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Cover Page Footnote

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ABSTRACT

Most studies investigating flipped learning fail to assess how student perceptions of flipped learning may change once the class is complete, and students have a chance to reflect on the experience. Follow-up studies are needed to evaluate the sustainability of the benefits from flipped learning among students and how they feel it prepares them, if at all, for future classes and/or their professional lives. Therefore, the objective of this study was to explore how graduate and undergraduate dietetics students retrospectively perceive a course that used flipped learning 2 years after they completed the course. Two focus groups with undergraduate (n=5) and graduate (n=6) students were conducted regarding their perception and experience in a flipped advanced metabolism class with the same instructor. Content analysis was applied to the focus group transcripts by two investigators. Six themes were discovered from the focus group transcripts: 1) metacognition and the learning process, 2) roles and responsibility for learning, 3) collaborative learning, 4) class experience, 5) adjustment to flipped learning, and 6) flipped learning is conditional. Overall, students felt that the flipped class helped them learn how they learn and they have to put in work to achieve deeper learning. Students thought that the class activities used in a flipped class were engaging, added variety, and allowed them to apply their knowledge. Students reflected that using flipped learning helped them build relationships in their class, created a safe space for questions, and there was more time and opportunities to ask questions vs. traditional lecture.

KEYWORDS

flipped learning, longitudinal, qualitative, undergraduate, graduate

INTRODUCTION

The basics of flipped learning have 3 main components: preparation for class, in-class activities, and then post-class assignments.¹ The preparation materials can include

readings, recorded lectures, quizzes, videos, assignments, etc. Most of the in-class time should be spent applying knowledge by solving problems or having discussions. After class, students may write reflections, or complete

another assignment that requires critical thinking.

Research suggests that flipped learning can improve student-teacher relationships,^{1,2} result in deeper learning,¹⁻⁴ help students apply knowledge,^{1,5,6} improve attendance,⁷ reduce multitasking activity during class,¹ and improve exam scores^{8,9} compared to traditional lecture courses. One study found that flipped learning resulted in higher exam scores for those students who had the lowest pretest scores at the beginning of the semester.¹⁰ Furthermore, flipped learning pedagogy can help dietetics programs meet educational competencies (KRDNs) required by the accrediting body. Specifically, awareness of learning styles, identifying strengths and areas for improvement, conflict management and resolution, and working in a team¹¹ are all curricular requirements for dietetics programs that can be met with flipped learning pedagogy. However, there are also some challenges with flipped learning for both the instructor and students.

Flipped learning requires more preparation time for the instructor before the class begins.¹² The instructor must prepare all of the pre-class materials, design in-class activities, and prepare post-class materials. Although some studies have suggested that students are satisfied with flipped learning courses at the end of a semester,^{9,13-17} student buy-in can be challenging to achieve.^{4,5,9,12,18,19} In a previous study among graduate students, buy-in was not achieved until about 6 weeks into the semester.⁴ Students can get frustrated with how time-consuming class preparation activities take^{4,15} and taking responsibility for their learning.⁴

Most studies use student evaluations to measure student satisfaction, which are typically at the end of the semester; however, students may change their minds or gain new perspectives about a course long after the course is over.²⁰ For example, when asked after graduation, students reported that they would increase their rating of a class that they thought they learned the most from and

decrease their rating of a class they studied the least for.²⁰ This suggests that students may have been unhappy with their expectations of class difficulty at the end of the semester, but learned to appreciate the experience of a course later on.²⁰ Researchers have called for follow-up studies about flipped learning that extend beyond one semester.²¹ Therefore, the objective of this study was to explore how graduate and undergraduate dietetics students retrospectively perceived a flipped class two years after completion.

METHODOLOGY

This qualitative study utilized a phenomenological approach. Focus groups were conducted to explore how graduate and undergraduate dietetics students retrospectively perceived a flipped class.

Setting

For this study, students from two different classes were recruited. One class was a graduate-level metabolism course that is required for a Master's of Science in Nutrition and Wellness program during the fall 2018 semester. The other class was an undergraduate, upper-level metabolism course that is required for all dietetics students during the spring 2019 semester. For both classes, students were expected to complete readings from a textbook, watch videos posted online, and take notes on the readings and videos prior to attending class. The undergraduate students were assigned online multiple-choice quizzes before class. Both classes were given guided reading questions that would support their reading, although these questions were phased out for the graduate students over the course of the semester, as it was expected that they would be able to develop skills in reading comprehension and notetaking.

