as it is helpful for the student learners to not only relate to the content, but also to the people providing it. This echoes the themes of representation that were repeated by the student contributors in their interviews. The two instructors also acknowledged the expertise of the student contributors, being that of the authentic student perspective: "So they are quite familiar with the material and they also understand the struggles that many of our students face with the material . . . They know how to slow down through the most difficult parts and really explain concepts quite well."

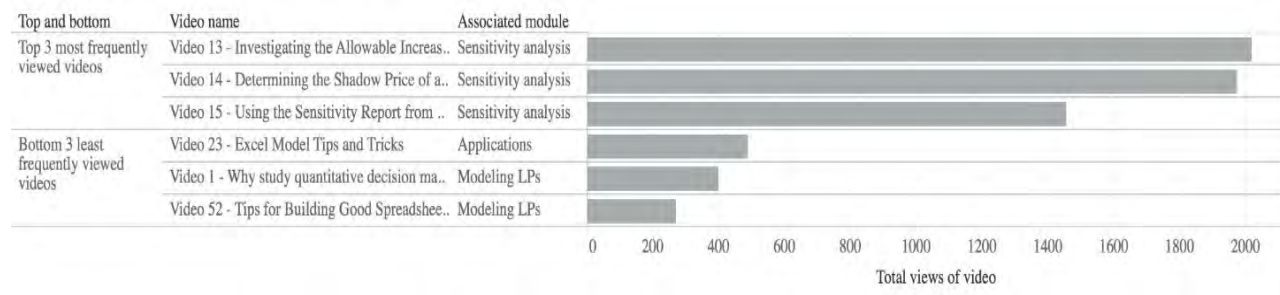
One instructor highlighted that the student contributors could see practice problems in a different light, and they were able to generate practice problems that the instructors would not have otherwise considered. The two instructors also listed other valuable components that the student contributors brought to the supplemental resources, including their "unique perspective," "background," "voices," "creativity," and "energy" that made the content "more exciting."

The instructors felt that the flexibility and diversity of the supplemental resources offered the personalized learning experiences that cannot be offered in lectures of 200 students: "Different students find different concepts challenging, but the large lecture classroom limits opportunities for personalized learning experiences . . . We have a limited amount of time in the classroom to teach the course material, and students may feel that not enough time is spent covering the topics that they find most challenging . . . the array of detailed feedback and multimedia used in these videos, including whiteboard problems, Excel walkthroughs, and tutorial voiceovers, offers a dynamic learning experience that accommodates a diverse range of student learning styles."

Because students were able to review the concepts they find challenging at their own pace through the supplemental resources, the instructors were able to *conduct lectures and office hours more effectively*. Rather than having the student learners ask rudimentary questions on definitions and formulas, they were able to receive this clarification with immediate feedback through the supplemental resources. This allowed the instructors to more effectively use their valuable time to help the student learners, leading to richer and more thought-provoking conversations in lectures and office hours: "Thanks to these supplemental resources, we are able to use our office hours to answer deeper, more challenging questions to simply spend extra time with students who are really struggling."

Lastly, through the data on student interaction with the videos (figure 1), the instructors were able to identify the most viewed videos, which happen to be the videos that contain the most unanimously challenging concepts of the course, providing the data to equip the instructors for targeted interventions to help the student learners learn better.

Figure 1. The top and bottom three portions of video view data by students (N = 205)



Undoubtedly, the supplemental resources cannot and do not replace the role of the two instructors, but rather, the supplemental resources have been able to support the instructors in identifying the challenging parts in student learning and in providing flexible and diverse learning resources outside of the lectures. This freed up the instructors' time to more effectively lead deeper discussions or help the students who truly struggle with the course concepts.

