

Collaborative Autoethnographic Study of a Large-Scale Flipped Classroom Implementation with Multiple Instructors

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Abstract

The flipped classroom model is being used in many engineering courses. By guiding students to study course material online or outside of scheduled class time, instructors can focus on hands-on assignments and projects during their interactions with students. The flipped classroom model implements online learning as an effective technique to engage students and maximize learning. However, developing online content is time-consuming and can be challenging. Moreover, the course can be very dependent on previously developed material and can be challenging to adapt for instructors who are new to the course. The challenges to adapt to the new course may also include differences in teaching styles of instructors which may not necessarily be compatible with the existing design of the course.

These challenges intensified for large-scale courses with enrollment numbers in the hundreds as several instructors are required each semester. The flipped delivery requires careful collaboration and coordination amongst instructors. Although the results may be very fruitful, this may need a considerable amount of discipline and planning. This paper aims to understand the experience of four instructors who co-taught sections of a large first-year course using flipped course delivery.

A collaborative autoethnographic study is used to understand the effective strategies and challenges encountered from the instructors. Six themes emerged from the data on the instructors' experiences of a large-scale flipped classroom implementation with multiple instructors. These six themes include: building a community of teaching; consistency across sections, while still allowing for flexibility; in-person time with students needs to complement videos; setting clear student expectations; pride of what was accomplished; and collaboration brings value but can be challenging.

Overall, the results from this qualitative collaborative ethnography provide insight into the experience of four instructors team teaching using a flipped classroom model. These findings can be useful to others who are looking at implementing flipped classrooms when there are multiple sections. Future research can further look into other perspectives, including bringing in student perspective to the instructor experience.

Introduction

Blended learning models and flipped classrooms offer opportunities for exploratory, hands-on application of technical material during instructor-led class time [1], [2]. While these models have been implemented in many engineering programs, large-scale enrollment courses present difficulties in regard to scalability, feasibility, and effectiveness [3].

ENGG 233, Computing for Engineers, is a required common course for all first-year engineering students at the Schulich School of Engineering, University of Calgary. The large-scale enrollment of approximately 850 students presents challenges for implementing effective active learning experiences. These challenges are increased by frequent turnover of assigned instructors from year to year. Despite expertise in the course subject matter, instructors may not be familiar with the course format or the implementation of hands-on active learning. To better understand the experiences of faculty members, a collaborative autoethnographic study was undertaken to record the experiences and observations of each ENGG 233 instructor in the 2018 offering of the course.

This paper will compare the observations and perceptions of the four faculty members as they consider the challenges presented by the course format. Although it is important to also understand the student perspective, the purpose of this paper is to present a qualitative narrative of the instructor experience through reflections.

Course Implementation Background

Prior to 2015, ENGG 233 was taught in a traditional lecture format and focused on C++ syntax and programming. In 2015, the course was redesigned to focus on algorithmic thinking, exploratory experiences, and applied design-focused projects developed to deepen student learning and impact [4]. The format was changed to a blended learning format, allowing students to spend their in-class time with the instructors on creative application and practical knowledge rather than theoretical concepts. This format has been continued into 2019, along with the addition of supplemental scheduled tutorial sessions [5].

The technical theory portion of the course is taught ahead of the weekly hands-on laboratory sessions using several online video lessons of approximately 10 to 15 minutes each. Throughout the several course offerings since 2015, the videos have been continually refined and improved to offer detailed domain knowledge support. The video formats vary from lectures and screen-capture demonstrations to problem-solving breakdown examples and “just-in-time” tutorial help topics. Another video type called “What I struggled with” was created based on results from online learning platforms such as a popular UCSD Coursera specialization on data structures and algorithms [6]. This format type allows students to hear about specific challenges and highlights from peers who have taken the same course in the past.

Online content is recorded and integrated using a variety of materials and equipment, including a webcam, a high-quality microphone, screen recording software, PowerPoint, Storyline 360 by Articulate, and LMS-compatible quiz assessments. Each week, lectures build on the course concepts from previous videos while introducing new content and terminology. Active

participation and accountability are integrated through short, embedded quiz questions throughout the videos. Questions are drawn randomly from a quiz bank where possible to avoid academic misconduct issues.