In class, time was used for solving problems using team-based learning. Typically, for both classes, a team quiz was the first activity

Table 1. Semi-Structured Focus Group Questions for Graduate and Undergraduate Students who Experienced a Flipped Class

Main Question	Probing Question (if applicable)
1. Overall, how do you feel about the flipped class format?	a. Think about how it compares to traditional lecture on: class preparation time, studying for exams, time spent in class, methods of learning, etc.
2. What did you like most about the class?	a. Why did you like this the most?
3. What did you dislike the most about the class?	a. Why did you dislike this the most?
4. If this was your first experience with a flipped class, what was it like?	a. If this was not your first time experiencing the flipped class, how did it compare to the other flipped courses you have taken? b. Compare your experiences in other classes that have used mostly lecture. How was your experience different? Similar?
5. How do you feel about learning on your own?	
6. How do you feel about how class time was spent?	a. Specifically, think of the activities you did in class and compare to lecture-based courses.
7. Why do you think [instructor's name] used the flipped format for this class?	a. What do you think her goals were for you?
8. How did the team activities affect your experience or your learning in this course?	a. Imagine if this course had no team activities, how would it have changed your experience for learning?
9. How, if at all, do you think the flipped learning approach affected how you learned in this class (Merlin-Knoblich & Camp, 2018)?	
10. What challenges, if any, did you encounter while in the flipped learning class (Merlin-Knoblich & Camp, 2018)?	a. How did you manage those challenges?
11. Imagine that most of your classes have been flipped. How do you think this would impact you, if at all?	a. Do you think this would be a positive or negative for students? Why?
12. How do you think being in a flipped class has changed you as a student, if at all?	a. Have you changed how you approach a class, assignments, preparation, learning style, etc.?
13. If you could give [instructor's name] advice about the class from the student perspective, what would it be?	a. Is there anything you think [instructor's name] could do to make the flipped format easier for students to adjust to? What would it be, and why? b. What did you think about the guided reading questions?
14. Is there anything else you would like to share about your experience in the class that you have not shared yet?	

students would complete. These were open-book, open-note, short-answer quizzes and typically 5-10 questions. Then, students would be given problems they would need to solve as a team that would require them to apply the content, such as case studies. After class, students were expected to read the chapter again, review their notes, and complete learning reflections.

Participants & Recruitment

This study was approved by the [blinded] University Committee on the Use of Human Subjects in Research. Two years after the class, the graduate (n=9) and undergraduate (n=16) students were sent an email from the instructor asking for volunteers to participate in a virtual focus group about the course. If students were interested in participating, they

could click on a link within the email to provide consent using Qualtrics Survey Software. After consenting, students were asked for their contact information as well as their availability for a focus group. Students were given 2 weeks to fill out the survey before the focus group was scheduled. Once the focus group was scheduled, those who had not consented yet were sent another email with the date and time the focus group along with the consent link again.

Data Collection

The virtual focus groups were conducted using Zoom and were recorded for transcription. The focus groups were moderated by trained graduate assistants who had successfully completed a graduate research methods course, including qualitative methodology. Two focus groups, one for graduate students (n=6) and one for undergraduate students (n=5) were completed in fall 2020 and spring 2021, respectively. The semi-structured focus group included 15 main questions that asked students to reflect on their current perception of the flipped course. Students were asked a variety of questions about the course including what went well, what was challenging, how they think it had impacted their learning, how it changed them as a student, and how they think the flipped class could be applied elsewhere in their curriculum (Table 1). After the focus group, students who attended the focus group were emailed another Qualtrics Survey Software link via email to ask them for demographic information.

Table 2. Demographic Characteristics of Graduate and Undergraduate Student Focus Group Participants

Characteristic	Graduate Students (n=5) ^a	Undergraduate Students (n=5)	Total (n=10)
	(mean ± SD)		
Age	24.6 ± 1.14	22.2 ± 0.45	23.4 ± 1.51
	N (%)		
Gender (Female)	4 (80)	5 (100)	9 (90)
Race			
White	4 (80)	5 (100)	9 (90)
Asian American or Pacific Islander	1 (20)		1 (10)
Ethnicity (non-Hispanic)	4 (80)	5 (100)	9 (90)

^a One participant did not fill out the demographics survey

Data Analysis

Descriptive statistics were applied to the demographic information using the Statistical Package for Social Sciences version 27.0. Focus groups were transcribed verbatim by the focus group moderators. Content analysis²² was applied to the transcripts during the summer of 2021 by the two authors who have experience in qualitative research. Each researcher coded the transcripts individually. Then, the researchers met to discuss codes and create themes from the final list of codes. If there was a disagreement between the researchers about a code or theme, the researchers reviewed the focus group transcripts again and discussed until agreement was achieved.

