## Flipped Classroom in an Orthopaedic Assessment Course: Students' Perspective

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**Context:** The flipped classroom, moving lecture outside class time and homework to the classroom, has been researched widely across many disciplines. Athletic training education has little research investigating this pedagogical approach.

**Objective:** To explore students' perceptions of a flipped orthopaedic assessment course.

Design: Qualitative study using a phenomenological approach.

Setting: Focus group interviews with undergraduate students enrolled in an orthopaedic assessment course.

**Patients or Other Participants:** Students (N = 15) enrolled in either the Physical Exam of the Lower Extremities in Athletic Training or the Physical Exam of the Upper Extremities in Athletic Training course participated in a focus-group interview in January or April 2016.

**Main Outcome Measure(s):** Focus group interviews were conducted with a structured interview protocol. Interview data were analyzed inductively to uncover dominant themes by first organizing the data, then summarizing it into codes, and finally interpreting. Credibility was secured through member checking, triangulation, and investigator triangulation.

**Results:** Themes indicated that participants in a flipped classroom found that this pedagogical practice was helpful, allowed for repetition, initially created more work, and was self-paced.

**Conclusions:** Evidence demonstrated that the flipped classroom for this orthopaedic assessment course was favorably received by the participants.

Key Words: Athletic training pedagogy, education, active learning, blended learning

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### Flipped Classroom in an Orthopaedic Assessment Course: Students' Perspective

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#### **KEY POINTS**

- A flipped classroom can promote student-centered active learning.
- Participants stated a flipped classroom was helpful and allowed time for repetition of skills in orthopaedic assessment courses.
- Initial impression from participants was the flipped classroom created more work; however, the participants in this study found the added outside class work led to deeper understanding of the material.

#### INTRODUCTION

Athletic training educators are investigating pedagogies that encourage application of material and stimulate higher-level thinking to promote long-term retention and recall. Educators have used a lecture format as the main focus of the classroom, but other pedagogical methods such as active learning are beginning to be investigated to determine their efficacy. A lecture-only classroom approach is one in which the students are passive learners, often sitting and taking notes. In contrast, active learning has been defined as course-related activity requiring students to do anything other than simply watching, listening, and taking notes.<sup>1</sup> Smith and Cardaciotto<sup>2</sup> have stated that active learning is an instructional approach that may foster student engagement. A flipped classroom creates an active learning environment and has been used in many allied health settings, including pharmacology,<sup>3–6</sup> medicine,<sup>7–9</sup> dentistry,<sup>10</sup> dietetics,<sup>11,12</sup> veterinary medicine,<sup>13</sup> nursing,<sup>14,15</sup> and athletic training.<sup>16,17</sup> This pedagogical method is a blended learning environment in which students learn instructional content through watching video lectures asynchronously, and synchronous sessions are spent on homework, discussion, interaction, or hands-on activities. A flipped classroom uses technology to move the formation of knowledge outside class and gives time in class to apply the new knowledge through group work or learning activities guided by the instructor that enhance application of knowledge.<sup>18</sup> This pedagogical approach allows for student to have learn-by-doing experiences to help construct, organize, and support their own knowledge and educational advancement.9

Although there has been interest in a flipped classroom model in higher education, research has been limited. In published literature reviews,<sup>3–17,19,20</sup> the following were found regarding the implementation of a flipped pedagogical approach: satisfaction with pedagogy,<sup>5–8,10–13,15,19,20</sup> increased faculty feedback,<sup>7,9,13</sup> motivation of students to become self-learners and involved in the learning process,<sup>3,9,10,12,19</sup> and improved student performance outcomes.<sup>3,4,13,19,20</sup> The athletic training profession has begun to research the flipped classroom approach.<sup>16,17</sup> Currently, 2 studies have investigated the flipped classroom in athletic training, focusing on student engagement<sup>17</sup> and implementation of a flipped classroom to maximize student learning.<sup>16</sup> The objective of this study was to expand the research on a flipped pedagogy in athletic training education by exploring students' perceptions of a flipped classroom in an orthopaedic assessment course.