Students are given the opportunity to integrate domain knowledge and creative problem-solving skills during their interactive laboratory sessions. This course component was designed around a studio format that allows students to work collaboratively while seeking personalized feedback [7], [8]. Instructors and teaching assistants coach students through weekly assignments in preparation for a larger design-based project. The final design task encompasses technical and creative aspects that provide students with some autonomy and flexibility as they implement the required technical elements.

Methodology

This research has been designed as an autoethnography, specifically a collaborative autoethnography is defined as “engineering in the study of self, collectively” [9]. The intent of collaborative autoethnography is to engage in a process that reflects on the experiences of a collaborative effort, it is “a process because as the researcher studies and analyzes their own experiences, meaning is made influencing future experiences and reflections” [10]. The collaborative autoethnography approach merges together three distinct research methods and approaches: (1) the reflexive study of self through autobiography, (2) a lens from the study of culture through ethnography, and (3) the multiple perspectives from a group through collaboration [11]. This method was chosen for review of the implementation of team teaching in a large-scale flipped classroom as it allows the group of instructors to wrestle with the commonalities and differences among their stories, and discover meanings through the social and cultural contexts [9].

Keep in mind that collaborative autoethnography is a qualitative method of analyzing self-narratives. No quantitative results will be presented, rather the main themes resulting from qualitative coding will be summarized using examples and quotes from the instructor reflections. The coded data all came from instructor self-reflections of their collaborative process.

Instructor Results

The 2018 course implementation involved four instructors of varied background and expertise. **Instructor 1** had three previous years of teaching experience internationally. It was their first time specifically teaching ENGG 233 as well as their first experience teaching a blended learning format course. **Instructor 2** had two previous years of teaching experience and had previously taught an introductory programming course three times. It was their first experience teaching a blended learning format course. **Instructor 3** had eight years of previous teaching experience and previously taught object-oriented programming twice. It was their first experience teaching a blended learning format course. **Instructor 4** had seven years of teaching experience and had taught a variety of programming courses. They had recorded the online lectures for this course and this was their fourth time teaching this course in the blended learning format.

Each instructor was asked to record their observations, experiences, and challenges related to ENGG 233 implementation. This information is documented and summarized below in a first-person format to ensure accuracy, and to follow the principles of autoethnographic studies. Minimal edits have been made for readability and clarity.

Course Instructor 1

ENGG 233 was my first teaching experience as an instructor since starting my PhD, including ~200 students in the class. Being a flipped course, the whole course consists of videos lasting between 2 and 3 hours per week, tutorials lasting 75 minutes per week around the topic of “computer programming”, assignments divided into 8 sections, project, midterm, and final exam. My experience in this course had two main challenges as follows.

Challenge 1: First-year teaching and first-year students

Being a first-year instructor for first-year students, I was experiencing some different challenges. First, building the disciplinary procedures for the classroom. Second, developing positive instructor-student relationships in class to be more active.

Class visitation: To address the challenges, I needed to have advice from experienced instructors. As this class was taught by four different instructors, I decided to have class visitation from the most experienced instructor of the team who had taught this course for a couple of years. During the class visitation, I attended another class like a student and tried to build my teaching experience. That experience led to me to develop the following solutions for the aforementioned challenges.

First, dedicating a part of the first day of class, in which most of the students are present, to explain course policies in detail may help to prevent many behavior challenges by defining acceptable rules. Establishing a weekly review for the expectations in each assignment and later for the project is also a key element of an orderly class. To overcome the second challenge, after observing the class of the other successful instructor, I figured out that being an expert in the content area is a prime element to provide appropriate commentary on student questions and reaction. Finally, I recommend making learning fun by creating a highly interactive programming environment in the class so students can see the output of what they learn instantly.