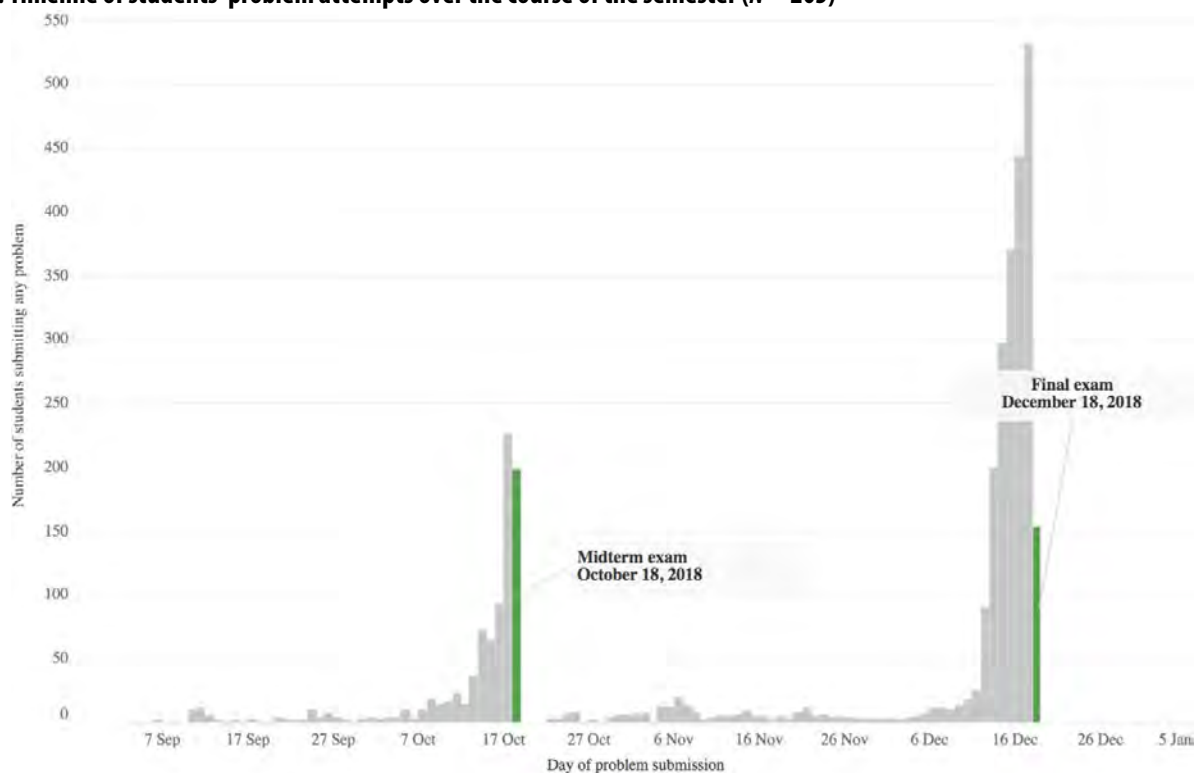
Impact on learning for the student learners

To evaluate the impact that the supplemental resources had on student learning, we considered the student learners' engagement data with the supplemental resources throughout the semester, as well as surveys on their learning experience with the supplemental resources.

The first survey asked the student learners to write about what motivated them to use the supplemental resources. Students used the resources to "prepare for exams," "understand all concepts during a short span of time," "practice difficult concepts and homework questions," "learn better through audio and video," "practice and apply what [they] learned with immediate feedback," and "learn harder topics on [their] own time at [their] own pace."

As reflected in figure 2, many students used the practice problems to prepare for the midterm exam in October and final exam in December. Figure 2 also illustrates how frequently the student learners watched the videos throughout the semester to clarify course content, catch up on missed lectures, improve recollection of the material, target-study trickier topics, and practice newly learned concepts. Thus, the supplemental resources became a helpful source of support for these student learners. The student learners also described how the supplemental resources affected their learning, such as providing more opportunities for practice, offering concise explanations, and illustrating alternative approaches to solving questions. Many student learners also alluded to the "human touch" and "accessibility" of the supplemental resources, appreciating the beneficial impact to their learning, which connects back to the original intentions of the project. The following written response from one student learner is representative: "The fact that I can pause the videos, and re-watch them made it so much easier for me to understand concepts at my own pace. Sometimes during lectures, I feel bored when I've already understood a concept well . . . some other times I struggle to understand a concept or miss a keyword during lectures, and don't even know what to ask. Videos really help at those times."

Figure 2. Timeline of students' problem attempts over the course of the semester (N = 205)



A similar sense of flexibility and accessibility is shared in the following comment: “When I was sick and couldn’t make it to class, I watched the supplemental videos to make sure I didn’t lag behind and could follow in the next class.” Immediate feedback from the problem sets was also appreciated: “The problem sets that allowed me to practice and apply what I just learned with immediate feedback about any wrongdoings.” The depth of the content and the explanation performed by the student contributors were valued as described in the following comment: “I overall enjoy the resources offered to help with the success of the students in this course. I think that they cover course topics in a reasonable depth, and that the students who put them together (particularly the videos) are very enthusiastic and knowledgeable.”

The student learners also showed appreciation for the different perspectives that were provided by the student contributors. Although there was no response that specifically referred to the demographic diversity of the student contributors, the student learners, instead, recognized a *broader concept of diversity*: the diversity in teaching styles offered by the student contributors through the supplemental resources. The significance is that, with a diverse group of student contributors who naturally portray a variety of teaching styles, the diversity in teaching styles among the student contributors can better appeal to the diversity of learning preferences among the student learners, which cannot be provided by the large lecture-style of the course. One student learner noted that the supplemental resources “helped me grasp the material *more intimately* and have a *new perspective* in understanding the class” (emphasis added).