#### METHODS

A qualitative research design was chosen for this study because the aim was to further understand, through the students, their perspective on a flipped classroom. For the purpose of this study, a flipped classroom consisted of audiorecorded lectures that were listened to outside of class to assist with the formation of knowledge, and application of the knowledge during class time through group work or learning activities guided by the instructor.<sup>18</sup> Focus group interviews allowed participants to express meaning about their flipped classroom experience. All participants were notified that their responses would remain confidential. The interview protocol and consent form were reviewed and approved by the institutional review board. All participants signed a consent form before focus group interviews.

#### Participants

Participants were selected through purposeful sampling of undergraduate students in which a flipped classroom was implemented. Fifteen students (10 female, 5 male) volunteered for the study (Table 1). Participants were from 2 different cohorts in one athletic training program because of sequence of courses; 7 were first-year students enrolled in Physical Exam of the Lower Extremities in Athletic Training and 8 were second-year students enrolled in Physical Exam of the Upper Extremities in Athletic Training.

#### Intervention

Two courses were flipped during the 2015-2016 academic year and were taught by the principal investigator: Physical Exam of the Lower Extremities in Athletic Training and Physical Exam of the Upper Extremities in Athletic Training. The courses used a combination of lecture and active learning strategies (simulations, group work, think-pairshare). The courses met 4 times a week for 50 minutes. The online portion of the flipped classroom included audiorecorded lectures and preclass quizzes. The audio-recorded lectures were developed with Camtasia (TechSmith, Okemos, MI) using narrated screen capture with relevant information displayed using PowerPoint (Microsoft, Redmond, WA). These audio-recorded lectures were embedded into the Moodle (version 3.4; Martin Dougiamas, Course Management System, Perth, Australia) course Web site and were provided as video links. The audio lectures were supplemental to the learning and allowed participants to acquire content and knowledge before classroom application. These audio recordings were made available at the beginning of each content area and remained accessible through the end of the course so that participants could continue to review them at any time.

#### Table 1. Study Participants and Course Name

Physical Exam of the Upper Extremities in Athletic Training	
Participant	Sex
1	F
2	M
3	M
4	F
6	F
10	F
11	M
12	F
Physical Exam of the Lower Extremities in Athletic Training	
5	F
7	F
8	F
9	F
13	F
14	M
15	М

Abbreviations: F, female; M, male.

Supplemental literature was available on Moodle for participants before the class sessions. A preclass quiz (only one attempt) was required and was completed online to assess and ensure compliance for the before-class work. The quizzes were designed at the lower level of Bloom's taxonomy,<sup>21</sup> and included recall items and vocabulary from the online video lessons. The quizzes were a total of 5% of the participants' overall course grade. The correct quiz responses were made available after the due date so that participants could use them as a study resource.

The didactic component of the class included both lecture and active learning strategies. A lecture component was kept in this course to ensure delivery of specific content, consisting of anatomy review, terminology, and components of the evaluation process. The active learning strategies used were patient simulations and think-pair-share. Simulations included several days of mock evaluations in which participants were placed in groups and assigned different injuries. Participants rotated role-playing throughout the simulation, taking turns as either injured patient or evaluator. Think-pair-

# Table 2.Semistructured Focus-Group InterviewQuestions

- 1. Describe your experience with the flipped classroom.
- 2. What was your initial reaction to the flipped classroom?
- 3. What did you like about the flipped classroom?
- 4. What did you dislike about the flipped classroom?
- 5. What was your experience with the in-class work (simulations, think-pair-share)?
- 6. Were you provided time in class to ask questions?
- 7. Did the flipped classroom contribute toward your learning?
  - a. In what way?
  - b. Clarify?
- 8. Would you change anything regarding the current implementation of the flipped classroom?
- 9. Would you recommend a flipped classroom to other faculty or courses?

share involved giving the participants a problem and requiring the participants to think individually and then work in pairs to solve the problem. These think-pair-share problems included scenarios that required differential diagnosis. One example of think-pair-share included a patient scenario in which all palpable tenderness was found on the lateral side of the ankle. The class was asked to think about different conditions for the patient and write them down. Then the participants shared their thoughts and worked through the evaluation process in pairs. To summarize the learning, participants shared their ideas with the entire class. The instructor facilitated both the think-pair-share and simulations and was available to clarify any misconceptions or incorrect information as needed.