Challenge 2: Difference between instructor who teaches the videos and the tutorial instructor

In the flipped classroom, we have instructor-generated videos to teach the students the core concepts of the course. This classroom was not completely flipped. Although all concept attainment happens outside class with the videos, I was delivering additional content with pre-designed problems during class. The challenge here was that the videos were very well-structured with another instructor who was teaching another section of this course. To prevent students in my section from having any negative impact of having a different instructor than the videos, I started to use the same teaching method as the videos. Moreover, I started to integrate active-learning activities that allowed students to practice programming in an interactive

environment by writing the programs to new problems based on the contents they have already learned. Another experience was that even some minor points are important for delivery, such as postures. I was able to monitor engagement or disengagement, eye contact or other signs of connection between the professor and students.

Course Instructor 2

Challenges of designing tutorial material

Learning programming requires solving various mini-problems and looking at example code. In a flipped course, the role of tutorials is more pronounced in this regard since lecture videos are focused on explaining core concepts and cover a broad range of ideas. Tutorial sessions enable a deeper understanding of course material by demonstrating the step by step process of solving a coding problem. Therefore, designing the example problems for tutorials that provide complementary insights into the course concepts while fitting within the limited time of a session is crucial. The other challenge was to ensure all instructors have comparable material in terms of depth and breadth of the topics covered and emphasized in each session. The collaboration between instructors of the course helped greatly in resolving these challenges. While the insight from the seasoned instructor of the team who had previously taught this course helped with selecting the best examples, the discussions between other instructors brought new ideas with a more diverse range of engineering problems.

Challenges of preparing course documents and exams

In this flipped course, while it was possible to re-use previously written documents, some had to be updated or completely redone. For example, assignments needed touch-ups to reflect date and regulation changes, but exams and the final project had to be designed from scratch. Due to the large number of students in this class, writing new documents was challenging because of a bigger chance of misunderstanding by students. The documents had to be revised and proofread by at least three members of the teaching team to ensure no information was missing and there was no ambiguity. This extra approval and revision process increased the time and effort to prepare the documents.

Challenges of working as a team of instructors

With four instructors working as a team to teach this course, communication overhead becomes a challenge. Each decision had to be clearly communicated with others and adjusted according to feedback. Also, several discussions had to be made to align each instructor's individual take on different topics of course material and exam questions. Weekly instructor meetings were helpful in achieving consensus and reducing miscommunications over email.

Reflection

Through the process of planning and teaching this course, I have gained a deeper understanding and awareness of my role and capabilities in the teaching profession. There was a challenge in

every class or almost every planning task. The reflection on myself, my experience, my peer instructors and my students helped me to both personally and professionally grow. While having to work as a team of instructors brings overhead of communication and collaboration in the process, it also helped me improve my teaching skills by closely watching slightly different variants of teaching methods of the same material in a longitudinal process. I believe for future offerings of this course, documenting processes such as teacher assistant onboarding with the Desire to Learn (D2L) system and previously undocumented material like examples solved in tutorials will be a great source of improvement. Moreover, detailed scheduling of deliverables and the timeline of the course can help with streamlining tasks and providing better delivery of the course material.

Course Instructor 3

In Class Challenges

Programming for engineering students is course that elevates the importance of using logic in solving engineering problems. Watching well-designed tutorial videos before attending the lectures helps students to frame problem-solving logic in the form of programming instructions. However, teaching all aspects of problem-solving is beyond the purpose of video tutorials which makes complementary sessions necessary. For this reason, the flipped course approach seems to be an effective one for teaching this content.

My main challenge in this course was helping students to think in a procedural and logical way about a problem and transferring their logic into programming instructions. Before each session, I reviewed all the relevant videos carefully and extracted all new concepts. I then scrutinized the content to understand which aspects of the newly taught parts required more emphasis and might be the source of misunderstanding. Then, I designed the problems around those parts and added some graphics to make them more understandable

Through the very first sessions, it became obvious to me that running my class as a “workshop” is the most efficient approach. I brought the problems to students, asked them to think about them and provide me solution logic using the new concepts they learnt from the videos, then solved the problem step by step illustrating the use of new concepts. The feedback from students and the type of questions they asked encouraged me to continue with this approach.

