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ORIGINAL RESEARCH

Athletic Training Students' and Preceptors' Perceptions of Active Learning Time and Bug-In-Ear Technology During Clinical Education Experiences

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Context: Engaging clinical experiences that allow extensive active learning and patient care interactions are important for the professional development of athletic training students. Understanding students' use of clinical time is important when attempting to improve these experiences.

Objective: To gain participants' perspectives on active learning during clinical education both with and without the use of bug-in-ear technology.

Design: Qualitative.

Setting: Three high schools, 2 rehabilitation clinics, 1 university, and 1 community college clinical sites within 3 Commission on Accreditation of Athletic Training Education–accredited undergraduate athletic training programs.

Patients or Other Participants: Thirteen athletic training students (11 female, 2 male; 22 ± 2 years old, 2 ± 1 years enrolled in the current accredited athletic training program) and 8 preceptors (5 female, 3 male; 35 ± 10 years old, 3 ± 3 years of experience as a preceptor) volunteered for this study.

Main Outcome Measure(s): After observation of the participants' clinical education experiences, individual in-person interviews were audiorecorded and transcribed verbatim. We used an inductive process of open, axial, and selective coding to identify themes. Trustworthiness was established with member checking, multiple-analyst triangulation, and data source triangulation.

Results: Three themes emerged from the data. Participants recognize that students spend much of their clinical time interacting with patients, completing administrative tasks, and doing custodial work. Participants noted their awareness of student activities increased after using the active learning assessment instrument. Lastly, participants perceived that bug-in-ear technology improved the efficiency of task completion but not the actual tasks completed.

Conclusions: Since several factors influence the amount of active learning time spent during students' clinical education, athletic training programs may benefit from looking at their own students' time spent during clinical education. Asking students and preceptors to assess active learning time may help them and clinical education coordinators identify ways to increase active learning and decrease unengaged and managerial time.

Key Words: Experiential learning, preceptor, clinical teaching

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INTRODUCTION

Athletic training students and preceptors have described clinical education experiences as critical to the development of competent professionals.[1] Engaging clinical experiences help students become socialized into the profession, develop high-level critical thinking skills, and gain confidence.[1–3] Students who experience meaningful clinical experiences are also more likely to persist in the athletic training profession.[4] Clinical education experiences that provide regular patient care interactions, communication with preceptors, and hands-on skill application are viewed as the most beneficial to students' development as clinicians.[1,2,5] Preceptors identify similar benefits of engaging clinical experiences.[1,6]

Existing research[7–10] suggests that students spend about half of their time during clinical education on active learning experiences, such as clinical application of skills and instructional learning time with their preceptors. When not actively learning, students spend their time on managerial (9%) and unengaged tasks, such as down time and waiting time (17%).[7] Researchers[7,8] have found the extent of students' engagement varies between settings, student levels, patient volumes, and clinical rotation assignments. Both preceptors and students perceive insufficient time, preceptor role conflict, and lack of student initiative to be barriers to student active learning and clinical engagement.[5] Students value when preceptors help immerse them in more engaging clinical experiences[2,3] and become frustrated when they feel their time is wasted at their clinical sites.[4,8]

Considering the importance of clinical education and engagement in these experiential learning opportunities, it is essential to ensure that students' clinical time is spent on meaningful experiences. Athletic trainers may seek out educational strategies to make clinical experiences more engaging for students, such as feedback,[11] graded supervision and autonomy,[12] and simulated skill application.[6] However, preceptors and students often struggle with determining the best way to implement the aforementioned strategies while also providing direct supervision. Bug-in-ear technology has been integrated into field-based education settings and has been shown to improve student confidence,[13] performance,[14] autonomy,[13] and instructor feedback delivery[14,15] during experiential learning. Bug-in-ear technology, or the use of 2-way radios, allows preceptors and students to communicate with each other over a greater distance than direct communication allows. This, in turn, can allow preceptors to increase the distance between themselves and students, potentially increasing communication and autonomy while maintaining supervision and the ability to intervene. To our knowledge, bug-in-ear technology has not been applied to the athletic training clinical education setting.

Given the positive results others have had using bug-in-ear technology in experiential learning settings,[13–15] we wanted to explore its use in athletic training clinical education. Active engagement during clinical education is important,[1–3] and bug-in-ear technology has the potential to increase responsibility during experiential education.[13,14] Therefore, we sought to gain preceptors' and students' perceptions of active learning time during clinical education with and without the use of bug-in-ear technology.