#### Data Collection

Data were collected through focus-group interviews with semistructured questions in January and April 2016. Semistructured, open-ended questions allowed for individual responses and gave opportunity to ask more probing or follow-up questions if further clarification was necessary.<sup>22</sup> The questions were designed to discover the participants' perceptions of a flipped classroom (Table 2). These interviews were recorded using Sound Recorder (version 6.1; Microsoft).

Recorded interviews were replayed for transcription of the focus-group interviews and information was stored on a password-protected personal laptop. All participants received via e-mail a transcript of the interview for final review and to make sure their experiences with a flipped classroom had been correctly captured.

The transcript notes were analyzed to discover patterns, ideas, explanations, and a deeper understanding of a flipped classroom. The principal researcher analyzed the data through organizing, summarizing into codes, and finally interpreting the data. Organizing the data was first done through personally transcribing the interviews. The analysis of the transcripts followed an inductive process. This process began through reading and rereading the transcripts to gain a deeper understanding of the data.<sup>22</sup> Dedoose (version 7.0.23; SocioCultural Research Consultants, Los Angeles, CA) was then used to organize the data into codes. This process required identifying transcript excerpts that contained content meaningful to the research questions and tagging them with codes. From this tagging and excerpting, different visual tools were used to understand the phenomenon of a flipped classroom in the orthopaedic assessment course.

A colleague with over 10 years of experience in higher education and 5 years of qualitative research was included to review and verify the data analysis. This process included asking the colleague to look at the transcript notes and determine themes to verify any similarities. From the visual tools and the colleague's triangulation, a rich description was developed regarding how a flipped classroom impacted the participants.

#### Data Credibility

Data credibility, to ensure consistency and authenticity, was ensured through triangulation, member checking, and investigator triangulation. Triangulation included using both transcript and interview notes. During each focus-group interview, the principal researcher took notes. The interview and transcript notes were analyzed to identify categories. Member checking involved asking the participants to review transcript notes to confirm findings.<sup>22</sup> At the conclusion of transcribing the interviews, all research participants received via e-mail a copy of the interview transcripts for review, clarification, and suggestions. This allowed participants to confirm, correct, or elaborate to ensure accuracy of participant comments. Investigator triangulation involved asking a colleague to review transcript notes to interpret the data.<sup>22</sup> This colleague had conducted studies in qualitative research and had no connection to the program or participants interviewed. Through triangulation, member checking, and investigator triangulation, credibility and validity improved.

#### RESULTS

Through data analysis, 4 common themes emerged: (1) the flipped classroom was helpful toward varied learning styles; (2) repetition of course content; (3) the flipped classroom created more work; (4) participants were able to choose when and how to watch the audio lectures, which led to self-pacing.

#### Helpful

Thirteen of the 15 participants (86.6%) in this study stated that the flipped classroom experience was helpful. Participant 12 stated that the flipped classroom "helped clarify things that you didn't completely understand" and participant 5 stated the flipped approach was "most helpful for me ... go over in class what is on the videos but we can also hear it again." Participant 4 stated "I think everyone who uses it [audio recordings] sees it as helpful, as another repeating factor, even if that isn't how you learn."

Participant 9 stated a preference toward a flipped pedagogical approach over the traditional lecture approach and wished that other courses would use this format:

I felt that I have learned more and retained more information than I had in other classes because it required us to learn more by going home and doing the [recorded] lecture notes and then coming and getting the hands-on experience. Because I feel like I am able to learn better with the hands-on experience.

Participant 6 felt that the audio-recorded lectures were helpful for review and it wasn't always necessary to carry a textbook around:

I think it was helpful that I didn't have to carry around my textbook to necessarily study, I could just have my laptop and be in the library and put headphones in and listen, take notes and things.

Seven of the 16 participants, when asked to clarify how it was helpful, stated that the flipped classroom provided another source for learning. Participant 7 stated that the audio lectures

clarified things that were in the book because book language can be hard to read sometimes...and it [reading] gets boring... but then when you listen to someone I can get that and it's good. Participant 12 stated that the flipped classroom was another tool for studying and that

...it was helpful with people who have different learning styles. I personally don't like reading textbooks because it generally makes no sense to me. The audio just helped to clarify everything. It gave me a different way to be able to learn.