At the end of each session, I gave students a more challenging question to help them test their critical thinking abilities and to see if they can use their newly learnt skills in a new context.

Team Work Challenges

Working as a team of four instructors in a course may be a great challenge at the first sight. However, it turned out to be one of the greatest experiences in my teaching profession, thanks to enthusiasm, passion, and open-mindedness of all the team members. The team members all had a very accepting attitude towards the feedback and criticisms of other members and collaborated smoothly during the whole semester. Having regular meetings, sharing in-class and in-lab experiences, helping each other through difficulties, and beyond all, the great coordination,

provided a warm teamwork atmosphere that helped each instructor to feel comfortable and not singled out for any reason.

However, giving each instructor the flexibility to follow their own personal method of teaching completely enriched the experience from both personal and pedagogical aspects. Each instructor could evaluate their own performance easily and adjust to meet their own standards.

Reflection

Dealing with first year students was a great experience as communicating with juniors seem to be more challenging. However, the great enthusiasm from students was the biggest asset to encourage me to improve in every session. Seeing how students grow and become better every week was a very satisfying feeling for me. Their reflection in exams and feedback in classes reinforced that fact.

On the other hand, working in a team of instructors is not always an enjoyable and successful experience. The differences in expectations and attitudes may be the source of conflicts. However, this course was a very fulfilling experience for me and I personally had a great experience due to the mutual understanding of every team member. I believe that freedom of sharing concerns, obeying the consensus, and having a collaborative attitude is the key to success.

Course Instructor 4

One of the main objectives of using the flipped classroom model in ENGG 233, is to offer our students a consistent level of instruction. We aim to achieve this by developing lecture videos and online quizzes. However, to achieve consistency, lab sessions and in-person tutorials must be coordinated too. Both of these components are integral parts of the course which greatly contribute to student success. These components allow students to interact with their instructor, ask their questions, and receive advice and coaching.

We followed a methodical approach towards coordination with the instructors. We committed to weekly meetings, put practical procedures in place, and followed a series of internal deadlines. Above all, we tried to preserve creativity in teaching by setting the topics to be covered but allowed each instructor to follow their own approach towards problem solving.

We worked closely with the instructors to develop the lab assignments each week. This allowed us to agree on a set of problems which covered a portion of the course material. Therefore, we could effectively use the meeting time to plan the overall structure of our in-person tutorials. Furthermore, we shared our individual experiences in labs, and in-person tutorials with each other during the meeting and via email. This allowed everyone to better understand which approaches worked, how the students were doing with the material, and what needs to change.

Scheduling meetings, setting up procedures and coordinating tasks were time-consuming; especially at first. However, with having a practical and concise procedures, the semester actually started to feel lighter than previous semesters as we could count on each other for feedback and leadership.

Despite our different levels of experience in teaching and with the flipped model, the results across the four sections were very much the same in terms of student grades. Given our large sample sizes (i.e. over 200 students in each section), I believe this is a strong indication about the consistency of instruction this past semester.

Analysis

The above collaborative autoethnographic reflections from the instructors were analyzed and coded for different themes. The initial list of themes and brief descriptions was sent out to the instructors for review to ensure they were an accurate description. The final results found six different themes emerge from the instructor reflections on their experience in the large-scale blended learning course with multiple instructors. These themes, with a few key examples from the text above are summarized here. Course Instructor will be abbreviated to CI (i.e. CI1, CI2, CI3, CI4).

Built a Community of Teaching

Many of the instructors spoke about the value from the teaching community. Although many team-teaching activities provide a community, since the majority of the instructors had not taught this course or taught a blended course previously, they took great value from the teaching community. They had the opportunity to watch each other teach (CI1) and “share individual experiences in labs and in-person tutorials” (CI4). It was really great to be able to watch “slightly different variants of teaching methods” and share new ideas with the other instructors (CI2). The team of instructors were able to “help each other through difficulties” because they were built on a foundation of “enthusiasm, passion, open-mindedness [...and an] accepting attitude towards feedback and criticisms” (CI3). Overall, it is evident through the instructors’ reflections that their collaboration and constructive team environment added value to their teaching experience.

