ATHLETIC TRAINING EDUCATION JOURNAL

www.natajournals.org
ISSN: 1947-380X
DOI: 10.4085/1004315

ORIGINAL RESEARCH

Measuring Student Engagement in a Flipped Athletic Training Classroom

Gayle A. Thompson, PhD; Suzan F. Ayers, PhD
Western Michigan University, Kalamazoo

Context: *Active learning* describes any instructional approach that fosters student engagement in the content and is believed to promote critical thinking more fully than do traditional lecture formats.

Objective: Investigate student engagement, specifically professional relevance and peer interaction, with active learning techniques used in a flipped classroom format.

Design: An exploratory study utilizing both quantitative and qualitative survey instruments.

Setting: Commission on Accreditation of Athletic Training Education–accredited undergraduate entry-level athletic training program.

Patients or Other Participants: Seventeen students (11 females, 6 males) of at least sophomore level, enrolled in the lower extremity orthopaedic assessment course in the athletic training program.

Main Outcome Measure(s): A mixed-method analysis was used. Quantitative questionnaires were analyzed with comparisons of medians and the Friedman test for nonparametric analysis. Qualitative questionnaires were coded using deductive and inductive reasoning and analyzed with emerging themes and shared coding procedures. Validity evidence is presented for quantitative data. Independent coding was used to confirm the trustworthiness of the qualitative data analysis.

Results: Participants reported a high level of course preparation, perceived content relevance, and value of peer interaction, all of which are indicators of student engagement. Four qualitative themes emerged: (1) content relevant to profession, (2) class activities fostering professional development, (3) becoming a reflective practitioner, and (4) pedagogical reflections.

Conclusions: A primary finding of our study was the high degree of perceived relevance of classroom content to professional practice. Participants indicated they learned as much as they taught in peer interactions and perceived both to be at essentially the same high level. Evidence supports the use of an active learning instructional format to engage students. Participants indicated a high level of support for the flipped classroom despite the greater effort required by the emphasis on student responsibility and the active learning nature of the course.

Key Words: Active learning, relevance, peer interaction

Please address all correspondence to Gayle A. Thompson, PhD. thompsongayle02@gmail.com.

Full Citation:
Thompson GA, Ayers SF. Measuring student engagement in a flipped athletic training classroom. *Athl Train Educ J*. 2015;10(4):315–322.

Measuring Student Engagement in a Flipped Athletic Training Classroom

Gayle A. Thompson, PhD; Suzan F. Ayers, PhD

INTRODUCTION

Athletic training educators have been promoting a variety of instructional techniques for more than a decade in an effort to better prepare students as entry-level athletic trainers.[1–4] While numerous terminologies are used to describe these pedagogies, including *peer-assisted learning, flipped classroom,* and *case-based* and *problem-based learning,* most align closely with the broad term of *active learning instructional techniques*. *Active learning* describes any instructional approach that fosters student engagement in the material and is believed to promote critical thinking more fully than do traditional lecture formats.[5] Students are involved in meaningful learning activities instead of passively hearing the instructor lecture at them. The learning techniques associated with active learning align fully with the hands-on practical application of material required in athletic training curriculums. By the nature of these programs' content, candidates must possess basic knowledge as well as the ability to apply this knowledge in practical settings.

Since athletic training education is inherently practical and application based, many athletic training educators are drawn to active learning techniques.[3,4,6,7] Recent recognition of the needs of the millennial generation has heightened educators' awareness of new instructional approaches.[6,7] One approach gaining popularity is the use of the flipped classroom, in which students are responsible for reviewing content before class (eg, PowerPoints, podcasts, readings) so that class time can be spent on discussion and interaction with hands-on activities that foster content application.[8–10] In addition, Berry[11,12] has described the use of case-based scenarios and student involvement in learning activities to more fully engage students in content and to promote critical thinking. Given the scope of this article, readers are directed to other publications for more information about specific active learning techniques.

Currently, much of the literature on active learning in athletic training education has focused on the clinical education component and not the didactic classroom. Many researchers[13–17] have specifically investigated the effectiveness of peer-assisted learning in the clinical education setting. In general, these studies found that students benefitted from interaction with their peers and promoted more formal incorporation of peer interactions within a curriculum. In another case, Heinrichs et al[18] used active, learner-centered modules to improve critical thinking in students' clinical case presentations. They found interactive modules improved the quality of the students' case analyses and presentations. While these studies demonstrate support for the use of active learning techniques, their focus only on clinical education ignores a significant component of athletic training education.