Participant 6 agreed that the flipped approach was helpful for varied learning styles, "just because some people learn better sitting in class and some might learn better online or handson."

Participants found the pedagogical practice of the flipped classroom to be helpful in this orthopaedic assessment course. They also valued the audio lectures as another resource for participants with varied learning styles.

#### Repetition

The participants commented that the audio-recorded lectures used in the flipped classroom provided repetition of content. Nine of the 15 participants (60%) stated the flipped classroom gave more time to apply the knowledge through repetition, whether inside or outside of class time. Participant 11 stated that through repetition of the videos, "if you weren't understanding something you could pause it, and then go back and replay it again." Participant 12 added, "I liked that you were able to go back and listen to the audio over and over again. Just reviewing stuff over and over again to make sure you know the material."

Two participants explained the repetition as a way to really learn the material that allowed for more hands-on practice. Participant 14 stated that this flipped orthopaedic class, unlike other courses, led to "more repetition in your class. I'm studying things outside of class and then you [the instructor] are bringing it into the class, driving it into our heads. I retain it a lot better." Participant 6 added that the flipped classroom led to

...extra practice with the in-class group work, we had to switch partners and try things [assessment skills] on other people...going through the mock evaluations too... to realize what you know and don't know and go back and review outside of class time.

This study supports that a flipped classroom provides repetition of material. The participants also found this pedagogy allowed for time to practice assessment skills during class time and reinforced the material.

#### More Work

Although the intent of a flipped classroom is to not create more lectures and cover added content, the participants in this course perceived that the flipped classroom created more work and that their studying habits and time management had to be evaluated. Half of the participants stated time was an important factor in the flipped approach. Participant 9 stated,

...initially I felt like it was a lot more work. I needed to go to lecture for 50 minutes and have to listen to audio lectures...it takes me awhile to do the audio lectures because I pause every so many words to write everything down word for word... It was a little overwhelming at first.

Although half of the participants mentioned that the flipped classroom required more work, 7 of the 15 participants (46%) stated that the added work was worth it. The flipped classroom created a learning environment they felt led to a better understanding of the content, even if it required some added time or work. Participant 15 stated that

...at the very beginning when you hear about it [flipped classroom] you think that it is going to be more time that you'll have to take outside of class. But then that goes away pretty quickly because you realize it's beneficial to the class in general.

Participant 11 also commented,

At first, it's a little overwhelming because you have to do extra lectures. But really, it's more beneficial for you because your learning is more efficient. Extra time out of the day...the extra stuff you have to do with audio lectures...but really you are doing yourself a favor and saving yourself time in the end.

Although the purpose of the flipped classroom was not to cover more content, the initial impression from the participants was that this approach required more time. However, the participants in this study found the added outside class work led to favorable results and understanding of the material.

#### Self-Paced

All participants in this study mentioned timing and pacing regarding listening or watching the recorded lectures. Eight of the participants preferred to watch the recorded lectures before class, whereas 6 of the participants preferred to do so after the in-class lecture or before the test.

The participants who preferred to watch the recorded lectures before class felt more prepared and understood the material that was being discussed in the classroom. Participant 15 mentioned watching the videos:

...the Sunday night just before we went into a new lecture. Just because I might only be able to watch it once. And that was most beneficial for me going into the classroom so I would be able to understand what we were talking about in class more than if I waited until partway through or towards the end, closer to the test.

Participant 12 stated that watching before class

was really helpful to know what we would be talking about that day in class so you were a little bit more prepared on the material. I tried to watch it [audio lectures] before class. It definitely made that class easier if you did. I feel like I learned it better if I watched it before.

Whereas a majority of participants preferred to watch the audio lectures before class, 6 of the participants preferred to do so after the classroom lecture. Participant 1 stated,

I mostly liked to watch after the lecture. Because I like hearing it from the professor's point of view first so they teach us everything we should know. I don't want to watch the video beforehand, because I might understand something wrong and then just be completely confused during class. I would make review days and sit there and watch videos, listen to them, write notes and go through everything again. The video lectures were just something to refresh my memory.

