ATHLETIC TRAINING STUDENTS’ PERCEPTIONS OF VIDEO-FEEDBACK
FOR THE SELF-ASSESSMENT OF CLINICAL SKILLS:

GOPRO® VS. TRADITIONAL VIDEO

by

CHRISTINA EDINE LANDRETH

B.S., University of Michigan, 2010

A thesis submitted to the Graduate Faculty of the
University of Colorado Colorado Springs
in partial fulfillment of the
requirements for the degree of
Master of Sciences
Department of Health Sciences
2016
This thesis for the Master of Sciences degree by

Christina Edine Landreth

has been approved for the

Department of Health Sciences

by

__________________________
Amanda J. Elder, Chair

__________________________
Craig L. Elder

__________________________
Mary Ann Kluge

__________________________
Date
Context: Athletic training education requires a complex integration of skill acquisition and feedback in order to develop high quality evaluation skills in entry-level practitioners. Video-feedback has been used successfully in several areas of healthcare education and has shown positive effects on skill learning, self-efficacy and verbal/nonverbal communication skills; however, research on student perceptions of video-feedback, as well as information regarding first person video capture methods remain lacking. Objective: The purpose of this study is to assess undergraduate athletic training students’ perceptions of GoPro® and traditional video methods as feedback mechanisms for self-assessment of their lower extremity clinical evaluation skills. Participants: Undergraduate athletic training students who had successfully completed a lower extremity evaluation course (n=13) were recruited from two accredited athletic training programs. Intervention: Participants completed two standardized patient scenarios, with a one-week interval between sessions, while being recorded using either the GoPro® or traditional video capture method. Participants completed a demographic questionnaire and confidence questionnaire prior to each scenario, a confidence questionnaire following the scenario, and an additional confidence questionnaire and video technology questionnaire following individual review of each scenario. Main Outcome Measures: Video technology questionnaire scores and confidence questionnaire scores. Results: Students perceived both GoPro® (x=31.44) and traditional video (x=33.15) to be effective methods for feedback on their clinical skills with 7 of 13 (53.8%) participants preferring GoPro® over traditional video. Self-assessment combined with video feedback had no significant effect on confidence, nor was any change in confidence determined across time for either of the video capture conditions. Conclusion: Athletic training students perceived GoPro® and traditional video feedback to be effective methods for reviewing their clinical skills. Further research should focus on longitudinal review as well as instructor feedback in combination with both GoPro® and traditional video methods in athletic training education.
Acknowledgements:

A very big thank you to my committee members: Dr. Craig Elder and Dr. Mary Ann Kluge, and especially to Dr. Amanda Elder, my advisor. Additional thanks and appreciation to my standardized patients, Caitlin Moeller, Nicol Hart, and Jenn Kimbrow, for assisting with my research and supporting me along the way. Thank you also to my mom, for your unwavering support throughout my educational career and always being a voice of reason these past two years.
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CHAPTER 1
INTRODUCTION

Athletic Training educators are continuously searching for ways to improve the profession and equip students for successful transition into entry-level positions. While guidelines are set forth by the Commission on Accreditation of Athletic Training Education (CAATE) to ensure that certain competencies are taught, the challenge for educators remains the advancement of students towards clinical proficiency, competence and excellence. Athletic training student perceptions of educational strategies are vital to their involvement in their own education and motivation to learn. Mensch and Ennis\(^1\) found that both athletic training students and staff perceive the use of scenarios and case studies, authentic clinical experiences, and a positive learning environment to be the most valuable components of the learning process. These experiences provide students with real-world situations that require critical thinking and application of clinical skills.\(^{1-3}\) In order to bridge the gap between classroom learning and clinical application, educators must provide students with life-like scenarios throughout the learning process to promote valuable feedback on clinical skill development.

In order to ensure that athletic training students gain the most from simulated and clinical experiences, adequate feedback and self-assessment are critical.\(^ {4-6}\) Feedback plays a vital role in enhancing learning and providing optimum opportunity for students to benefit from a teaching environment; however, feedback delivered in an ad hoc fashion may be ineffective, and understanding student preferences for feedback can
optimize the learning experience. Through these learning tasks, athletic training students gain necessary practice and constructive feedback that will help them improve and refine their skills. While feedback can be delivered in a variety of forms, video-facilitated feedback provides students with visual documentation of their injury assessment skills. Video-facilitated feedback is not novel; it has been successfully utilized in education of various healthcare professions including medicine, nursing, and more recently athletic training. Used as a tool for learning clinical skills, improving verbal and non-verbal communication, and increasing practitioner self-efficacy, video-facilitated feedback has proven its value in healthcare education.

In conjunction with simulated scenarios, video feedback allows students the opportunity to review and assess themselves during their clinical examinations. Self-assessment forces students to be responsible for their own education and incorporates them into the learning process. Kawaguchi supports the combination of simulated scenarios and subsequent video feedback as an effective means of promoting comprehensive injury evaluation skills in athletic training education.

Traditionally, researchers in the healthcare professions have assessed the benefits of feedback provided by third person point-of-view cameras. This point-of-view allows the student to review the scenario from an onlookers’ perspective. While this type of video-facilitated feedback is useful in various areas of education, the value of the first person point-of-view has not yet been assessed. With the influx of the GoPro® and various first person point-of-view cameras in the past decade, people are now able to review footage from a unique perspective. The GoPro® camera has been used for
years to help athletes capture their performance in the first-person and make adaptations based on the feedback provided. The first person point-of-view offers something a traditional view cannot—the ability to review footage as you experienced it. Athletic training students may gain similar value from this first person point-of-view, as it allows them to review skills from their own perspective. They may gain more precise feedback of what they did such as where they looked, how they addressed the patient, and the techniques they applied.