METHODS

We used a qualitative research design to gain preceptors' and students' perspectives of time spent during clinical education.[16] Qualitative methods allow researchers to perform an in-depth investigation into a topic of interest, such as active learning, and capture the context of different settings and participants in their natural environment.[16] Using a combination of qualitative methods, including field observations, interviews, and field notes, also facilitates triangulation of multiple perspectives, including preceptors, students, and the researchers.[17]

Participants and Setting

After obtaining institutional review board approval, we used purposeful and convenience sampling procedures[18] to seek perspectives of preceptors and students affiliated with Commission on Accreditation of Athletic Training Education (CAATE)–accredited programs. Thirteen athletic training students and 8 preceptors from 3 undergraduate athletic training programs participated in this study. Preceptors were employed in high school (n = 3), National Collegiate Athletic Association Division I university (n = 2), community college (n = 1), rehabilitation clinic (n = 1), and club sports clinic (n = 1) settings. Institution and participant names were assigned codes and pseudonyms to maintain participant confidentiality. Preceptor and institution demographics are shown in Table 1, and student demographics are shown in Table 2.

Instrumentation

To meet the study objective of obtaining participants' perspectives of active learning during clinical education, we chose to have participants (1) reflect on students' activities on a daily basis using a validated instrument and (2) complete a semistructured interview after observations were completed. We used the previously validated Athletic Training–Clinical Education Time Framework (AT-CETF) instrument to categorize students' time spent during clinical education experiences.[7] We made minor modifications to reflect current terminology in the National Athletic Trainers' Association educational competencies (eg, changing "evaluation" to "clinical examination") and added additional examples of each category to facilitate accurate reporting.

We piloted the modified instrument with 2 students and 1 preceptor during 2 days of actual clinical education experiences. Pilot participants agreed that the instrument was an appropriate mechanism for recording students' time spent;

Table 1. Preceptor Participant Demographics

Pseudonym	Institution/Group	Experience as Preceptor, y	Experience as Clinician, y	Sex	Age, y	Ethnicity	Work Setting	Highest Degree Completed
Jay	Thornfield 1	10	18	M	44	Latin American	Community college	Master's
Emma	Thornfield 2	10	27	F	55	White	Private high school	Master's
Elizabeth	Thornfield 3	5	8	F	30	White	Club sports clinic	Master's
Meg	Pencey 1	2	8	F	33	White	Division I University	Master's
Edward	Pencey 2	1	1	M	25	White	Division I university	Bachelor's
Phoebe	Walden 1	3	4	F	32	White	Rehabilitation clinic	Master's
John	Walden 2	2.5	14	M	40	White	Public high school	Bachelor's
Anne	Walden 3	1	2	F	24	White	Public high school	Bachelor's

therefore, no changes were made. The AT-CETF categories are listed in Table 3.

In addition to the quantitative instrument, we used a semistructured interview guide to gain participants' perspectives on their general preceptor-student interactions, experiences completing the AT-CETF, and experiences with the bug-in-ear technology. The interview guide was developed based on principles of qualitative research,[16] previously published guides,[1,17] and objectives of the research study. The preceptor guide consisted of 6 questions (Table 4), and the student guide consisted of 8 questions (Table 5). Each interview ended with a member-checking question asking participants to clarify key themes that emerged from their interview. After the principal investigator developed the interview guide, the guide was peer debriefed by the second author. Two changes were made to the preceptor interview to improve clarity, and 1 change was made to a question to make sure it wasn't leading. No changes were made to the student guide. The interview guides were then pilot tested with 1 preceptor and 2 students who fit the inclusion criteria for the study. After each interview pilot, participants were asked if questions were clear, in a logical order, and unbiased. All participants agreed that guide was clear and appropriate, and no additional changes were made.

Procedures

We contacted clinical education coordinators affiliated with CAATE-accredited athletic training programs located within a 60-mile radius of the principal investigator's institution. This distance allowed for the principal investigator to travel to the included sites for observation and interviews throughout the data collection time frame. Four clinical education coordinators agreed to participate and provided the names and contact information for preceptors and students currently engaging in clinical education experiences within their program. We purposefully sampled[16] preceptors and students with various experience levels located in a variety of settings to provide a broad range of participant perspectives.