RESULTS

A total of 11 students participated in the two focus groups. A majority of focus group participants were white (90%) females (90%) (Table 2). Six themes were discovered from the focus groups: 1) metacognition and the learning process, 2) roles and responsibility for learning, 3) collaborative learning, 4) flipped

learning is conditional, 5) class experience, and 6) adjustment to flipped learning.

Metacognition and the Learning Process

Both undergraduate and graduate students felt like the flipped learning experience helped them learn how they learn best. It also gave them confidence in their own learning. Students also reported that having a flipped class helped them realize that they have to put in more work and effort to achieve deeper learning. For example,

Having taken the class, I feel like I've learned more about what I'm good at and what I'm not good at, so I guess more so self-awareness of how I learn on my own. So it made me feel more confident in doing things myself and then also knowing, you know, areas that I might want a second opinion on or I may want to consult people on. –
Graduate Student

I think it just helped me develop a different learning style and try something different than just reading over lectures to study and I would get a big whiteboard and sit down and draw things out. And I feel like I got involved in my learning in a different way that I hadn't really done before. –
Undergraduate Student

Roles and Responsibility for Learning

Two years after experiencing the flipped classroom, graduate and undergraduate students perceived their role in learning and responsibility for learning differently. For graduate students, they expected that they would be responsible for their own learning in graduate school, no matter how their graduate classes were taught. They did report that they felt like the flipped learning format helped hold them accountable for this expectation of themselves. For example, one graduate student described their perception of their role in the classroom, "I feel like I was actually

participating in class, not just listening or like zoning out. I had an active role in class."

For undergraduate students, they reported that they would have stepped up to take responsibility for learning if they felt like it was expected, for example, in the flipped class. However, if they perceived that it was not expected of them to take responsibility for learning, as in a lecture-based class, they did not think it was their responsibility to learn and they felt like it was the teacher's responsibility to teach them. One undergraduate student described their perception of how the teacher's expectations affects how they see their role as a learner,

... so if I got something wrong, if I didn't understand something, it was on me [in the flipped class]. It wasn't on anybody else and that was kind of nice. There are lecture classes that I've been in where it's like, 'this doesn't make sense', and it's because the teacher just didn't explain it well. Whereas in a flipped-style classroom, because you have all this information and resources ahead of time and you're expected to learn and then have a discussion in class, you're able to clarify anything that you're confused about and you're in charge of your own learning, so you make it as clear as you can. It's not on the teacher, you're not depending on somebody else to learn anything.

Collaborative Learning

Both graduate and undergraduate students felt like the class provided a safe space to ask questions. They also appreciated that there was more time and opportunities to ask questions compared to a traditional lecture-based course. Students recalled feeling comfortable asking questions and felt they were able to build relationships with their peers. One graduate student described their experience with collaborative learning in the flipped class,

I think working in a team made me more comfortable to ask questions, cause to you guys, I'm like, 'to be honest, I don't know what the heck is going on, can you help me?' and it's not like 'hey, teacher, I don't know anything can you help me?' so like it made me more comfortable asking questions because I was able to ask my peers, not somebody that's kind of intimidating like your professor.

Looking back, students also valued learning from peers in the flipped course, which they felt like was not something they were able to do in traditional lecture-based courses. As one undergraduate student described,

... I liked the collaboration with my classmates. I feel like in a lecture-style class you don't get to talk things through and bounce ideas off of each other, where I feel like we took those quizzes together at the beginning of each class period and I thought that was really helpful. Because ten out of ten times, someone knew something that I didn't and we all kind of contributed to the quiz and we were all able to put equal effort in, which was nice.

Flipped Learning is Conditional

While students appreciated many aspects of the flipped classroom and found it beneficial, they did not think that it would work for all classes and students. They thought that the success of the flipped class depends on the student interest in the subject matter, a student's motivation to learn, the class size, the textbook, the physical space of the classroom, the subject of the course, and the level of students (i.e. 100 vs. 400 level courses or graduate vs. undergraduate). One undergraduate student remembered how the physical space of the classroom was a barrier for flipped learning, "It was like the classroom was just not set up to be a flipped room for us to collaborate well. That was always my least

favorite part of when we would do those quizzes together and everyone trying to like, get into groups, and move the desks around."