Participant 9 also watch the videos before the test: "I think one thing that helped me too is if I do the audios a week before the test...I can see how much I've already learned."

Several participants also mentioned that they liked listening and watching the audio lectures at their own convenience. Participant 10 mentioned that "you could just listen to it on your phone or wherever and you could do other things like clean." Participant 2 stated that he could review and "wash dishes, I would play it [audio lecture] in the background."

Five of the 15 participants when asked about the recorded lectures mentioned length was a critical piece. Participant 15 stated,

Last semester if I saw a video that was 50 minutes long, there would be times I wouldn't watch it because I had so much I had to do for that class anyways as well as other classes I was taking. Since it was 50 minutes long I felt like there was no way I was going to be able to find the time to even work on that [recorded lecture]. So, I wouldn't watch it. Whereas if it was shorter even a half hour or less, people are going to [watch it]...it's easier to fit it in your schedule if it is broken into different sections, you could go in and watch it.

Participant 7 stated that "some videos were really long and it was hard to engage in the longer videos. I liked the ones that were shorter."

All participants in this study mentioned timing of watching the videos, which allowed a self-paced learning environment.

#### DISCUSSION

Overall, the participants in this study stated that the flipped classroom was helpful and that they liked this pedagogy. Previous studies<sup>5–7,11,13,15,17</sup> investigating the flipped classroom approach and faculty/student satisfaction have found mixed results. Some studies<sup>5–7</sup> have stated that students and faculty enjoy the flipped classroom over a traditional format. Koo et al<sup>6</sup> investigated a flipped classroom in pharmacy and found that students viewed the learning experiences positively and felt more engaged during class time. In another study<sup>5</sup> in pharmacy, 59.8% of the students stated they preferred the flipped course compared with a traditional course. Athletic training education research<sup>17</sup> demonstrated that students enjoyed the flipped format, benefited from this pedagogy, and stated this learning format was meaningful. There have been some studies that showed students felt the flipped approach was negative because of increased workloads<sup>6</sup> and were less satisfied with the flipped classroom.<sup>23</sup> Although some studies<sup>5–7,11,13,15,17,23</sup> have demonstrated mixed results when investigating satisfaction with the flipped approach among faculty and students, research needs to be conducted that further investigates the flipped approach as associated with learning outcomes.

Participants in this study stated that the audio-recorded lectures were important, and they all mentioned timing of

watching the videos as well as liking the self-pacing, which is supported through previous studies.<sup>6,11,14,15,24,25</sup> Nursing education has investigated a flipped classroom and reported that students found this pedagogical approach more flexible and that students took ownership in learning,<sup>15</sup> and this led to self-paced learning<sup>11</sup> Flexible pedagogies can enhance learners' capabilities to think, anticipate, and prepare for conditions of complexity or uncertainty and change beyond the classroom.<sup>24</sup> Bloomfield and Jones<sup>25</sup> found that repetitious viewing of video clips of clinical skills enhanced student learning because it provided the student with opportunity to revise the content. Previous studies<sup>26,27</sup> have stated that one of the main benefits of audio-recorded lectures in a flipped classroom is that students can repeatedly interact with a concept until it is mastered. With a flipped classroom, students can review audio lectures as many times as needed outside of the classroom before any face-to-face class time, which provides flexibility in learning for the student.

Participants stated the flipped approach was helpful and allowed opportunity for more hands-on practice, which has been supported in several studies.<sup>4,9,15,17</sup> Å study<sup>15</sup> investigating a flipped approach in a public health science course reported that the flipped classroom led to a more engaged, supportive classroom and was an active learning environment, which in turn enhanced interaction and engagement. This is further supported by research in pharmacology<sup>4</sup> and athletic training<sup>17</sup> that demonstrated a flipped classroom led to more active engagement. Moraros et al<sup>9</sup> stated that students felt a flipped approach led to greater number of opportunities to be actively engaged in their own learning and progressively improve their mastery over the course content. When students spend time outside of the classroom gaining concepts and knowledge, the in-class time is available for more engaged learning through problem solving, discussions, experiments, and more interaction with peers and the instructor.