The principal investigator observed (without intervention or interaction) and audiorecorded (100-P Series, Manufacturer, Sennheiser, Germany; and Pro 88W, Audio-Technica US, Stow, OH) student and preceptor activities and interactions on 4 separate occasions over the course of 1 month's time. During the first 2 observations, the student and preceptor communicated in a direct, verbal fashion, which is typical. During the

Table 2. Student Participant Demographics

Pseudonym	Institution/ Group	Year in Accredited Athletic Training Program	No. of Preceptors, Including Current and Past Clinical Rotations	Sex	Age, y	Ethnicity	Typical No. of Hours Spent at Current Clinical Rotation per Week (Self-Reported)
Nick	Thornfield 1	1	1	M	26	White	20–25
Daisy	Thornfield 1	2	3	F	21	Latin American	26–27
Harriet	Thornfield 2	2	3	F	24	Latino/White	25
Jane	Thornfield 2	1	3	F	20	Latin American	15
Catherine	Thornfield 3	1	5	F	22	African American/ Asian/ Latin American	15–20
Mary	Thornfield 3	1	1	F	23	White	15–16
Jo	Pencey 1	3	11	F	24	Latin American	20
Beth	Pencey 1	1	1	F	21	Latin American	15
Elinor	Pencey 2	1	1	F	20	White	20
Marianne	Pencey 2	1	1	F	22	White	25
Holden	Walden 1	3	5	M	21	White	20
Dagny	Walden 2	3	6	F	21	White	23
Diana	Walden 3	3	5	F	21	Asian	20

Abbreviations: F, female; M, male.

Table 3. Athletic Training–Clinical Education Time Framework Categories

Instructional time
Spoken instruction
Practical instruction
Observational instruction
Educational evaluation
Clinical time
Prevention and health promotion
Therapeutic intervention
Clinical examination and diagnosis
Acute care
Healthcare administration
Managerial time
Custodial task
Preparation task
Unengaged waiting time
Down time
Transition time
Engaged waiting time

last 2 observation days, their communication was augmented with the use of bug-in-ear technology. On all 4 occasions, the student and preceptor completed the AT-CETF[7] instrument after the conclusion of the clinical education session. In addition to collecting AT-CETF data, we conducted individual, semistructured interviews with participants to gain their perspectives on the topic of interest.[16]

Interviews were conducted with each participant within 24 hours after the last observation day. Interviews were audio-recorded (Zoom H2; Samson Technologies, Happauge, NY) and transcribed verbatim. Participants were then asked to review the transcripts and to provide additions and clarifications through email, if desired, as a form of member checking. Participants were not permitted to change their original responses. Participants were allotted 3 weeks to respond to the member checking, after which data analysis was initiated.

Data Analysis and Trustworthiness

To gain an understanding of participants' perceptions and reflections on active learning time, we focused our analysis on the interview data. Results of the quantitative analysis of the completed AT-CETF instruments are presented in a different article.[18] We used a general inductive process of open, axial, and selective coding to analyze the interview data.[16] Initially, 2 researchers (S.L.N., T.M.K.) independently coded 4 interviews (2 preceptor and 2 student) and created a draft codebook of initial codes and categories. Both investigators then independently coded the remaining interviews, meeting 3 times throughout the process to further refine the codebook. Trustworthiness was ensured throughout the data collection and analysis process with several methods. Multiple researchers were involved in the development of the interview guides and data analysis process, minimizing bias potentially presented by one researcher.[19] The methods used for this study are appropriate and recognized methods in both general qualitative research[16,20] and athletic training clinical education settings,[11,17] improving the credibility of the findings. Member checking was used during and after the interview, allowing participants to confirm the meaning of their responses.[19] In addition, multiple data sources, including the AT-CETF instrument, researcher observation, and participant interviews, triangulate the data sources and further improve the credibility and quality of the findings.[19] Lastly, including a variety of clinical settings, preceptor-student groups, and athletic training programs improves trustworthiness and the transferability of the findings.[19]

RESULTS

Three themes emerged from the data related to perceptions of student active learning during clinical education. The first theme described the different *activities students completed* during clinical education, including patient care, administrative duties, and custodial work. For the second theme, preceptors and students described having an *increased awareness* of students' activities after using the active learning assessment instrument. Lastly, the third theme revealed that participants perceived that *bug-in-ear technology* improved the efficiency of task completion but did not change the actual tasks students completed during clinical education.