This study combines the strategies of video-feedback and simulated scenarios in an effort to enhance athletic training education. By capturing the first-person point-of-view, students are provided with an additional form of video feedback to aid them in self-assessment of clinical skills. The purpose of this study is to examine athletic training students’ perceptions of GoPro® compared to traditional third person video methods as a means of self-assessing their lower extremity clinical skills.

**Delimitations**

The parameters set for this study by the author include:

- Undergraduate athletic training students enrolled at CSU-Pueblo and Colorado Mesa University.
- Undergraduate athletic training students who have completed a lower extremity injury evaluation course—including junior and senior level students.
- Use of the Video Technology Questionnaire to assess student perceptions of the video capturing method.
- Use of the Confidence Questionnaire for student self-assessment of clinical skills.
• All questionnaires and instructions are given in English.

**Limitations**

Several limitations exist based on the design of the study that may have an impact on overall outcomes.

• There will be limited generalizability of the results, as students will only be selected from two Athletic Training Education Programs (ATEP) in Colorado.

• Generalizability is further limited due to the small sample size as a result of location and time constraints.

• The Standardized Patient scenarios are not as realistic as they could be to a true injury evaluation, limiting students’ self-assessment of an actual lower extremity evaluation.

• The study only looks at self-assessment of athletic training students’ clinical skills using video-based review. In an ideal study, improvement of clinical skills would be investigated and instructor feedback would be incorporated into the study design.

**Assumptions**

• Participants are answering all questionnaires thoughtfully and honestly.

• Participants can read and understand English.

• Participants have adequate training and understanding of lower extremity injury evaluation.
Hypothesis

Athletic training students’ confidence ratings will improve following video-review of their simulated scenario.

Research Questions

The following research questions were addressed in this study.

- What are athletic training students’ perceptions of both GoPro® first person point-of-view and traditional third person point-of-view as tools for self-assessing lower extremity clinical evaluation skills?

- Do athletic training students prefer GoPro® first person point-of-view or traditional third person point-of-view as a tool for providing video-feedback of a simulated scenario?
Athletic Training Education

Athletic training education is constantly adapting and evolving as educators strive to provide students with the best possible evidence-based education. The Commission on Accreditation of Athletic Training Education (CAATE) works to provide athletic training educators with the necessary resources and guidelines to ensure the competence and success of entry-level athletic trainers. These guidelines, outlined in the 5th edition of the Athletic Training Education Competencies, provide the basic requirements necessary for completion of professional education. Requirements delineated in the text include: evidence-based practice; prevention and health promotion; clinical examination and diagnosis; acute care of injury and illness; therapeutic interventions; psychosocial strategies and referral; healthcare administration; and professional development and responsibility. These areas are markedly interdependent and the text acknowledges the need for Clinical Integration Proficiencies “which represent the synthesis and integration of knowledge, skills, and clinical decision-making into actual client/patient care.” Ideally, assessment of these proficiencies would involve real patient interaction; however, a disconnect exists between classroom psychomotor skill learning and clinical competence. This disconnect requires that further educational opportunities be incorporated into the curriculum prior to real-world application. Educators have developed numerous
methods to enhance clinical skills such as practical examinations, peer guided scenarios, case studies, and standardized patients. In order to advance knowledge from evaluation components to a comprehensive injury evaluation, repetition combined with adequate feedback is required.

Mensch and Ennis\(^1\) examined the educational strategies perceived to be the most beneficial to student learning in athletic training education. Both students and staff perceived the use of scenarios and case studies, authentic experiences, and a positive educational environment to be most conducive to student growth. The use of scenarios improved student comprehension allowing for application of clinical skills. Additionally, when integrated into an effective curriculum, these pedagogic tools can help encourage student autonomy and enhance student confidence. Student perceptions of the quality and components of their educational experience should be recognized, as they are vital to promote learning. By examining current programs and adapting based on students’ educational experiences, educators can provide the most effective learning environments.

**Feedback**

In addition to real or simulated application of skills, feedback plays an important role in the development of athletic training students’ clinical skills, reasoning and professional behavior.\(^{4-6}\) Provided by professors, preceptors, and peers, feedback in athletic training serves to improve clinical skills by correcting behavior and challenging students to grow. Corrective feedback is used to inform the student of an aspect of their knowledge, understanding, or application of a skill that is incorrect. Directive feedback
guides that student toward the correct information and provides clarification or
enhancement of the students’ skill or knowledge.\textsuperscript{4} Equally important, feedback is used
to encourage behaviors and acknowledge areas where the student excels. Without
adequate feedback, students remain unaware of their strengths and weaknesses and
are unable to adapt accordingly.

Ende\textsuperscript{20} describes the role of feedback in clinical medical education and states
that acquisition of a clinical skill requires feedback that provides insight regarding the
dissonance between the intended and actual result. Feedback provides information
rather than judgment and is an integral component of the learning process. Without
feedback, “mistakes go uncorrected, good performance is not reinforced, and clinical
competence is achieved empirically or not at all.” Ende concludes that feedback is both
necessary and valuable and that adequate feedback requires practice and planning.