Both undergraduate and graduate students thought the flipped class would be more difficult for a lower level, general education course with a large enrollment, especially in a traditional lecture hall vs. a room set up for collaborative learning. Additionally, if it was difficult to learn from the textbook, students did not think that a flipped classroom would work well. They did not think that first- or second-year undergraduate students would benefit from a flipped learning experience. As one graduate student explained,

I think it definitely makes more sense to not have it for intro level classes or even second level, but like third and fourth year of undergrad and then at the master's level where you already have the base knowledge so you're not reading gibberish in your textbook, cause that would be, like if they gave me chemistry 101 textbook, 'read this and then come to class, we're just going to, you know, start doing some lab experiments', I'd be like, 'I have no idea what's happening.'

Class Experience

Something that both graduate and undergraduate students remembered over a year after the course concluded were the class activities, and some students even remembered specific activities that were used in class. They felt that the class activities used in the flipped classroom were engaging, added variety, and allowed them to apply knowledge. For example,

I think the flipped format let us go further with the material as well because we had to read before showing up so it's not like us just like going through the book which we can do by yourself, we can do that at home, so by reading it at home and then coming in,

then we're able to actually apply the material. So it was a lot more engaging compared to just your standard classroom. – Graduate Student

They reported that they enjoyed the active learning strategies more than traditional lecture. As one undergraduate student described, "We did a variety of activities each class I feel like and lectures it was just 'show up to class with your notebook or your laptop and take notes and then leave.' It definitely was more of an experience."

Adjustment to Flipped Learning

Undergraduate and graduate students remembered that the flipped learning process was frustrating at first and felt overwhelmed during the semester, but the graduate students and some undergraduate students reported that they were able to adjust to this mode of learning. The graduate students expected to be challenged and seemed to be grateful for the challenge over a year later. As one graduate student explained,

I found the topic to be really challenging, but, and I don't know that it was necessarily a bad thing, I knew that I needed to be challenged in order to get better, so while it wasn't the topic I was best at, what I didn't like, by the end of the topic I was better at it, which was a good thing.

The undergraduate students remembered not fully adjusting during the semester and a year later they still talked about the stress of exams and "teaching myself". As one undergraduate student remembered,

I remember when I was taking that class, I was kind of frustrated because I felt like I was teaching myself everything. But it's kind of a catch-22 because with the flipped classroom you have to be able to do that beforehand to have the discussions and activities during class. I would much rather have

those discussions and activities, but at the time, when I was preparing for class, I was like, 'I don't understand this.' I just got really frustrated with it, but it was mostly cleared up during class the next day, so it was fine.

The undergraduate students still felt that there should be more instructor guidance in the form of handouts because they remembered being afraid of missing details in class.

DISCUSSION

In this study, graduate and undergraduate students were asked about their perception about flipped learning in a metabolism course over a year after the course concluded. Students felt that the class helped them become confident in their ability to learn on their own. This conflicts with a previous study that found students in flipped classes reported higher self-efficacy in learning at the end of the semester compared to traditional courses, but this difference decreased 10 months after the semester ended so that it was no longer significantly different from students in traditional courses.²³ While this study did not have a comparison group nor did it quantitatively measure self-efficacy, the students in this study felt confident in their ability to learn on their own and felt that they identified how they learned best based on their experience in the flipped course.

Interestingly, over a year after the course ended, there were differences in how graduate and undergraduate students perceived their role in learning and who is responsible for their learning. Advocates of flipped learning report that it allows for students to take ownership over their learning;²¹ however, undergraduate students reflected on how that was somewhat frustrating at first and may not ever fully adjust to the process. Previous studies have also found that students need an adjustment period.^{4,15,24,25} With lecture-based courses, students may think they learn more because they are following along with the instructor and perceive they understand, even though they may not be able to solve problems

independently.²⁶ The adjustment period at the beginning of the semester can also cause students to think that relatively simple introductory information is more difficult than students in traditional lecture courses.⁸