Activities Completed During Clinical Education

Preceptors and students described that students complete a variety of activities during clinical education, including patient care, administrative duties, and custodial duties (Figure).

Table 4. Preceptor Interview Guide

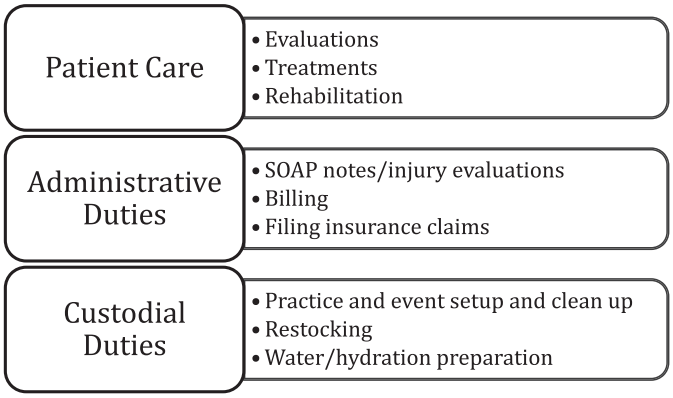
1. Please tell me about your interactions with your athletic training student(s) during their clinical education experiences.
2. Please tell me about the role and responsibilities that you and your student(s) have during your clinical education interactions.
3. During this study you filled out the Athletic Training–Clinical Education Time Framework to assess what your student was doing during clinical education experiences. Can you reflect upon the process of using this?
4. Can you discuss your experiences using bug-in-ear technology with your student during this research study?
   a. General thoughts?
   b. Benefits?
   c. Challenges?
   d. Can you discuss using bug-in-ear in relation to active learning?
5. Do you have any other comments you would like to share regarding your clinical education experiences or participation in this research study?
6. It appears that these are a few key points that emerged from your responses (list/describe): Would you agree with this? Are there any key points you think I have missed?

Table 5. Student Interview Guide

1. Please tell me about your interactions with your current preceptor during your clinical education experiences.
2. Please tell me about the roles and responsibilities that you and your preceptor have during your interactions.
3. Please discuss the most helpful behaviors your preceptor does to improve your learning.
4. Please discuss behaviors your preceptor does that do not improve your learning.
5. During this study you filled out the Athletic Training–Clinical Education Time Framework to assess what you do during clinical education experiences. Can you reflect upon the process of using this?
6. Can you discuss your experiences using bug-in-ear technology with your preceptor during this research study?
   a. General thoughts?
   b. Benefits?
   c. Challenges?
   d. Can you discuss using bug-in-ear in relation to active learning
7. Do you have any other comments you would like to share regarding your clinical education experiences or participation in this research study?
8. It appears that these are a few key points that emerged from your responses (list/describe): Would you agree with this? Are there any key points you think I have missed?

Patient Care. Several participants referenced different patient care experiences in which students were involved during clinical education. Examples of patient care included clinical examination, treatment, rehabilitation, and communication with patients regarding their injury or condition. Jay, a collegiate preceptor, stated: "If they are here during the rehab and the evaluation phase of the day, then I'll let them formulate a treatment plan, evaluation plan, or rehab plan, modality plan. That way they go from beginning all the way to the end." Jay's student, Daisy, made a similar comment when reflecting on her interactions with patients: "My role is to evaluate the athletes pertaining to football players. So basically I evaluate them, give them rehabs." Holden, a student in a rehabilitation clinic, also mentioned different patient care scenarios in which he is involved: "Sometimes we are doing consults with patients, sometimes we are doing reevaluations, sometimes we are helping out the physical therapists on the other side." Mary, a student in the collegiate club sports setting, mentioned that in the clinic she spends a lot of time completing evaluations and rehabilitation programs: "My roles in the clinic—new evaluations … [my preceptor] gets us involved with working with the rehabs, so [correcting] patient [exercise] form," whereas these duties change when they complete sport coverage: "and then at games, we are definitely on blood control so any acute kind of things." These findings suggest that both preceptors and students recognize that students are engaged in several types of patient care interactions during their clinical education experiences.

Figure. Activities completed by students. Abbreviation: SOAP, Subjective, Objective, Assessment, Plan.