Feedback is equally important in the athletic training clinical setting where
students are exposed to, and involved in, the management of real injuries and illnesses.
Students rely on feedback during their clinical experiences to correct or confirm
behaviors in order to help them achieve their goals as athletic training students and
ultimately as clinicians. Nottingham and Henning\textsuperscript{6} found that both athletic training
students and approved clinical instructors perceived immediate feedback to provide an
opportunity to discuss performance and correct skills. Additionally, students tended to
be more receptive to feedback in areas that they felt needed improvement. Effective
feedback in the clinical setting plays an important role in athletic training student
education and developing the foundation of clinical competence.
**Video Feedback**

Students often receive either written or verbal feedback throughout their professional education, yet visual feedback may provide athletic training students with another tool to assess and advance their clinical skills. Video feedback is promoted in the literature as an effective technique in teaching clinical skills, verbal and non-verbal communication, as well as promoting self-efficacy in clinical evaluation techniques. Numerous healthcare professions including medicine, nursing, physical therapy and athletic training take advantage of video-facilitated feedback as a tool to promote self-assessment and learning.

**Clinical Proficiency** Video-recorded feedback provides an opportunity for students to evaluate their clinical skills and recognize areas for improvement. By viewing their footage, students are able to analyze themselves from a perspective that provides exact recall of the clinical examination. Students are able to explore all aspects of their abilities and gain a realistic self-awareness of performance and a motivation to improve knowledge and skill.

In a study of 40 nursing students, Grant and colleagues examined the effect of videotape facilitated debriefing on the skills of students completing high-fidelity simulations. Video-taped debriefing sessions provided an accurate account of events and stimulated discussion of the scenario. Students completing the intervention group had higher average performance scores, but the difference was not statistically significant. In contrast, significant differences were found for a variety of behaviors including patient identification, team communication, and vital sign assessment.
Additionally, individuals who participated in the video-facilitated debriefing session expressed satisfaction in viewing their footage and recognized its role in the learning process.

In a similar study, Parish et al.\textsuperscript{7} investigated the use of video feedback for both individual and group review sessions within a cohort of third-year medical students. Students completed a videotaped session during their ambulatory rotation and subsequently reviewed their footage. Participants met either individually with a faculty member or in groups of four to receive feedback. Those who met individually with a faculty member were more likely to express the adequacy of their feedback, comfort with the setting and ideas about how they could improve performance. Both groups felt that video review was a valuable and effective teaching modality and found improvement in clinical skills over the course of the study.

Kawaguchi\textsuperscript{15} examined the use of video feedback in athletic training education to shift students from an area of competency to that of clinical proficiency. Students were recorded during an uninterrupted injury evaluation. They were then provided their footage for review and met with an instructor to discuss their performance. Review of the footage prior to meeting allowed students to interpret the video and facilitated further discussion during instructor debriefing. In addition to promoting self-assessment, Kawaguchi discussed the benefit of video review for instructor evaluation of clinical proficiency following the scenario and archival data of the students’ performance.
Confidence/Self-Efficacy Beyond teaching clinical skills, video review is an effective tool for improving the self-efficacy of athletic training students. While students are learning and practicing new psychomotor competency skills, video review adds an additional learning component to the process. Students are able to compare what they are doing to what is expected of them for a particular task. Bobo examined athletic training students’ sense of self-efficacy of their psychomotor competency skills throughout the learning process. In this study, self-efficacy of entry-level Masters students is assessed as they complete an upper body neurological screen. Self-efficacy questionnaires were completed on five occasions: prior to learning the skill and before and after two performances of the psychomotor competency skill. Between performances, students reviewed their video footage embedded with written comments and were allowed time to practice. Bobo revealed an overall improvement in self-efficacy between questionnaires prior to and following videotaped review. She concluded that video feedback may provide a means of increasing students’ self-efficacy when learning a new clinical skill.

Verbal and Non-verbal Communication Another area crucial to the success of healthcare practitioners is the area of verbal and non-verbal communication. How well an individual can communicate with his/her patient affects the patient’s perception of overall care. A successful athletic trainer asks the right questions, promotes conversation and addresses the patient with the right tone of voice, eye contact and posture. Teaching communication skills is often a difficult task and video recording with subsequent review and self-assessment has proven to be a successful method.
Heinerichs et al. evaluated athletic training students’ assessment of their non-verbal communication skills following video-taped review of a clinical skill simulation exam. Students completed three separate standardized patient scenarios while enrolled in a therapeutic exercise course and following completion, students were given one week to review their footage. The students completed a Non-Verbal Communication Reflection Form in response to their review. Over the course of the study, Heinerichs and colleagues found that 98% of students believed that their non-verbal communication skills improved due to the video-taped review process.

**Perceptions of Video Feedback**

While video feedback has proven to be an effective tool in healthcare education, student perceptions of this learning method have not been thoroughly investigated. Nilsen et al. examined students’ perceptions of videotaped consultations and the subsequent feedback method—consisting of group video review. Common concerns of this form of review included students’ apprehension of watching themselves with other students and the process of being videotaped during consultation. On the other hand, the video evaluation process ultimately strengthened self-esteem and confidence and most students viewed it as a worthwhile experience. Similarly, Strand and colleagues explored nurse practitioner views of using video capture technology to review competency assessments in physical examination. Participants indicated low image and sound quality of the video and apprehension of being recorded as potential downfalls of the study; however, they did recognize the value of self-assessment and the increased feedback video provided.
Nesbitt et al\textsuperscript{21} evaluated student views on the use of two styles of video-enhanced feedback compared to standard lecture feedback during clinical skills training. Undergraduate medical students either received standard lecture feedback, individualized video feedback or enhanced unsupervised video feedback following completion of a surgical suturing task. Nesbitt and colleagues found that students preferred individualized video feedback, in which the participants met with a content expert for 20 minutes, compared to the other two methods. Students strongly agreed that the feedback they received was adequate, the feedback improved their subsequent performance, and they were highly satisfied with the form of feedback for future clinical skills training.