This emerging pedagogical awareness, as well as ongoing reform in athletic training education, created a "perfect storm," leading us to investigate use of active learning techniques in the formal classroom. Essential athletic training content, such as orthopaedic assessment, lends itself to the use of active learning techniques that encourage interaction in the classroom; however, there is little evidence to support whether active learning promotes the desired learning outcomes. One approach to gain this evidence is to study student engagement, defined as *the willingness of students to interact with content in meaningful ways other than traditional studying*,[19] which has been positively linked to student learning.[20–23] Student engagement has many facets, yet 2 of these—(1) relevancy of material and (2) interaction with peers and instructors—are closely aligned with the goals of active learning. The purpose of our study was to investigate student engagement, specifically relevance and interaction, with active learning techniques used in a lower extremity orthopaedic assessment course with a flipped classroom format.

METHODS

Participants

Our study was approved by the institution's institutional review board. Seventeen students enrolled in the lower extremity orthopaedic assessment course within the athletic training curriculum, taught by one of the primary investigators, were invited to participate. Participation in the study was voluntary, and participant identities were not revealed to the instructor until after final course grades had been submitted. All 17 students (11 females, 6 males), of at least the sophomore level in the athletic training curriculum, enrolled in the course agreed to participate.

Study Setting

This study was conducted within the lower extremity orthopaedic assessment course at a large public university in the midwestern United States housing a Commission on Accreditation of Athletic Training Education–undergraduate entry-level athletic training program. The course met 2 times per week for 14 weeks and used a flipped classroom format, in which students were responsible for previewing specific material before class time. Student engagement was encouraged in the course by integrating specific classroom active learning activities into the format of the course. These activities included, but were not limited to, assigned and student-developed authentic scenarios, practical lab activities, and case studies.

Instrumentation

Level of student engagement was measured throughout the semester using 2 self-reported instruments, as follows.

Daily Questionnaire. Participants completed a 6-item questionnaire at the conclusion of each class session. Two items used dichotomous (*Yes*/*No*) responses. The other 4 items used a 10-point ordinal scale to allow students a wide range of possible responses as well as to provide an even number of possible responses, therefore eliminating a purely central or neutral category. In addition, these students are commonly asked to rate things on a "1 to 10 scale," so their

Table 1. Daily Questionnaire

Items (All Ordinal Responses Indicated, 1 = Low and 10 = High)
1. Did you complete the "homework" (readings, ppts, assignments, etc) before class? (yes/no)
2. Value of completing work before class to be successful in class today. (ordinal, 1–10)
3. How likely something from class will EVER be used in a professional setting? (ordinal, 1–10)
4. How much information you learned from peers? (ordinal, 1–10)
5. How much information you taught/explained to peers? (ordinal, 1–10)
6. Is there a different way to cover today's content that you think would be more useful to you than the activities we did? (yes/no) If yes, please share a specific alternative approach you think would have helped you learn today's content more easily and/or better:

familiarity with this scale was deemed a strength of this approach. The questionnaire is provided in Table 1.

Validity evidence to support the interpretations of the Daily Questionnaire stems from the ability to directly extrapolate the question responses to specific aspects of student engagement theory.[22] Measurement experts familiar with active learning techniques as well as the content of the athletic training program reviewed the questionnaires before administration, offering content validity evidence. Participants were asked to comment on perceived relevance and level of interaction as it pertained to level of student engagement in addition to specific educational outcomes for the course. Interpretations of the data collected were descriptive and were used for exploring the holistic construct of student engagement in active learning techniques.

Weekly Journal. Participants responded weekly to 5 open-ended questions (see Table 2). These questions prompted participants' reflection on the relevance of the course content and active learning techniques used during the course that week to the development of their professional skill set.

Credibility of the Weekly Journal is enhanced by the triangulation of the findings being corroborated by the findings of the Daily Questionnaire. Findings were reviewed and analyzed by the course instructor as well as by a second researcher not involved in the course's instruction. Dependability of the data is supported by the familiarity participants had with the questionnaire after completing the instrument 7 times throughout the semester and by the consistency demonstrated in the responses.

Table 2. Weekly Journal

1. Your understanding of how this content matters to you as a future professional.
2. How this information will improve your professional skill set?
3. How you applied this content in your practical placement?
4. If you did not apply this in your practical placement, can you imagine a time when this information will be useful to your professional practice? If so, when/how? If not, why not?
5. Is there anything else you wish to share about this week (content, activities, class, practicum/clinical rotation, etc)?

Procedures

Participants completed the Daily Questionnaire at the conclusion of each normal class session during which active learning techniques were used. Therefore, questionnaires were not given during class sessions during which exams were administered, there were guest speakers, student presentations were given, or review sessions were conducted. Therefore, questionnaires were administered on 18 separate days. The Weekly Journal was administered at the conclusion of each week when both class periods used active learning techniques. Since class only met twice each week, weeks that included examinations, guest speakers, student presentations, or review sessions were not included. Therefore, data were generated from 7 weeks during which the Weekly Journal was administered. Participants completed these outside of class and submitted them to the instructor via e-mail.