Administrative Duties. Preceptors and students described that students gain experience with administrative duties, such as documenting patient care and filing insurance claims, during their clinical experiences. Elizabeth, in the club sports setting, said "[My students] help with paperwork. They have access to our electronic medical records and we expect them to assist in putting in paperwork." She expanded on this, stating that: "We do require them to type in the SOAP [Subjective, Objective, Assessment, Plan] note and not just upload it. I think even [though] they weren't completely 100% involved in the evaluation, they at least can see that pattern as they are putting the notes in and they can get used to that note-taking portion." Holden, in the clinic setting, said: "We have a lot of admin work … we do billing and stuff ... so I can help her with that." Dagny, in the high school setting, said: "If there were any injuries; we document a lot of things." Our participants' reflections reveal that preceptors intentionally involved athletic training students with administrative duties, particularly patient care documentation, at their clinical sites.

Custodial Duties. In addition to patient care, several participants described that students take on a lot of custodial (eg, cleaning, organizing) and preparation (eg, filling water coolers, restocking) duties during clinical education. Several participants provided examples of these tasks, including "pre-game setup" (Harriet) and "setting up the field, breaking down the field" (Edward). Custodial and preparation duties were the responsibility of some preceptor-student groups more than others. The Pencey 1 group discussed custodial duties extensively in their interviews, suggesting they recognized this as part of their clinical experiences. Jo, a first-semester student, said her primary responsibilities consisted of

> *…Making sure not only women's basketball gets water, but all other teams get water out to their practices … we get duties done inside the clinic, like closing duties and things like that. So I feel like I'm just helping all the preceptors get practices ready and closing at the end of the day.*

Beth, the senior-level student at the same clinical rotation, made a similar statement: "We are covering more sports. I spend more time setting up for them and picking up and

stuff." This group's preceptor, Meg, also mentioned that her students do a lot of custodial work: "I am pretty sure that they spent all time doing charts or water … which is terrible I suppose in a clinical experience." Meg and her students' comments suggest their experiences were largely focused on the custodial and preparatory responsibilities of the clinical site.

Awareness of Activities Completed During Clinical Education

Throughout the research study we asked preceptors and students to record students' activities using the AT-CETF tool. During the interviews, several participants reflected on the use of this instrument, revealing the instrument itself increased their awareness of student activities—and sometimes altered their activities completed. Dagny, a student in the high school setting, said she realized how rarely education-related activities occur: "That was interesting because that made me realize how little we do on that blue sheet [AT-CETF] like in the first [active learning] section." Harriet also stated how it increased her awareness: "Breaking it down was interesting, so kind of put in perspective what I don't do as much and what I do a lot of and then it made me think about how many times I do pay attention during practice, and attentively." Marianne said using the forms made her think more about her activities: "I wonder how much time I've spent doing this … it is something that was on my mind." Holden spoke about how completing the AT-CETF made him more aware, potentially changing behavior:

> *As for the study, it kind of open[ed] my eyes to the idea of considering as you go through [the] day how much time you are spending doing certain activities. How many times I spent more time cleaning and filling up water like more of the custodial tasks and then patient care things. I think having to write down how much time you spent doing things, it makes you realize like I said where your time is being spent the most and "oh man I spent a lot of time folding towels today," I don't want to do that. Obviously if it needs to get done it needs to get done but that makes you think about where your resources were being used.*

Preceptors also thought completion of the AT-CETF increased their awareness of what their students did during their clinical experiences. Jay commented: "Five hours, I'm like what did they do for 5 hours? In your mind it meshes, and with somebody studying you and now you got to break everything down, you really have to think about what do we really do." Similarly, Meg reflected: "I think it's a good process because it actually made you sit down and look at what your students actually did that day …. So it makes you sit down and look at how much time you really do spend with them." Edward, a clinician working in the same facility as Meg, made a similar statement: "To look back and that wow I'm really not spending time with them like I think I am. I thought that was a cool reality check, am I really teaching my students and am I really spending time with them?" Elizabeth said not only did the AT-CETF increase her awareness of what her students did throughout the day, but it also prompted change in her interactions with them: "I think I tried to vary their experience a little bit more. I think I tried to get them a little bit more opportunity in certain areas versus others, more evaluation experience."