**Self-Assessment**

Combined with self-assessment, video-feedback provides students an opportunity to thoroughly evaluate their skills. They gain a more personal connection with their education, as they are able to review themselves rather than receive feedback from other individuals. By taking the additional person out of the feedback process, the students focus on their strengths and weaknesses and identify areas that they want to improve upon. Parker et al\textsuperscript{18} questioned whether content and competencies were enough and described ways to encourage reflective practice in athletic training students. Self-reflection is promoted as a necessary process for effective learning and professional development. Zick et al\textsuperscript{9} investigated medical students' self-assessment of their communication skills following review of videotaped interaction with standardized patients. The students were asked to observe their
strengths and weaknesses and answered questions in an open-ended format. Using video as a basis for self-assessment offered great value in allowing the learners the opportunity to review their own behavior. The study suggests that an open-ended approach to self-assessment is both feasible and practical and that a more integrative approach including self-assessment, SP exams, direct observations of encounters and patient feedback would stimulate reflection and motivate self-improvement.

**Video Technology**

Current video technology methods offer students a third person recall of their clinical examination or simulated scenario. With a first person point-of-view, students have the ability to “relive” the scenario from their own perspective. GoPro® prides itself on making the world’s most versatile camera. The camera offers something that a traditional video camera cannot—a simple and unencumbered way to capture the user’s point-of-view. Commonly used for recreational purposes, GoPro® and other point-of-view (POV) cameras have made their way into athletics as a way for athletes to capture their performance. They offer a form of feedback that allows athletes and coaches to make corrections from the athlete’s perspective. Recognized by the U.S. Ski and Snowboard Association (USSA) in 2015 for technology that helped both showcase the sport and provided “coaches and athletes with insightful training analysis,” GoPro® has proved its utility in areas beyond home video. More recently, the GoPro® camera has begun its journey into education, providing first person point-of-view during classroom learning. Most notably, the camera offers a true participatory view by
recording exactly what the individual sees, hears and says and provides this feedback to the instructor.

Participants in the classroom setting, as well as medical students in the operative setting, preferred the novelty of the GoPro® camera and the true first-person footage it provides to that of a traditional view. Paro et al compared Google Glass™ and GoPro® technologies during various operating procedures. Users found the first person point-of-view to be useful and informative and recognized that reviewing the footage provided insight into techniques that they may not have noticed during the time of performance. Pros and cons of the cameras were described, but participants enjoyed the true first person point-of-view footage compared to integrated cameras that provided a third person perspective of the operating room.

Summary

While various studies have examined and supported the role of video technology in the path to clinical proficiency, none have yet compared the first person point-of-view to traditional third person point-of-view. Additionally, while nursing and medicine have assessed student perceptions of video technology, no study in the athletic training literature evaluates students’ opinions of this feedback method. Self-assessment is determined to be a useful tool in clinical skill acquisition, but no study assesses the use of video facilitated feedback and its effect on confidence. Therefore, the purpose of this study is to determine athletic training students’ perceptions of GoPro® compared to traditional video feedback as a means of self-assessing their clinical skills.
CHAPTER 3

METHODS

Participants

IRB approval was obtained prior to initiating the study (Appendix A). All subjects completed consent forms for study participation (Appendix B) and the use of videotaped footage (Appendix C) prior to initiating their first scenario. A convenience sample of athletic training students from two CAATE-accredited athletic training education programs were recruited to participate in this study. All participants completed a lower extremity orthopedic evaluation course during either Fall 2014 or 2015 semesters. All potential participants received information regarding the study through emails sent to their student accounts provided by faculty with student permission (Appendix D). If the student responded, a follow-up email was sent in which the participant was asked to sign up for two 30-minute time slots in which to complete two lower extremity standardized patient (SP) scenarios and study questionnaires. A total of 13 Athletic Training students from junior (n=9) and senior (n=4) level classes participated.

Procedures

Junior and senior level athletic training students who volunteered to participate in the study were assigned to one of four groups based on when they scheduled their scenario. During the first testing period, Groups A and B completed the Standardized Patient 1 (SP1) scenario, while groups C and D completed the Standardized Patient 2 (SP2) scenario. Groups A and C completed their scenario using the GoPro® camera,
while groups B and D used the traditional video method as depicted in Figure 1. Participants completed the scenarios according to their assigned time slots, as determined through online scheduling. Each SP encounter took place in the medical examination room attached to the main athletic training facility on campus and lasted under 10 minutes. Before beginning the scenario, each participant completed a Confidence Questionnaire (CQ) and a Demographic Questionnaire (Appendix E). Prior to entering the evaluation room, the primary investigator read a script, introducing the participant to the study and what they were asked to do for the evaluation. Participants were asked not to discuss any of the case information with other participants.