Data Analysis

Collection of both quantitative and qualitative data allowed for a mixed-method analysis. Quantitative data generated from the Daily Questionnaire were calculated descriptively using SPSS (version 20; SPSS Inc, Chicago, IL). Use of an ordinal scale for questionnaire responses produced data most appropriately analyzed with comparisons of medians and nonparametric analysis.[24,25] Since we did not meet the assumption of independence, the Friedman test, with Wilcoxon signed-ranks test for post hoc analysis, was selected for comparisons between item responses and (1) part of the body (*joint; ie, foot, ankle, knee, hip, spine*) and (2) aspect of orthopaedic assessment covered (ie, history/observation/palpation [*HOP*], range of motion [*ROM*], *special tests*, or *holistic evaluations/case studies*). A priori significance was set at $P < .05$.

To maximize trustworthiness, qualitative data produced via the Weekly Journal were independently reviewed by each investigator. Based on student engagement theory,[22] the themes of relevance and interaction with peers were established a priori. Using deductive and inductive reasoning, we identified additional emerging themes. Once themes were established, shared coding procedures were decided upon. Investigators implemented these procedures with the remaining data, categorizing responses under the appropriate themes.

RESULTS

All 17 students enrolled in the course agreed to participate: 11 female (64.7%) and 6 male (35.3%) participants. Daily Questionnaire results are provided in the first section in the upcoming text and include 296 of 306 possible responses (17 participants over 18 class sessions), for a response rate of 96.7% (296/306). Overall frequencies and medians are presented in Table 3. Medians (Mdn) to item responses based

Table 3. Daily Questionnaire (Q; n = 296): Overall Descriptives and Frequency of Responses: %, (*f*)

	Median	Range	Low (1–3)	Neutral (4–6)	High (7–10)
Preparation (Q2)	10.0	9	1.4 (4)	5.7 (17)	92.9 (275)
Relevance (Q3)	10.0	4	0.0 (0)	0.3 (1)	99.7 (295)
Amount learned (Q4)	8.0	10	8.4 (25)	16.2 (48)	75.3 (223)
Amount taught (Q5)	8.0	10	11.5 (34)	25.7 (76)	62.8 (186)

on *joint* and *aspect of assessment* are presented in Tables 4 and 5, respectively. The Weekly Journal results are in the second section below and include 97 responses of the 119 possible reflections (17 participants over 7 weeks), for an 81.5% response rate (97/119).

Daily Questionnaire

Pre-Class Preparation. Responses indicated a high rate of completing the pre-class preparation (96.6%, 256/265), with 31 responses missing on otherwise-completed questionnaires. Participants reported a high level of value in completing pre-class preparation to be successful in class (Mdn = 10), with 87.5% (259/296) of responses ranging between scores of 8 and 10. There was a statistically significant difference in responses to perceived importance of pre-class preparation depending on the *aspect of assessment* being covered (χ^2 (2) = 8.052, P = .045). Post hoc analysis with Wilcoxon signed-rank tests was conducted with a Bonferroni correction applied, resulting in a significance level of $P < .013$. Pairwise comparison showed a statistically significant difference in perceived prepreparation importance between *ROM* and *special tests* ($Z = -2.493$, P = .013). Median interquartile ranges (IQRs) for perceived importance of preparation for *ROM* were 9.0 (8.0 to 10.0) and 10.0 (9.0 to 10.0) for *special tests*. No other significant pairwise differences were found among aspects of assessment. No significant differences were found in perceived value of pre-class preparation among joints of the body covered (χ^2 (2) = 2.908, $P = .573$).

Relevance of Content. Responses indicated high agreement with the relevance of class content to professional practice (Mdn = 10.0), with only 1 of 296 responses being <6 on the ordinal 1 to 10 scale, and 236/296 (79.7%) of the responses being 10. There was a statistically significant difference in responses to relevance of class material depending on the joint of the body being covered (χ^2 (2) = 17.0, $P = .002$). Post hoc analysis with Bonferroni correction ($P < .01$) was conducted. Median IQR values for perceived relevance responses were 10.0 (10.0 to 10.0) for the *foot, ankle, knee*, and *hip*; however, perceived relevance of the *spine* differed, with a median IQR at 10.0 (9.0 to 10.0). This resulted in a statistically significant difference in perceived relevance between the *spine* and *knee* ($Z = -2.844$, $P = .004$) and the *spine* and *hip* ($Z = -3.213$, $P = .001$). No other significant pairwise differences were found among joints. No significant differences were found in perceived relevance among aspects of assessment ($\chi 2$ (2) = 4.492, P = .213).