Both preceptors and students also described difficulty completing the AT-CETF initially, which became easier over time. Nick said: "The form is hard to fill out just because it's been 5 or 6 hours and we don't really remember exactly everything you did minute for minute, like the form asks you to do." Daisy mentioned: "I thought it was kind of hard." Likewise, Phoebe stated:

> *It's a hard sheet to fill out. It got a little easier towards the end but I think if I knew I had these practices at these times it would probably be a little bit easier. But because our schedule is all over the place you know it makes it a little bit hard to pinpoint specific time.*

Elizabeth also spoke about her adjustment to the instrument: "I think once we did the first time though you're having better understanding like of the sense of time and thinking about okay, what did we really do and how much time are we spending in this respect?" Completing the AT-CETF at the end of the day, rather than throughout the day, like the researcher, likely contributed to the challenges participants noted. For these participants, completing the instrument increased their awareness of student activities, and their increased awareness made it easier to complete the instrument on later days.

Bug-In-Ear Technology and Active Learning Time

Participants were asked to reflect on the relationship between using the bug-in-ear technology and students' activities. Most participants perceived that bug-in-ear technology did not change the tasks students completed; however, they believed that using the radios improved the efficiency of tasks and communication between preceptors and students during these tasks. Jane mentioned that before the bug-in-ear technology, "I would feel I would have to keep running back and forth between patients." Diana, a student in the high school setting, said "I could talk to her back and forth, then she could tell me some new things she wanted me to try or she could say that he looked really good and I could relay to her what I was thinking and what I wanted to do next." Nick articulated a similar thought:

> *The efficiency of [some of] the tasks [changed], mainly doing patient care–related ones. I think I was more efficient, like when I have those questions, I don't have to waste time by walking to [my preceptor] asking the question and walking back, just a quick question quick answer, and then get right back to the patient care, the patient treatment. I think overall it's lot more efficient, like when [my preceptor] wants us to go start getting all the water ready, he can just quickly give us a quick call.*

Preceptors also perceived increased efficiency and communication using the bug-in-ear technology. Elizabeth described that she was able to complete "A baseline concussion test or paperwork in [another room with a window]" using the bug-in ear technology, making task completion more efficient. John said "It did change the way we communicated or worked together in the aspect of assessments," allowing him and his student to complete clinical examinations in different areas of the athletic training clinic while maintaining communication. Participants' comments suggest that using 2-way radios does not alter *what* students do in the clinical setting, but it does influence *how* they do these activities.

DISCUSSION

Active learning is a critical component to students' professional and clinical skill development.[1–3] Preceptors and students describe that self-assessing students' active learning time may facilitate student engagement during clinical education experiences. In addition, using bug-in-ear technology may improve efficiency and communication during task completion.

Activities Completed During Clinical Education

Participants identified several ways in which students engage in patient care during clinical education experiences, including therapeutic interventions, clinical examinations, administrative functions, and prevention skills. The finding that both students and preceptors describe frequent patient care interactions is promising considering the importance of engaging clinical experiences.[1,2] Integrating students into clinical experiences, particularly with patient care interactions, is important to their development as competent clinicians, their socialization into the profession, and their confidence in their clinical abilities.[1,2,4,8] Our results suggest students are integrated throughout the continuum of patient care.

Interestingly, participants in our study did not discuss instructional time during their interviews. Their descriptions of time spent during clinical education instead focused on patient care, administrative duties, and custodial work. In previous studies,[1,2,6] preceptors and students have identified instruction and practice time as valuable components of clinical education. Students find their experiences to be more meaningful when they interact regularly with their preceptors.[2] Similarly, preceptors find these opportunities to learn from and teach students as beneficial and a motivating factor of serving as a preceptor.[21,22] It is possible instruction was still occurring during our participants' experiences, but it is unknown why they did not discuss these interactions, considering the value noted in previous studies.

Participants, particularly students, discussed custodial and preparatory work nearly as much as patient care and administrative duties. Results from other studies[8,23,24] have found students become frustrated and anxious when they perceive they are spending excessive time on menial tasks and not enough time applying skills during clinical education. It is possible that groups who discussed this more, such as the Pencey 1 group, might have said this because the students were assigned to a pre-season sport and had a low patient load compared with other groups. Others[2,8] have noted that patient volume and in-season sport assignment may influence opportunities for student learning. Some researchers have found high levels of active learning and engagement in high school rotations,[8] whereas others have found lower amounts of clinical integration and engagement with high school rotations.[7,9] The inconsistent findings between research studies suggest that the differences in active engagement may be attributed to factors other than setting, such as individual preceptor approach,[6] differences in student initiative,[5] or other factors that have not been investigated. Regardless of the setting or clinical assignment, participants in our study identified that students were responsible for completing managerial tasks. While athletic venue setup, filling water coolers, and maintaining a clean health care facility are components of athletic training, excessive time spent on these activities leads to student frustration.[8] Therefore, it is important to minimize this unengaged time during clinical education. When there are no patients to treat, time spent discussing scenarios, practicing skills, or other learning-based activities may reduce unengaged waiting time. Clinical education coordinators, preceptors, and students should work together to minimize the time spent on these activities and to improve the time spent on active engagement in clinical education.