Overall, the supplemental resources had a positive impact on student learning “as it helps *reinforce and test [student] knowledge* in a way that breaks down the class content” (emphasis added). The effectiveness of the supplemental resources on student learning is also evidenced from the follow-up

survey results presented in table 2, though it is possible that student learners who did not use these materials would have been less likely to complete the voluntary survey.

Table 2: Student responses about the effectiveness of the supplemental resources (N students = 10)

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Overall, I found the supplemental videos effective in assisting my understanding the course content	9	1	0	0	0
Overall, I found the supplemental practice problems effective in assisting my understanding the course content	7	3	0	0	0

Q4: What are the challenges and lessons encountered by the student contributors and faculty?

While 74 percent of articles analyzed in a systematic literature review on students as partners neglect to report any challenges (Mercer-Mapstone et al. 2017), we believe that discussing these challenges, as well as the lessons derived from these challenges, are crucial to improved implementation of student involvement in supplemental instruction for enhanced benefits to the three parties in the future.

Challenges and lessons to student contributors

One source of challenge was the comprehensive competencies required by the student contributors for the creation of the supplemental resources. In the words of Marcia, “it was challenging to cover the learning goals in seven to eight minutes instead of 50 minutes. In the video we had to go over the procedures . . . we were showing the content thoroughly and concisely.” This challenge was referred to as a “*learning curve*” that accompanied the student contributors becoming familiar with the expectations of the project, as well as utilizing technology to create and edit educational videos.

Another challenge corresponded to the theme of *autonomy* that the project provided the student contributors. This autonomy was acknowledged and appreciated in one instance as being given “the freedom . . . to have our impact on this project.” However, the freedom mentioned was balanced by the observation of another student contributor referring to its “double edge” that brought a degree of “stress” and “ambiguities” at the initial stages of the project. The autonomy at the start posed a challenge of finding one’s way through the expectations and the feedback loop process. The learning curve gradually flattened, which was particularly felt by the two project coordinators (student contributors, Jordan and Adrina), as they found their roles in supporting and guiding the work of the other student contributors alongside the support provided by the scaffolding of the faculty. Conversations and exchanges among the team, as well as the availability of the faculty to comment and finalize the videos, were mentioned as helpful to ease the student contributors into the creative process. One of the sources of stress was the *tight timeline*—creating 52 videos and more than 200 practice problems with detailed feedback within four months. Becoming familiar with the technology, making adjustments to the

expectations, and learning the required consistency in delivery led to overall evaluation of the work as being challenging yet rewarding. Although the scope of autonomy was at first overwhelming to some, particularly to the student coordinators of the project, this autonomy eventually became an integral contributor to the sense of *self-efficacy* and *ownership* in developing the supplemental resources, because the autonomy allowed the student contributors to feel that the supplemental resources were genuinely created *by them for the student learners*.

Challenges and lessons to faculty

The instructors expressed that the most challenging part of the project was, in their words, finding the “right balance of oversight.” Even though the two instructors acknowledged the student contributors’ excellent understanding of the course, the student contributors’ knowledge on the subject was not perfect; therefore, the instructors had to review all the scripts prepared by the student contributors and periodically intervene to make the resources as clear and accurate as possible. One instructor explained: “Since the videos were recorded by students, who have had an excellent understanding of the course, their understanding of the subject is limited. Thus, while they can understand the learner’s perspective, what they said or stated might be less than perfectly correct. They needed to be screened.”

The instructors wanted to give the student contributors enough leeway to create their own stories and examples for the supplemental resources, while providing structure so that the end result would be a consistent, cohesive, and sustainable project. While much of the resource development process emphasized freedom, the instructors did intervene when it was needed in the process to ensure accurate delivery of content. However, due to the nature of the complex video production process, the instructors’ intervention required extra work from the student contributors. The video editing workflow was important to save time and reduce pains of editing; therefore, one instructor expressed his uncomfortable feeling about his intervention: “My least favourite part was . . . finding little things that needed changing because [the final drafts of the videos] were misleading; I felt bad that, after so much work, there would still be additional editing. However, with hundreds of students watching these videos each year, it was important to make them as clear as possible.”

Nonetheless, both instructors were impressed by the student contributors’ “professionalism, the quality of the finished product, their creativity, their enthusiasm, and their enjoyment of the project,” epitomizing how “one of the reasons I love teaching is because I get to work with people like our . . . student contributors.” The instructors further highlighted the various levels of benefits of the project: “As an educator, we believe this project served different groups. First, the students [student learners] who take the course with the supplemental resources; second, the student contributors who benefit from mentorship from instructors, mentoring the student learners, and learning about the world of academia; third, us, the instructors, who had an opportunity to get to know and work with the student contributors on a more personal level.”