There is currently no evidence to support the idea that flipped courses are best at a given time point in a student's higher education journey.²¹ The differences between undergraduate and graduate students in this study may be due to the small age difference as older and younger students value different things in their instructors.²⁰ For example, older students appreciate instructors' dedication and their ability to motivate students while younger students value instructors that help them do well in school.²⁷ The differences could also be attributed to the expectations graduate students have. In this study, graduate students were expecting to be more responsible for their learning and were motivated to take on this challenge. Students who are not ready for this challenge, for example undergraduate students, may view the workload required for the flipped class and the pre-class activities as an overwhelming task.²⁸ While the hours students spend preparing for a flipped class is purported to be much higher than traditional lecture classes,^{16,29,30} the time preparing for exams may be lower for students in flipped learning.²⁹ Students may struggle with prioritizing which resources to use to prepare for class, which leads them to spend longer on preparation.^{29,31} From these results, instructors may wish to implement more scaffolding for undergraduate students to help them understand how to use all of the resources available, managing the class preparation activities, provide opportunities for them to reflect on their progress, and clearly communicating what it means to be in a flipped class. Additionally, instructors who do use primarily lecture, especially in introductory courses, may want to consider using some active learning techniques so that students are held accountable and can practice learning on their own. Future research should attempt to understand why undergraduate

students assume they have no responsibility for their learning in lecture-based courses and what the best practices are to help students adjust.

Graduate and undergraduate students favorably remembered the impact that class activities had on their learning and described the class as an "experience". Some scholars have suggested that the course organization may be more important than the topic of the course in terms of student success in flipped learning.³² The strategies that instructors employ and how the course is organized can impact the skills and knowledge that students gain,^{33,34} how students connect to each other, and the course itself.³⁵ Activities that catch the attention of students can help them become more engaged and engaged learners will evaluate, question, reflect, and make connections between content.²¹ However, little is known about specific in-class activities utilized in flipped classes that have been studied and instead, most studies focus on student satisfaction, exam scores, or student perception.²⁹ Future studies may wish to report data and details related to specific class activities vs. the semester as a whole in a flipped class. This would allow other instructors to replicate the activities and report on results to improve generalizability across student characteristics, universities, and content.

Team-based learning was also a factor that students thought contributed to their learning. Challenging students to learn from mistakes and accept being wrong can be unsettling.³⁶ Many students are not willing to take this risk and be wrong in front of their peers and instructor.²⁶ This typically is not asked of students in traditional lecture courses. Instructors using flipped pedagogy must establish a safe environment for students to take these risks²⁶ and team-based learning may be a way to establish a safe environment. In previous studies, students felt that team-based learning improved their critical thinking, increased motivation to learn, and their ability to apply theory to practice.^{4,6} Student-student

interaction can help reduce the need for instructor guidance when a student is learning new information,³⁷ but this may not be enough for undergraduate students. Undergraduate students may need more structure for team-based learning in a flipped class. Assigning roles in a team or requiring team studying outside of class could help undergraduate students feel like they have more support.

Although this study is unique that it compares a retrospective report of student perception of a flipped class among undergraduate and graduate students, it is not without limitations. The small, non-diverse sample represents two classes on similar topics from the same university, which limits generalizability. This study only includes one focus group each from an undergraduate and graduate course. More focus groups were planned for future iterations of these courses; however, the graduate course has since been deleted due to curriculum revisions and the COVID pandemic changed the way the undergraduate course was organized for over two years. Although 44 percent of the students in these classes participated in the focus group, self-selection bias may also have been an issue because students who enjoyed flipped learning may be more likely to volunteer to participate in a focus group about it. Students may also have been hesitant to be critical of the course because they knew the instructor would read the transcripts, however, the focus group moderators assured participants that no names or identifying information would be used in the transcripts, the instructor was interested in honest feedback, and there were no wrong or right answers.

This study shows evidence that flipped learning pedagogy is viewed as beneficial to teamwork and independent learning skills by both undergraduate and graduate students a year after the class concluded. However, undergraduate students may need more support to adjust to the flipped pedagogy. Being a confident, self-directed learner is important for entry-level dietitians as they may need to learn new information and skills on the job and complete required continuing

education. Entry-level dietitians also need to be self-aware of their limitations and seek help and input from more experienced dietitians for difficult or novel cases. Teamwork is an especially useful skill for future dietitians as they will likely work in interdisciplinary teams in which team members learn from each other, work together to achieve a goal, and have a role or responsibility to carry out. Therefore, it may be advantageous for both undergraduate and graduate dietetics programs to adopt flipped pedagogy to provide students with skills that will be needed as entry-level dietitians.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

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