Following completion of the scenario, all participants filled out a second CQ prior to viewing their video footage. Participants then viewed their video on a computer where the footage was uploaded directly from the camera. Following video review, the footage was saved by participant number. Participants completed a third CQ and Video Technology Questionnaire (VTQ) after video review. A second SP encounter was completed one week after the participants’ initial testing period. At this time, Groups A and B completed SP2 and Groups C and D completed SP1 scenarios. Groups A and C were videotaped using the traditional video view, while Groups B and D completed the scenario using GoPro® first person point-of-view. Processes for viewing the video footage and questionnaire completion were consistent with that of the previous testing period.
Figure 1: Sequence of scenarios and questionnaires by group

Cohort (n=13)

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Week 1

|          | Standardized Patient 2 |
|          | Standardized Patient 1 |
|          | Confidence Questionnaire |
|          | TV Review |
|          | GoPro Review |
|          | TV Review |
|          | GoPro Review |
|          | Confidence Questionnaire |
|          | Video Technology Questionnaire |
Instrumentation

**Confidence Questionnaire** The Confidence Questionnaire was used to evaluate participants’ confidence in their athletic training clinical skills. Participants rated, on a 4-point Likert scale, how they perceived their confidence prior to the SP encounter, as well as, before and after viewing their videotaped session. Items included confidence in history taking, palpations, and special tests, as well as overall patient communication and confidence as an athletic training student. The questionnaire has been found to have high internal consistency (14 items; $\alpha = .971$) for assessing athletic training student confidence. Demographic information including information on past experience utilizing video for educational purposes was collected alongside the first confidence questionnaire given during the first testing period (Appendix E).

**Video Technology Questionnaire** The Video Technology Questionnaire (Appendix F) assessed participants’ perceptions of the two video technology methods used in the study. Participants completed the questionnaire twice: following review of both GoPro® video footage and traditional video camera video footage taken during their SP simulated scenarios. The questionnaire consisted of 10 items rated on a 4-point Likert scale and three open-ended questions to gauge student perceptions of each camera method. The questionnaire was developed by the primary investigator in order to assess video quality, how the video footage aids or hinders students’ self-assessment, and overall strengths and weaknesses of the video method. Reliability of the questionnaire was assessed during a pilot study of first year graduate athletic training
students at the University of Colorado Colorado Springs, following completion of a video recorded simulated scenario.

**Standardized Patient Case Development and Standardized Patient Training**

Three Athletic Trainers (ATs) were recruited to serve as standardized patients (SPs). ATs were selected due to their background and familiarity with the cases being portrayed. Each of the three ATs were provided with individualized SP materials prior to the pilot study and were able to use the study materials to portray the case during pilot scenarios (Appendix G). SP training materials were selected from a study by Walker et al\(^3\) that assessed whether SPs provide worthwhile experiences for athletic training students.

Two lower extremity cases were selected to ensure that all participants had adequate training to complete the evaluation. One of the SP scenarios is adapted from the SP training materials provided by Walker et al\(^3\) while the other was created based on the guidelines set forth in their study. The two SP scenarios, similarly challenging, both related to the foot and ankle.

**Video Technology**

**GoPro® HERO4 Silver** The GoPro® HERO4 Silver camera was selected to capture the participant point-of-view for this study. The camera features 1080p60 and 720p120 video capabilities. Additionally, the camera provides 12 MP photos at up to 30 frames per second, built-in Wi-Fi and Bluetooth. 1080p60w video recording capabilities were used throughout the study. During the study, the GoPro® camera was mounted to the head-strap by the primary investigator and placed at a 45° angle. The participant then placed the device on their head and adjusted it for comfort prior to entering the testing
room. The camera was turned on by the primary investigator and worn throughout the clinical evaluation. Upon completion of the evaluation, the camera was turned off by the primary investigator and removed from the participant. The head strap was sanitized with alcohol prep pads between participants.

**GoPro® Head Strap and Chest Mount** The GoPro® Head Strap and Chest Mount were assessed to determine which mount offered the best participant point-of-view for an athletic trainer conducting a lower extremity injury evaluation. The GoPro® Head Strap is fully adjustable and can be worn over a helmet or directly on your head to capture footage from a headlamp-like perspective. The chest harness allows an individual to capture more of their arms and hands and may provide a better idea of the skills that are being performed. The chest harness is adjustable to fit a wide range of adult sizes. The GoPro® Head Strap was ultimately chosen for use in this study.

**Flip Ultra Camcorder** The Flip Ultra Camcorder™ was selected to capture the third person point-of-view or the traditional video (TV) view, as it will commonly be referred to in this study. The Flip Ultra Camcorder™ offers one touch recording, digital zoom, 120 minutes of built-in memory and a flip-out USB that plugs directly into a computer. The camera was set up in the evaluation room on a small tripod prior to the study and placed in the corner in order to capture participant interaction with the standardized patient. Camera placement remained consistent for all participants throughout the study. The camera was operated by the primary investigator.
**Statistical Analysis**

The data was entered and analyzed using SPSS software (version 22; SPSS Inc, New York, NY). Descriptive statistics were computed for all demographic survey items. Each participant was individually entered using a numerical system of 1, 2, 3, etc. based on their ID number. Confidence Questionnaire and Video Technology Questionnaire answers were entered as a rating from 1-4 depending on Likert scale answers (1-strongly disagree to 4-strongly agree). A total outcome score from each questionnaire was computed for each individual, with a total of 40 points possible on the Video Technology Questionnaire and 56 points on the Confidence Questionnaire. Non-parametric statistics were chosen to accommodate the small sample size and assumptions. Wilcoxon Signed Rank Test was used to analyze the difference in Confidence Questionnaire scores (pre-scenario, post-scenario and post-video review) and Video Technology Questionnaire scores between the two video capture methods. Friedman’s test was used to assess the difference in Confidence Questionnaire scores prior to the scenario, after the scenario and following video review for both GoPro® and traditional video conditions. Additional qualitative analysis of open-ended VTQ responses was conducted.
INTRODUCTION