Many of the participants in this study reported the flipped approach was helpful and brought another learning style into the classroom. People learn in varied forms, whether listening, watching, reading, or actively involved in clinical skills or classroom activities. As athletic training education transitions to the professional master's level, these students are recognized as adult learners, and educators should be investigating pedagogical practices that may influence their learning styles. Studies<sup>28-31</sup> have demonstrated that learning styles affect the way students learn as well as relationships among learning preferences when comparisons are made by gender, personality, student retention, clinical education, and academic achievement. Research<sup>32</sup> in library and information studies has also found that diverse learning styles in the classroom are well suited for students who speak English as a second language. A few studies have investigated preferred learning styles in athletic training students.<sup>33–37</sup> However, most studies have investigated professional undergraduate learning styles, with varied results. Two studies<sup>33,34</sup> investigating undergraduate professional athletic training programs found that students had varied learning styles, whereas Harrelson et al<sup>35</sup> and Draper<sup>37</sup> found predominately kinesthetic preferences. Thon and Hanson<sup>36</sup> investigated both professional undergraduate and graduate athletic training students and found they preferred the diverger learning style. As defined by Kolb,<sup>38</sup> the diverger learning style involves concrete experiences and reflective observers. These individuals are intuitive

decision makers who function well in unstructured situations and have a very open mind to problem solving. Presently the research investigating the preferred learning style of professional athletic training students has focused on the undergraduate level. Continued research is needed, especially at the professional graduate level, regarding preferred learning styles of athletic training students.

Although this study did not investigate performance in a flipped class, studies<sup>3,4,6,13,19,20,39</sup> do demonstrate improved test scores. A study<sup>6</sup> in pharmaceutical education investigated if a flipped classroom would improve performance compared with a traditional classroom. In a pretest/posttest assessment of one course offered during different terms, the mean examination scores and overall grades improved significantly with the redesign from a traditional to a flipped format. In nursing,<sup>39</sup> a study was conducted to investigate the effects of the flipped classroom on knowledge acquisition. When comparing a flipped with a traditional course in a pretest and posttest assessment, the flipped classroom performed significantly better than the traditional course in 3-unit tests. Although the purpose of this study was not to investigate test performance of a flipped course, evidence does demonstrate that this pedagogical approach may directly affect students' learning.

#### LIMITATIONS

A limitation of the study is the small sample size. The small sample size for this qualitative study was because of a convenient sample of students who participated in the flipped orthopaedic assessment course. One must be careful not to generalize statements toward the entire population based on one qualitative study. Future research should involve investigating flipped classrooms with larger sample sizes and through qualitative methods as well as quantitative analysis.

#### RECOMMENDATIONS

In summary, the following recommendations may prove to be helpful for faculty considering the flipped classroom approach. First, video length should be 15 minutes or less. Research<sup>5,11,40</sup> has stated that videos should be learner paced and 10 to 15 minutes long. Second, students need to understand the flipped format and that technology will be used in the classroom. If students have not had a flipped format in previous courses, the instructor should make sure students understand what is expected. Third, the faculty should have a low-stakes assessment attached to items required outside of class. Lowstakes assessments promote less stress and a nonthreatening atmosphere for students where they have the opportunity to struggle though content and receive feedback on their effort without facing a penalty. In this study, the low-stakes assessment were quizzes. Spitzer<sup>41</sup> found that in middle-school classes, the final test performance was better when quizzing was implemented as compared with no quizzing. This testing effect is supported in the literature.<sup>41,42</sup> Lastly, the instructor must be aware that extra time will be required to flip the classroom. The instructor will need time to record lectures and prepare for active learning exercises.

#### CONCLUSIONS

Flipping a classroom is an innovative approach and involves both students and faculty to transition from passive to active learning approaches. This study contributes to the current research investigating a flipped classroom in athletic training education. Students felt the flipped approach in an orthopaedic assessment course was helpful, allowed for repetition, created more work, and was self-paced. Educators in many allied health professions are using the flipped approach to promote student-centered, active learning. Further evaluation of the flipped classroom would be useful in athletic training education to determine key components that facilitate critical thinking before, during, and beyond the classroom.

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