Interaction with Peers. Specific items on the Daily Questionnaire asked participants to comment on both (1) perceived amount of information *learned* from peers (Table 1, item 4) and (2) amount *taught* to peers (Table 1, item 5) during each class meeting. Medians for both items were 8.0. Although not statistically significant, frequencies of responses show that 75.3% (223/296) of responses for *amount learned* from peers were scored between 7 and 10, compared with 62.8% (186/296) of responses scored between 7 and 10 for *amount taught* to peers. There was a statistically significant difference, however, in responses to perceived *amount learned* from peers depending on the aspect of assessment being covered (χ^2 (2) = 8.075, $P = .044$). Post hoc analysis with Bonferroni correction ($P < .013$) showed no significantly different pairwise comparisons ($P > .013$), possibly because of the conservative nature of Bonferroni corrections. No significant differences in perceived *amount learned* were found among joints of the body covered (χ^2 (2) = 2.267, $P = .687$). No significant differences in perceived *amount taught* were found among joints of the body (χ^2 (2) = 5.458, $P = .243$) or aspects of assessment (χ^2 (2) = 7.536, $P = .057$).

The final item asked participants to indicate if they felt there was a better approach to reviewing the day's content. Only 16 responses (16/296, 5.4%) indicated the student would have preferred another approach to convey the day's content. When asked to offer a specific approach, only 9 responses were offered. Alternatives offered were not novel active learning approaches but instead typically indicated that participants preferred a different type of scenario or peer interaction.

Weekly Journal

Consistent themes were found in participants' Weekly Journal responses, including (1) content relevant to profession, (2) class activities fostering professional development, (3) becoming a reflective practitioner, and (4) pedagogical reflections on the university course in which participants were enrolled.

Table 4. Daily Questionnaire (Q) by Joint of the Body: Median (Range)

	Foot	Ankle	Knee	Hip	Spine
Preparation (Q2)	10.0 (1–10)	10.0 (5–10)	10.0 (6–10)	10.0 (5–10)	10.0 (6–10)
Relevance (Q3)	10.0 (7–10)	10.0 (6–10)	10.0 (7–10)	10.0 (8–10)	10.0 (7–10)
Amount learned (Q4)	8.0 (2–10)	8.0 (1–10)	8.0 (5–10)	8.0 (1–10)	8.0 (1–10)
Amount taught (Q5)	8.0 (2–10)	7.0 (2–10)	8.0 (2–10)	7.0 (2–10)	8.0 (1–10)

Table 5. Daily Questionnaire (Q) by Aspect of Assessment: Median (Range)

	HOP	ROM	Special Tests	Case Studies
Preparation (Q2)	10.0 (5–10)	9.0 (1–10)	10.0 (5–10)	10.0 (2–10)
Relevance (Q3)	10.0 (7–10)	10.0 (6–10)	10.0 (7–10)	10.0 (7–10)
Amount learned (Q4)	8.0 (3–10)	8.0 (1–10)	8.0 (1–10)	8.0 (1–10)
Amount taught (Q5)	7.0 (2–10)	8.0 (2–10)	8.0 (1–10)	8.0 (1–10)

Abbreviations: HOP, history/observation/ palpation; ROM, range of motion and muscle function.

Content Relevant to Profession. A majority of Weekly Journal responses (67/97, 69.7%) indicated that course content was "extremely important," "vital," and "crucial" as future professionals. In fact, responses unanimously indicated that the material directly related to participants' professional training. The ability to see direct relevance to a professional construct may appear obvious to educators as the orchestrators of a course, yet students' ability to perceive relevance is one of the challenges of engaging today's learner. Examples of participants connecting class work to professional application included the following:

> *Covering this material is extremely useful because of the fact that I will use the information I've gained constantly in my future. (AT43);* and *I am very aware and understand that the content that I am learning in this class will weigh heavily on what I will need to do in the future of my profession. Everything that we learn in class will be useful and even if it is hard or if no one likes to do it, it will most likely come up sometime this profession. (AT47)*

When asked how their understanding of content mattered as a future professional, participants unanimously indicated that the content would be directly related to their success as practitioners. Many comments also demonstrated an understanding of the importance of mastering the foundational content to build into future professional practice, including:

> *By learning these [skills] now, I can perfect them before my professional career and it helps me improve my skills now. (AT57);* and *This week's information is absolutely crucial in terms of what it means to me as a future professional. (AT54)*