Athletic training education programs (ATEP) require advanced pedagogical strategies to facilitate student learning and progression toward success as entry-level practitioners. The Commission on Accreditation of Athletic Training Education (CAATE) recommends “clinical integration proficiencies” to provide opportunities for students to complete comprehensive assessments in various areas of athletic training and to advance their clinical skillset. The means of integrating these proficiencies into athletic training education is largely program specific and remains inconsistent. However, research has shown that athletic training students and staff value the use of case studies, authentic experiences and a positive learning environment as tools to promote student growth. These methods should be employed with adequate feedback to both correct clinical skills and direct athletic training students towards future success. Immediate feedback is preferred by athletic training students and is most welcomed in areas that need improvement and as an instrument to promote discussion and correction of skills.

While instructor feedback provides both directive and corrective feedback, self-evaluation offers students the opportunity to assess their own skills and gain a more personal connection with their education. They are forced to identify their own strengths and weaknesses and focused areas they wish to improve upon. Parker
encourages reflective practice among athletic training students and promotes it as necessary for effective learning and professional development. Using video as a basis for self-assessment is highly valuable in allowing learners to observe and review their own behavior and can be easily combined with scenario-like methods.\textsuperscript{9}

Video-feedback has been used successfully by numerous healthcare professions,\textsuperscript{7-17} including athletic training,\textsuperscript{15-17} for the development of clinical skills,\textsuperscript{7,8,12,15} self-efficacy,\textsuperscript{17} and both verbal\textsuperscript{9,11,13} and non-verbal communication.\textsuperscript{16} Athletic training students may benefit greatly from similar video-feedback of their clinical injury evaluation skills in order to bridge the gap between motor skill learning and proficient clinical application.\textsuperscript{15} Additionally, video may be employed to help increase students’ self-efficacy in periods of clinical skill acquisition.\textsuperscript{17} Students in both nursing\textsuperscript{14} and medical\textsuperscript{10} education programs perceived video technology to beneficial for improving clinical skills, felt it provided a worthwhile experience and enhanced the feedback approach.

Research conducted on the value of feedback provided by third person point-of-view cameras has shown its utility;\textsuperscript{7-17} however, the value of first person point-of-view cameras for clinical skill learning has not yet been assessed in the athletic training literature and is limited in other health related professions. Preliminary studies using the technology in education and during surgical procedures has shown favorable review of the video footage provided as participants enjoyed the true first person point-of-view footage that the third person perspective did not offer.\textsuperscript{24,25}
In order to prepare athletic training students for entry-level positions, it is crucial to expose them to situations that necessitate implementation of comprehensive injury evaluation techniques in life-like situations and to provide them with thorough feedback. Combined with simulated or Standardized Patient (SP) scenarios, video-feedback can offer a method of self-evaluation, documented longitudinal tracking of clinical progress and authentic clinical experiences. Student perceptions of educational techniques should be used to help develop and adapt athletic training education in ways that are most favorable to student learning. The lack of information regarding student opinions towards video technology in athletic training education necessitates further research in this area. The purpose of this study was to evaluate athletic training students’ perceptions of two differing video-technology methods as tools for self-assessment of their clinical skills. Change in participants’ confidence was examined throughout the study as a means of self-assessment to determine the effect of video-feedback on athletic training students’ perceptions of their clinical skills.

METHODS

Participants

IRB approval was obtained prior to initiating the study (Appendix A). All subjects completed consent forms for study participation (Appendix B) and the use of videotaped footage (Appendix C) prior to initiating their first scenario. Undergraduate athletic training students from two professional athletic training programs who had previously completed a lower extremity injury evaluation course were recruited for this study. Participants were identified by athletic training faculty at their respective universities to
receive a study recruitment email (Appendix D). Those who responded were sent a follow-up email, in which they were asked to sign-up for two 30 minute time slots, one week apart, to complete study materials.

Procedures

Participants were assigned into one of four groups in order of their selected appointment time, and completed the corresponding Standardized Patient scenario (SP1, SP2) using either GoPro® or traditional video recording (Figure 1). Each participant completed a Demographic Questionnaire (Appendix E) and Confidence Questionnaire (CQ) before beginning their first evaluation (see Figure 1). Following completion of a SP scenario, each participant filled out a second CQ. Video footage was uploaded directly to a laptop computer, and subsequently deleted from the camera. Participants reviewed their scenario footage directly on the laptop. Following the video-feedback session, participants completed a third CQ and a Video-Technology Questionnaire (VTQ). Participants returned one week later and completed the opposite SP scenario using the alternate video capture method. Processes for viewing the video footage and questionnaire completion were consistent with that of the previous testing period.