Awareness of Student Activities

A key finding that emerged from our study is that preceptors and students believed their awareness of students' activities increased simply by participating in the research study and completing the AT-CETF. Rich[5] found similar results in her study on teachable moments, in which participants described behavior change and increased awareness after they were asked to identify teachable moments during their clinical experiences. These findings relate to the value of reflecting on performance and behaviors to improve self-awareness and metacognition.[25] Preceptors in our study also self-identified challenges with accurately assessing their own behavior and their students' behavior. Participants perceived it to be easier to complete the AT-CETF over time as they became more aware of their own behavior. These findings support the potential benefits that may be gained from asking preceptors and students to regularly assess what students are doing during clinical education, in addition to having an outside observer, such as a clinical education coordinator, observe students' clinical experiences.[5,7] This information can then be used to identify more opportunities for active learning and can minimize unengaged time or time spent on menial tasks.

Bug-In-Ear Technology and Active Learning

Our findings revealed that the use of bug-in-ear technology did not change *what* activities students completed during clinical education. However, students and preceptors described that bug-in-ear technology did influence *how* they completed tasks, particularly that bug-in ear technology increased their communication and efficiency when completing tasks. Participants perceived this increased efficiency of task completion as an advantage to using bug-in-ear technology. It is possible that their perceived increase in efficiency made students faster at completing preparatory tasks, which potentially resulted in more time for engaged waiting.

Previous research on bug-in-ear technology has not examined active learning or athletic training students specifically. However, research in physical education has found that bug-in-ear technology allowed a student teacher to gain more autonomy and confidence when teaching her students.[13] Other research in teacher education[14,15] and medical education[26] found that bug-in-ear technology allowed for more communication and feedback between teachers and students. These findings coincide with our participants' comments that bug-in-ear technology improved the communication between preceptors and students, an important aspect of positive clinical education experiences.[6,27] This perception of increased communication, along with more time spent on engaged waiting tasks instead of preparatory tasks, suggests our participants experienced positive effects of using bug-in-ear

technology during clinical education. Considering these findings, athletic training programs may consider introducing bug-in-ear technology as one educational strategy that can be used during clinical education, particularly to enhance communication. However, this may not work for every setting and preceptor, and emphasis on effective use should be made.

Limitations and Future Research

We included a small sample of participants from only undergraduate students in one area of the country, limiting the generalizability to master's programs and other geographic locations. The finding that participants became more aware of their behavior after completing the AT-CETF may have influenced the comparisons made over time. Additionally, participants' behavior may have been influenced by the principle investigator's presence or their participation in the research study. Future research should consider longitudinally exploring active learning throughout students' clinical experiences and time spent in their professional program. In addition, the influence of bug-in-ear technology and time of year can be investigated in more detail to understand more of these differences identified in our study and previous research.

Practical Application and Conclusions

Our findings suggest that students complete a variety of activities during clinical education experiences. Some include valuable active learning experiences, such as hands-on patient care and documenting patient interactions; however, participants describe much of their time is also spent on custodial and preparatory duties. Considering the importance of active engagement during clinical education,[1,28] athletic training program administrators may benefit from evaluating their own students' active learning time during clinical education. Our study revealed that simply asking preceptors and students to complete the AT-CETF instrument and to discuss their results may improve their awareness of student activities. Considering much of students' time during clinical education appears to be spent unengaged and on managerial tasks, using tools such as the AT-CETF may help preceptors and students identify ways to minimize this time. Clinical education coordinators may consider integrating this or similar tools into their program assessment.

In addition to observing how time was spent during clinical education, we also sought to understand participants' perceptions of bug-in-ear technology in relation to active learning time during clinical education. While participants did not describe a direct impact of bug-in-ear technology on active learning, they perceived improved efficiency and communication with completion of tasks, both educational and noneducational. Given these findings, athletic training programs may consider using bug-in-ear technology as an educational tool during clinical education. However, training on the effective use of the technology is important to ensure proper educational use of the equipment.

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