Class Activities Fostering Professional Development. Most participants reflected on the course material's relevance to their clinical education experiences in the present and began to connect these course experiences with future professional practice. Several also indicated that interaction with course activities and the feedback they received from peers and the instructor cultivated confidence in their ability to know "how to respond" (23/97, 23.7%) and to "be confident and know what I am doing" (9/97, 9.2%) for application in the "real world" (56/97, 57.7%). Statements included the following:

> *It's a great feeling when you can take the information you learn on paper and pencil and apply it in real life. (AT58);* and *With experience comes confidence and confidence is what we all need being that we are still pretty new at those kind of skills. So doing anything to that nature always helps because it will provide us with information/feedback (given from you and our partners) that we can use as a part of our skills. (AT42)*

Participants could also anticipate that while their expertise required further development, early exposure to this applied content improved understanding of material. Reflections indicated a level of understanding of how their actions in the present course could precipitate their future professional development. As health care professionals, several participants commented on how professional development allowed them to help their patients (12/97, 12.3%), as eloquently framed by one participant:

> *I can see my skills as an athletic trainer improving. At [my clinical education site] I am now jumping in on every evaluation I can do and I am building more and more confidence each week as we learn more. (AT44)*

When asked if they were able to directly apply course content during their clinical education, participants' responses were more diverse. Only about one-third of the responses (35/97, 36.1%) indicated participants were actually able to perform skills learned in class within their clinical education settings. There are a variety of reasons for this, from lack of initiative to simply not having the opportunity present itself during a given clinical education experience. For example, if content involved evaluation of foot injuries, a participant placed in a setting in which no foot injuries occurred would have limited opportunity for application.

Becoming a Reflective Practitioner. In addition to professional development relative to practical skills, participants offered evidence that they were becoming more reflective about the impact they were having on the individuals with whom they were working (20/97, 20.6%). Participants consistently shared insights into how they were assessing the effectiveness of their outcomes and professional behaviors. One of the most important actions observed was the participants' ability to evaluate their preparation, understanding, and application in practical, hands-on settings. Participants were also able to determine how each of these components related to what they observed professionals and peers doing at their clinical education sites. Some examples of participants' reflective comments include the following:

> *Being able to accurately assess these injuries will provide my patients and athletes with a much better plan of action to return to daily activities or to play. (AT44);* and *I can use this information to differentially diagnosis their injury and eventually figure out the clinical diagnosis. (AT57)*

Even when participants indicated that they were unable to perform tasks themselves during a clinical education experience, they were able to glean more information from the situations they witnessed their preceptors managing (17/97, 17.5%). Participants also commented that they would take the opportunity to practice skills learned in class with other students and preceptors in contrived scenarios (23/97, 23.7%):

> *Going over and understanding what we do in class helps me acknowledge what my preceptor is doing and why she is doing*

it. I have witnessed a few hip tests that I can now practice with my preceptor. (AT58); and *As I have talked to certified AT's, I have noticed how they all reiterate the importance of conducting special tests and knowing your anatomy in order to evaluate properly. (AT46)*

Perhaps the most rewarding finding involved participants exhibiting higher level thinking in decision making and using discretion in the application of professional skills. Beyond rote application of specific skills in specific scenarios, participants offered examples of how they expanded basic concepts in a professionally appropriate and almost 'expert-like' manner:

I now know the gist of how to properly do special tests on an ankle from how someone taught me, but now I need to find my own way of doing it so I feel comfortable with it. (AT51); and *This will make me a better health care professional because ruling out injuries is just as important as finding out what is causing the pain. (AT46)*

Pedagogical Reflections on Course. Many participants offered unprompted positive Weekly Journal comments (27/97, 27.8%) on the class format and how much they enjoyed the class activities. Participants demonstrated interacting with the material and commented on specific activities that further engaged them with the content. Generally, participants appeared to see the value in the active learning techniques used. While some offered suggestions to improve specific activities, no participants indicated a desire to return to a more traditional class format:

Doing this hands-on learning in class really helps me conquer my fear and prove to myself that I am capable of so much. (AT52); and *I love the hands on work we are doing with palpation and locating different bones in such in the foot. It's very fun when you can come in and take a quick quiz and then get right into working with each other. (AT42);* and *I loved all of the activities that we have done in class. (AT50);* and *I enjoy taking the lecture part of class out onto [the course Web page] so that we may get more hands-on during class. Labs have been very creative and have helped me understand the topic much better than being told, or reading the information. (AT48)*

DISCUSSION

Athletic training educators have been espousing active learning techniques for decades in an effort to provide a supportive learning environment for students.[1–4] Preprofessional health care education programs, such as athletic training programs, benefit from providing activities students will experience in early professional practical settings through the use of guided problem solving to foster successful skill application.[26] Students are given the opportunity to interact with content in controlled educational environments that encourage immediate and formative feedback.[6] Content learned in the classroom can be further developed through clinical education experiences that bridge content and application of knowledge in the field. Despite the athletic training literature on the value of utilizing these techniques in the clinical education setting described here, little evidence has been gathered to support the use of active learning techniques in the didactic classroom.