Instrumentation

**Video Technology Questionnaire** The Video Technology Questionnaire (VTQ) assessed participants’ perceptions of the two video technology methods used in the study. To gauge student perceptions of each camera method, the questionnaire captured 10 items rated on a 4-point Likert scale and three open-ended questions regarding each video type. The questionnaire was developed by the primary investigator
in order to assess video quality, how the video footage aids or hinders students’ self-assessment and overall strengths and weaknesses of the video method. The VTQ was

**Figure 1:** Sequence of scenarios and questionnaires by group

<table>
<thead>
<tr>
<th>Cohort (n=13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A (n=3)</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>Demographic Questionnaire</td>
</tr>
<tr>
<td>Confidence Questionnaire</td>
</tr>
<tr>
<td>Standardized Patient 1</td>
</tr>
<tr>
<td>Confidence Questionnaire</td>
</tr>
<tr>
<td>GoPro Review</td>
</tr>
<tr>
<td>Confidence Questionnaire</td>
</tr>
<tr>
<td>Video Technology Questionnaire</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>Confidence Questionnaire</td>
</tr>
<tr>
<td>Standardized Patient 2</td>
</tr>
<tr>
<td>Confidence Questionnaire</td>
</tr>
<tr>
<td>TV Review</td>
</tr>
<tr>
<td>Confidence Questionnaire</td>
</tr>
<tr>
<td>Video Technology Questionnaire</td>
</tr>
</tbody>
</table>
administered to first year athletic trainers for content review. This review indicated any needs for clarification within the VTQ, and subsequent revisions were made.

**Confidence Questionnaire** The Confidence Questionnaire\(^2\) was used to evaluate participants’ confidence in their athletic training clinical skills. Participants rated, on a 4-point Likert scale, how they perceived their confidence prior to the SP encounter, as well as, before and after viewing their videotaped session. Items included confidence in history taking, palpations, and special tests, as well as overall patient communication and confidence as an athletic training student. The questionnaire has been found to have high internal consistency (14 items; \(\alpha=.971\)) for assessing athletic training student confidence. Demographic information including information on past experience utilizing video for educational purposes was collected alongside the first confidence questionnaire given during the first testing period (Appendix E).

**Standardized Patient Scenarios** Athletic Trainers (ATs) were selected due to their background and familiarity with the cases being portrayed. Each of the three ATs were provided with individualized SP materials prior to the pilot study and were able to use the study materials to portray the case during pilot scenarios (Appendix G). SP training materials were selected from a study by Walker et al\(^3\) that assessed whether SPs provide worthwhile experiences for athletic training students. Two lower extremity cases were selected to ensure that all participants had adequate training to complete the evaluation. One of the SP scenarios is adapted from the SP training materials provided by Walker et al\(^3\) while the other was created based on the guidelines set forth
in their study. The two SP scenarios, similarly challenging, both related to the foot and ankle.

**Video Technology** The GoPro® Hero 4 was selected to capture the first person point-of-view for this study. During the study, the GoPro® camera was mounted to the head-strap by the primary investigator and placed at a 45° angle. The participant then placed the device on their head and adjusted it for comfort prior to entering the testing room. The camera was turned on by the primary investigator and worn throughout the clinical evaluation. Upon completion of the evaluation, the camera was turned off by the primary investigator and removed from the participant. The head strap was sanitized with alcohol prep pads between participants. The video footage was then uploaded via a USB cord directly to a laptop computer on which the participant would view their video footage.

A Flip Ultra Camcorder™ was chosen to capture the third person point-of-view for this study. This camera was chosen due to its small size to minimize invasiveness in the space being utilized for the simulation. The camera was placed on a small tripod upon a dresser in the corner of the evaluation room, facing the side of the SP. Camera placement remained consistent for all participants throughout the study. The camera was operated by the primary investigator. Following scenario completion, the attached USB was used to download the video to the laptop computer for participant viewing.

**Statistical Analysis**

Descriptive statistics were computed for all demographics. Confidence Questionnaire and Video Technology Questionnaire responses were rated on a 1-4
Likert scale. A total outcome score from each questionnaire was computed for each participant, with 40 points possible on the VTQ and 56 points on each CQ. Non-parametric statistics were chosen to accommodate the small sample size and assumptions. Wilcoxon Signed Rank Test was used to analyze the difference in Confidence Questionnaire scores (pre-scenario, post-scenario and post video-review) and VTQ scores across the two video capture methods: GoPro® and traditional video. Friedman’s test was used to assess the difference in CQ scores prior to the scenario, following the scenario and following video review for each of the video capture methods. Analysis was completed using SPSS software (version 22; SPSS Inc., New York, NY). Additional qualitative analysis of VTQ open-ended responses was conducted to determine consistent themes.

RESULTS

Demographics

A total of 14 undergraduate athletic training students entered into the study, with one dropping out following the first scenario. Thirteen participants aged 20 to 23 years (\( \bar{x} = 21.07 \pm 0.95 \) years) completed all study requirements. Those completing the study included 12 females and one male, nine of which were juniors and four of which were seniors (Table 1). Five of the participants had previously used the GoPro® recreationally, one had used it in class, and one had used it in both environments. One individual had in-class experience with traditional video, while three individuals had recreational experience, and five individuals had used traditional video both in class and recreationally. None of the participants had been recorded using either video method in
class, while two of the participants had experience with reviewing video footage from sports participation.