DISCUSSION

While our findings reflect elements of student-faculty partnerships, an increasingly prominent concept in the literature, the data that were collected are not about student-faculty partnerships, but rather about the interactions and experiences with the supplemental resources from the perspectives of the three parties. We acknowledge that, while the students were empowered to develop the resources,

analogous to the senior peer tutors who create peer-assisted resources in supplemental instruction, the instructors ultimately hired the student contributors, supervised the student contributors, and gave the final stamp of approval on the resources, which is contrary to the less practical ideals of a true partnership.

One of the key takeaways from exploring our project is the importance of hiring the right student contributors for the project team. Through the reflections, the instructors voiced the impact that the student contributors had on their teaching experiences, while the student learners voiced the impact that the work of student contributors had on their learning experiences. As described in table 1, many of the student contributors had not only taken the course, but also had experiences in teaching the course as a teaching assistant or peer tutor. By hiring student contributors with this dual background, the student contributors were able to bring their authentic student perspectives as both learners and teachers.

One of the initial drivers of our project was recognizing the need for more flexible, accessible, and diverse academic resources for the students. Therefore, we must also consider how the value of the student contributors in teaching and learning, through the implementation of the supplemental resources, is particularly significant in the context of the traditional, lecture-style teaching, as is the case for this particular course. In contrast to its traditional method of teaching through large and impersonal lectures, the student contributors' supplemental resources became a powerful tool to augment the teaching process of the faculty and learning process of the student learners.

Students and faculty have expertise in different aspects that both contributed to the process of teaching and learning (Bovill, Cook-Sather, and Felten 2011; Cook-Sather, Bovill, and Felten 2014). The student contributors provided an authentic student perspective. As reflected in their interview responses, the student contributors drew from their experiences as a student learner to understand which concepts are challenging and how the supplemental resources can be effectively delivered to the future students. Simultaneously, the instructors' specialty is in the subject matter. We cannot overlook the substantial time and effort invested by the instructors in reviewing each video and practice problem at each stage in the production process; this timely intervention by the instructors ensured the accuracy of the content across the supplemental resources. Both the student contributors' expertise in the perspective of a student learner and the instructors' expertise in the subject matter symbiotically led to the creation of high-quality supplemental resources. While our project did not start with an assumption of and was not designed to be a pure student-faculty partnership, through the project development, impact, and evaluation of the student contributors' work to the teaching experience of the instructors and the learning experience of the student learners, the student contributors were substantially engaged in a symbiotic relationship with the faculty.

The development of the supplemental resources has become an iterative process. While initially applying for the grant that supported our study, the instructors noted that students learn at different rates with different methods; in lectures of more than 200 students, the disparity between the learning experiences of the students are exacerbated. By creating and launching the supplemental resources, not only have the student learners benefited from the flexibility and diversity of the supplemental resources, but the instructors have also, in turn, benefited from better understanding how the student learners learn through analysis of their interactions with the supplemental resources. For example, as illustrated in figures 1 and 2, there were surges of student learners using the supplemental resources in the week before both the midterm and the final exams, and from the video views, the instructors can identify

which topics students struggle with. The instructors are able to take advantage of this information for future semesters to better promote the supplemental resources to the student learners, as the student learners have shown that the supplemental resources are used most effectively for studying for various purposes such as exams, assignments, and self-study. When the instructors can better understand how to support the student learners' learning experiences, the student learners will be able to interact with the supplemental resources more effectively, which ultimately allows the instructors to further better understand the learning experiences of the student learners, creating a perpetual positive feedback loop.

CONCLUSIONS

This article builds on the efforts that have been made to develop supplemental resources for large classrooms with diverse student populations. The original goal of our project was to enhance personalized learning and student engagement with course content and instructors through increased flexibility and inclusivity in accessing academic resources.

While our study was conducted in the specific context of an academic development project in a Western setting, the lessons learned may be applicable to other academic development cases. We pursued deeper reflections about the benefits, challenges, and impacts of the student contributors' work in the development of the supplemental resources. The reflections from the student contributors, student learners, and faculty may provide insights into developing supplemental resources; their incorporation by faculty and use by future students enhanced teaching and learning, but they also helped in building a community of practice that includes student contributors into the design and evaluation of teaching.

The supplemental resources have provided a positive learning experience for the student learners and an impactful teaching experience for the instructors. Our study shows that all three parties involved in the project are *beneficiaries* in teaching and learning. We hope that the findings from our case are insightful to other faculty members and institutions as they undertake academic development projects and as they consider involving student contributors. However, the underlying pedagogical framing in the era of self-determined learning (heutagogy) can continue to be an area of exploration for future direction of this study. Furthermore, our findings suggest a potential need for further exploration on the impact of the supplemental resources on student learning through an experimental study, which may be more generalizable.

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