While many approaches can be used to study the effectiveness of active learning techniques, our research focused on the impact of active learning on student engagement, specifically relevance and peer interaction. Content relevance refers to students' ability to connect what they are learning in the didactic setting to application in real-life practice. When students can readily make associations between theoretical and practical applications, motivation improves and they become more engaged in the material, which is an important aspect for many active learning techniques.[23,27,28] Interaction among peers and with instructors in the classroom is one of the major shifts in education from traditional pedagogy to more progressive active learning instructional techniques. This aligns with the perception that today's learners require more interaction than did previous generations.[7,17,22,29] The ability of learners to interact, and therefore engage each other in content and problem solving, is the foundation of collaborative learning.[3,20,30]

Relevance to Professional Practice

A primary finding of our study was the high degree of perceived relevance of content to professional practice. This was confirmed in both the Daily Questionnaire and Weekly Journal. Hermann[31] found that unless students perceive the relevance of the content, they may resist, instead of fully engaging in, content. Overall, participants repeatedly indicated a strong connection between course content and relevance to current and future clinical practice. These findings should be interpreted in light of the characteristics of an athletic training program. Evaluation of musculoskeletal injuries is foundational to the athletic training profession. It would be logical, therefore, that students would find the content highly relevant to future professional practice. Courses with a more general educational emphasis, regardless of the active learning techniques used, may find it more difficult to exhibit the same high level of perceived relevance across students.

However, participants indicated that class activities supported the relevance of the material as well. Therefore, not only was the content itself professionally applicable, but the mode of delivery was also viewed by participants as meaningful, adding benefit to the use of active learning techniques. In athletic training education, as in other health care curriculums, content is essentially established; therefore, one of the biggest challenges is maximizing effective pedagogy. Many athletic training researchers[3,4,32] have been proponents of active and authentic strategies to enhance student learning. Mensch and Ennis[3] found the use of scenarios and case studies, authentic experiences, and a positive interactive environment vital to student learning. Walker[4] discussed the role of higher level questioning to enhance critical thinking and engage students in the material. Each of these techniques offers an example of the active learning activities used in the athletic training course for this study, so the congruence of our findings with those of previous studies is logical.

An interesting finding from our study was that the perceived relevance of the *spine* scored significantly lower than the knee or hip. In reviewing the frequencies of scores, this is likely the result of the spine being scored a 10 less frequently (60.8%, 31/51) than the knee (89.4%, 42/47) or the hip (87.5%, 42/48), yet still the median score was 10.0 for all 3 joints. This finding could result from the trepidation students sometimes report in approaching assessment of the spine, or perhaps some athletic

training students perceive the spine as being outside of their scope of practice. This finding emphasizes the need to further encourage student engagement when more challenging content is being covered.

Interaction with Peers

Overall, participants indicated they learned as much as they taught in classroom interactions with peers, and they perceived both values to be at essentially the same high level. Peer interaction in athletic training education has been widely studied in the literature as peer-assisted learning.[13–17] Weidner and Popp[17] found that students indicated they were less anxious interacting with peers than with instructors, and they also found that increased collaboration improved confidence and clinical skills. Another study[16] found peers were highly accurate in assessing each other's skills. Each of these studies supports the value of utilizing peer interaction in the classroom for the development of both those giving and those receiving feedback.

Henning et al[30] pointed out the fluid nature of peer interaction in that both teaching and learning can take place simultaneously within a group. Instead of formal roles of 'teacher' and 'learner' in peer interactions, group interaction fosters feedback and collaboration to critically think through a shared problem. Students are encouraged to ask questions and reflect on content as well as to defend their reasoning.[4] Teaching also requires a higher level of understanding of the material and is an effective means of reinforcing content for deeper comprehension.[15] The connection we found between the findings of Henning et al and our own results indicated that the proportions of reported peer interactions were roughly similar in terms of the amount *learned* from or *taught* to peers in this sample.

It should be emphasized that peer collaboration, while effective, is not intended to replace the input and assessment of the instructor or another 'expert' in the field. If students are unsure of content themselves, it is unlikely they will be effective in helping their peers.[15] Peer collaboration is, however, highly useful as an informal tool with which to further engage students in content and to develop professional skills. Collaboration with student peers can closely resemble professional collaboration in many settings[30] as well as help students give as well as receive constructive feedback. Despite being previously advocated in the classroom,[15] use of peer-assisted learning has primarily been reported in the clinical education environment. This study offers some support for the use of peer-assisted learning in the didactic classroom, as was used in our study.