Consistency Across Sections, While Still Allowing for Flexibility

When a large first-year class, there is often the challenge across different sections of perceived fairness. Since all students were writing the same midterms and final exams, it was important in this course to ensure that “all instructors have comparable material” (CI2) with a “consistent level of instruction” (CI4). However, “giving each instructor the flexibility to follow their own personal method of teaching completely enriched the experience” (CI3). It is evident that in this context there is a high degree of coordination required, but that it is important to “preserve creativity in teaching” (CI4) to allow each instructor to use the approach that is best suited for them.

In-Person Time with Students Needs to Complement Videos

As the videos had been prepared by one of the instructors (CI4), many of them commented on the importance of blending the videos with the in-person content. CI1 changed their teaching style to “use the same teaching method as the videos” so that the students would have a more seamless experience. The instructors also spoke about the importance of having “complementary

insights” to the video content each week (CI2) and emphasizing the parts of the videos which “might be the source of misunderstanding” (CI3). CI4 is the instructor who prepared the videos, and notable is the only one who didn’t comment on making an intentional choice to integrate with the course content as this was likely easier for them.

Setting Clear Student Expectations

The context of being a large-class and a first-year class, emphasized the importance of setting clear student expectations. It was important to define acceptable rules at the beginning and have a “weekly review of these expectations” with the students (CI1). CI3 observed also that “communicating with juniors seems to be more challenging, however the great enthusiasm from students was the biggest asset to encourage me to improve” (CI3). Overall, although the first-year large-class was challenging, the students were each to learn and it was good to keep a fun and challenging environment.

Pride of What Was Accomplished

Through reading the reflections, it is evident that the instructors are proud of what they accomplished. They spoke of how the experience allowed them to “gain a deeper understanding and awareness of [their] role and capabilities in the teaching profession” (CI2). The instructors also felt proud, “seeing how students grow and become better every week was a very satisfying feeling” (CI3). They worked very hard throughout the semester to create the most effective learning environment, and the instructors were truly happy to see the success of their students, as well as their own success.

Collaboration Brings Value but can be Challenging

As demonstrated in the previous theme, collaboration brings value, however this is not without effort. When working with a group of four instructors, there is significantly “increased time and effort to prepare documents” and there can be a large “communication overhead” (CI2). Throughout the process there were moments when “differences in expectations and attitudes may be the source of conflicts” (CI3) Since coordination was “time consuming, especially at first,” the instructors “committed” to a weekly meeting (CI4). “The weekly meetings were helpful in achieving consensus and reducing miscommunications over email” (CI2). Many of these reflections are similar to those that might come out of any teamwork activity. It is important to remember when engaged in a team-teaching scenario to consider, as often instructors can focus on student learning without considering how their health as a team is important.

Conclusion

The large-class implementation of a flipped learning style with multiple instructors was effective in fostering a productive team environment and engaging student learning experience. The instructors greatly benefited from the team-teaching approach and the teaching community built among them. It was important for this community to be open-minded and willing to share feedback with each other. In terms of flipped learning, to ensure the videos were effective and fair across all students and lecture sections, instructors intentionally integrated with the video

content and coordinated their in-person content for a more seamless experience for the students. Working with first-year students is challenging and setting expectations was critical, but there was a true sense of pride from the success of the course and student achievement. Overall, although there are challenges that come with team-teaching, collaboration, large-scale classrooms, and flipped classrooms, the value that was brought outweighed any challenges.

The six themes observed in this scenario can be helpful to institutions looking at running a flipped model delivery for large courses. Most importantly, by intentionally setting up an effective and respectful community of teaching for the instructors involved, many of the challenges and difficulties can be avoided. The community will allow for consistency across the sections while still allowing for flexibility. Through frequent conversations, the community of instructors can ensure to build a course with clear expectations and that has in-person activities that balance well with the in-class activities. And lastly, but maybe most important, if other institutions can foster this community of practice the group of instructors will feel a great sense of pride of what was accomplished when they are finished.

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