Flipped Classroom Format

We also looked at the perceived value of the flipped classroom approach used for the course in which participants were enrolled. Inherent in a flipped classroom format is the student's advance preparation. Participants generally indicated a high level of not only completing the pre-class assignments but also of valuing the completion of those materials as necessary for successful participation during class. It is interesting that there were many participants who did not respond when asked if they completed the pre-class materials, which may be assumed to mean they did not complete the materials. Although not a direct indicator of participants' actual completion of the assigned prep work, this information reinforces the basic premise of student responsibility inherent in the flipped classroom approach. Giving students responsibility for pre-class preparation has also been found to build on students' belief in their ability to learn, thus improving motivation and engagement.[23]

In a study specifically examining the value of preparation in a flipped classroom, Gipson and Richards[33] found that while only 28% of students completed pre-class prep work, they scored as high on a posttest as did students exposed to traditional lecture-based format as a result of student interaction during in-class activities. This is reinforced by our findings that while participants indicated they had prepared for class, the real learning took place during classroom interaction. Both components are major contributors to successful educational outcomes.

We did find that participants reported less value in completing pre-class work when comparing *ROM* to *special tests*; however, the overall perceived value was still quite high. This could likely be the result of the nature of discerning proper technique for goniometry and the specific manual muscle testing techniques. These techniques are often met with some resistance in athletic training students, as the meticulous nature of these skills can be challenging to learn independently. These are also skills that preceptors may not demonstrate using as much during clinical education, and therefore students are less familiar with ROM techniques than with special tests.

Participants' feedback on the pedagogical techniques used in class was encouraging. As already reported, participants offered a large amount of unsolicited support on both questionnaires for the flipped classroom format, despite the emphasis on student responsibility and the active nature of the course. Smith and Cardaciotto[5] insightfully compared active learning to broccoli; while students recognize the value of the approach, they may not always enjoy it. Since the present study involved participants who had been selectively admitted to their chosen program, it would seem likely they would be highly engaged in the material and motivated to be successful. While student engagement is not a direct measure of student learning, it is an important indicator of learning behaviors. Athletic training educators should continue to investigate the application of active learning techniques to meet desired educational outcomes in our professional preparation programs.

Limitations

Participation in our study was not revealed until final grades were submitted, according to the approved Human Subjects Institutional Review Board protocol. Yet as students in the athletic training program, participants may have been hesitant to reveal what could be seen as negative input to their athletic training instructor. Also inherent to the study was the familiarity participants had with the Daily Questionnaire. Since the same questionnaire was repeatedly used for data collection, over time participants may have put less effort toward their responses or developed a degree of test/retest familiarity. As with many forms of research, the potential for bias exists as a result of the integration of one of the researchers with the participants and research design. However, participants were never assigned a grade based on the

quality or content of their responses but only on the submission of the work.

CONCLUSIONS/AREAS OF FUTURE STUDY

Athletic training educators are implementing a variety of active learning techniques in order to improve the quality of our programs. Anecdotal evidence is not enough to support whether these techniques lead to desired outcomes. This study adds to the body of evidence that a flipped classroom approach may enhance student engagement in course content. Students are able to see the applicability of course work to future professional goals as well as to become dynamically involved in their learning. Peer interactions also help facilitate problem solving and mimic a team approach to health care. While the clinical component of athletic training education has been using similar hands-on active learning for years, applying these same approaches in the didactic classroom can be beneficial as well.

Future studies are warranted, however, into other aspects of active learning and ways to determine effectiveness. These could include comparison of a traditional lecture format with more active learning techniques in a more intervention-based study. Investigating specific outcomes, such as employer perception of the quality of graduates and Board of Certification Examination performance when active learning techniques are used would yield useful data. Future studies could also compare students at different stages of their education or in different courses. While there remains much to be explored in the outcomes of active learning, athletic training education can lead the charge.

REFERENCES

1. Coker CA. Consistency of learning styles of undergraduate athletic training students in the traditional classroom versus the clinical setting. *J Athl Train*. 2000;35(4):441–444.
2. Leaver-Dunn D, Harrelson GL, Martin M, Wyatt T. Critical-thinking predisposition among undergraduate athletic training students. *J Athl Train*. 2002;37(suppl 4):S147–S151.
3. Mensch JM, Ennis CD. Pedagogic strategies perceived to enhance student learning in athletic training education. *J Athl Train*. 2002;37(suppl 4):S199–S207.
4. Walker SE. Active learning strategies to promote critical thinking. *J Athl Train*. 2003;38(3):263–267.
5. Smith CV, Cardaciotto LA. Is active learning like broccoli? Student perceptions of active learning in large lecture classes. *J Schol Teach Learn*. 2011;11(1):53–61.
6. Hughes BJ, Berry DC. Teaching and learning: self-directed learning and the millennial athletic training student. *Athl Train Educ J*. 2011;6(1):46–50.
7. Monaco M, Martin M. The millennial student: a new generation of student. *Athl Train Educ J*. 2007;2(2):42–46.
8. Berrett D. How 'flipping' the classroom can improve the traditional lecture. *Chron High Educ*. 2012;12:1–14.
9. Bull G, Ferster B, Kjellstrom W. Inventing the flipped classroom. *Learn Lead Technol*. 2012;40:10–11.
10. Davies RS, Dean DL, Ball N. Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educ Technol Res Develop*. 2013;61:563–580.
11. Berry DC. Authentic learning and student choice: is there a place to allow athletic training students to set their own learning destiny? *Athl Train Educ J*. 2012;7(4):205–210.
12. Berry DC. Case-based learning in athletic training. *Athl Train Educ J*. 2013;8(3):74–79.
13. Henning JM, Weidner TG, Jones J. Peer-assisted learning in the athletic training clinical setting. *J Athl Train*. 2006;41(1):102–108.
14. Henning JM, Weidner TG, Snyder M, Dudley WN. Perceived frequency of peer-assisted learning in the laboratory and collegiate clinical settings *J Athl Train*. 2012;47(2):212–220.
15. Mackey T, Kamphoff C, Armstrong J. Perceptions of participants involved in peer assisted learning in a professional athletic training education program. *Athl Train Educ J*. 2010;5(1):12–21.
16. Marty MC, Henning JM, Willse JT. Accuracy and reliability of peer assessment of athletic training psychomotor laboratory skills. *J Athl Train*. 2010;45(6):609–614.
17. Weidner TG, Popp JK. Peer-assisted learning and orthopaedic evaluation psychomotor skills. *J Athl Train*. 2007;42(1):113–119.
18. Heinrichs S, Vela LI, Droulin JM. A learner-centered technique and clinical reasoning, reflection, and case presentation attributes in athletic training students. *J Athl Train*. 2013;48(3):362–371.
19. Axelson RD, Flick A. Defining student engagement. *Change*. 2010;43(1):38–43.
20. Carini RM, Kuh GD, Klein SP. Student engagement and students' learning: testing the linkages. *Res High Educ*. 2006; 47(1):1–32.
21. Kuh GD. What we're learning about student engagement from NSSE: benchmarks for effective educational practices. *Change*. 2003;35(2):24–32.
22. Taylor L, Parsons J. Improving student engagement. *Curr Issues Educ*. 2011;14(1):1–32.
23. Zepke N, Leach L. Improving student engagement: ten proposals for action. *Active Learn High Educ*. 2010;11(3):167–177.
24. Pett MA. *Nonparametric Statistics for Health Care Research*. Thousand Oaks, CA: Sage Publications; 1997:131–145.
25. Jamieson S. Likert scales: how to (ab)use them. *Med Educ*. 2004; 38:1217–1218.
26. Clark R, Harrelson GL. Designing instruction that supports cognitive learning processes. *J Athl Train*. 2002;37(suppl 4): S152–S159.
27. Ambrose SA, Bridges MW, DiPietro M, Lovett MC, Norman MK. *How Learning Works: 7 Research-Based Principles for Smart Teaching*. San Francisco, CA: Jossey-Bass Publishers; 2010.
28. Claxton G. Expanding young people's capacity to learn. *Br J Educ Stud*. 2007;55(2):115–134.
29. Grail Research Analysis. Consumers of tomorrow: insights and observations about generation Z. http://grailresearch.com/About_Us/FeaturedResearch.aspx?aid=107. Published 2011. Accessed March 10, 2014.
30. Henning JM, Weidner TG, Marty MC. Peer assisted learning in clinical education: literature review. *Athl Train Educ J*. 2008;3(3): 84–90.
31. Hermann KJ. The impact of cooperative learning on student engagement: results from an intervention. *Active Learn High Educ*. 2013;14(3):175–187.
32. Mazerolle SM, Pagnotta KD, Salvatore AC, Casa DJ. Athletic training educators' pedagogical strategies for preparing students to address sudden death in sport. *Athl Train Educ J*. 2013;8(4): 85–96.
33. Gipson M, Richards J. Student engagement through podcasting. *Nurse Educ*. 2011;36(4):161–164.