**Table 1.** Demographics (age, gender and year in school by group)

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Group A (n=3)</th>
<th>Group B (n=4)</th>
<th>Group C (n=3)</th>
<th>Group D (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years (range)</td>
<td>21 (20-22)</td>
<td>21.75 (21-23)</td>
<td>21 (20-22)</td>
<td>20.33 (20-21)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Year in School</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juniors</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Seniors</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Video Technology Questionnaire Analysis**

The primary purpose of the study was to determine if athletic training students preferred GoPro® or traditional video feedback as a tool for self-assessment of their lower extremity clinical skills, for which the Video Technology Questionnaire was used. Average outcome scores from the completed VTQs—with 40 points indicating complete agreement with all VTQ questions—were compared in order to quantitatively determine preference, while a selection of participants’ open-ended responses are reported. Wilcoxon Signed Rank Test revealed no statistically significant difference in VTQ scores following review of the traditional video footage compared to GoPro® (z=-1.749, p=0.080) with a median of 30 under each condition. Mean outcome scores of the VTQ administered following completion of the GoPro® video review and traditional video review were 31.44 and 33.15 respectively (Table 2), suggesting the participants found
both the GoPro® and the traditional video review to be useful for clinical skill training.

Response averages for each question on the VTQ are displayed in Table 3.

**Table 2.** Mean Confidence Questionnaire and Video Technology Questionnaire scores by Group (N=13)

<table>
<thead>
<tr>
<th>Group (n)</th>
<th>GoPro® Mean ± SD</th>
<th>Traditional Video Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CQ1</td>
<td>CQ2</td>
</tr>
<tr>
<td>A (3)</td>
<td>38.67±5.77</td>
<td>40.33±2.08</td>
</tr>
<tr>
<td>B (4)</td>
<td>42.50±4.04</td>
<td>40.00±2.58</td>
</tr>
<tr>
<td>C (3)</td>
<td>45.00±6.24</td>
<td>42.67±8.14</td>
</tr>
<tr>
<td>D (3)</td>
<td>40.33±4.04</td>
<td>41.33±4.93</td>
</tr>
<tr>
<td>Total</td>
<td>41.69±4.96</td>
<td>41.31±4.27</td>
</tr>
</tbody>
</table>

**Note.** CQ=confidence questionnaire; VTQ=Video technology questionnaire

**Table 3.** Athletic Training Students’ Perceived Value of Video Technology Type by Question

<table>
<thead>
<tr>
<th>Video Technology Questionnaire Rating Item</th>
<th>GoPro Scenario Median (Range)</th>
<th>Traditional Video Scenario Median (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The image quality of the video footage was clear and details could be seen.</td>
<td>4 (1)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>2. The sound quality of the video footage was clear and I could hear the conversations.</td>
<td>3 (3)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>3. The video camera was easy to use and operate.</td>
<td>4 (1)</td>
<td>4 (1)</td>
</tr>
<tr>
<td>4. The video camera interfered with my clinical assessment.</td>
<td>3 (3)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>5. The video camera made me nervous when conduction my evaluation.</td>
<td>3 (3)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>6. The video footage provided allowed me to adequately assess me skills.</td>
<td>3 (2)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>7. Reviewing the video footage provided will improved my future clinical skills.</td>
<td>3 (2)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>8. Reviewing the video footage was beneficial to my growth as an athletic trainer.</td>
<td>3 (2)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>9. Reviewing the video footage was a worthwhile experience.</td>
<td>3 (2)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>10. I would be highly satisfied with this form of feedback for future clinical skills training.</td>
<td>3 (2)</td>
<td>3 (2)</td>
</tr>
</tbody>
</table>

1=strongly disagree 4=strongly agree
Overall, based on open-ended responses, participants indicated that they preferred the GoPro® to the traditional video method, with seven (53.8%) participants choosing GoPro® as the technology of choice for subsequent feedback of their clinical skills. Four (30.8%) of the participants indicated that they preferred the traditional video method over GoPro™, while two (15.4%) of the participants indicated that they prefer GoPro® for practicing skills, but the traditional video method for reviewing the scenario. Student responses to open-ended questions resulted in three themes: vantage point, audio, and device properties. Vantage point refers to the point-of-view of the camera and what the specific view provides to the participant. Audio comments discuss the sound quality of the device when uploaded on the computer for video review. Comments regarding device properties refer to participant use and experience with the cameras during the evaluation process. A selection of student responses to open ended questions, divided by themes, is displayed in Table 4.
<table>
<thead>
<tr>
<th>Themes</th>
<th>GoPro®</th>
<th>Traditional Video</th>
</tr>
</thead>
</table>
| Vantage point  | • “I personally notice I go off feel, not sight, so most of the video was of my athlete.”  
• “I could see things from my perspective and the view was never blocked.”  
• “It was easier to see structures when I palpate.”  
• “I liked the perspective better this way. It’s closer and feels more personal.” | • “I can see the whole picture instead of the things I’m looking at or the GoPro® is positioned to.”  
• “It allowed me to really see and understand how important body language is.”  
• “There were some angles where I couldn’t see all the tests I was performing.”  
• “Could see myself and body language.” |
| Audio          | • “It made me hear myself without looking at myself, so I could put myself in my patient’s shoes.”  
• “The sound was kind of hard to hear.”  
• “The video makes you slightly nervous.”  
• “It was very difficult to hear the audio. That made it hard to assess my verbal and questioning skills.” | • “Conversations were harder to hear.”  
• “Good for hearing how I communicate with the athlete.” |
| Device Properties | • “Wearing it on my head was quite uncomfortable and bothered me a little during the eval.”  
• “It made me more nervous to perform the exam.” | • “Made me nervous and could have been aimed better to get everything.”  
• “Difficult to position to get entire evaluation.” |
Confidence Questionnaire Analysis

Outcome scores from each Confidence Questionnaire (56 points indicates complete confidence in athletic training skills) was used to determine if there was a difference in confidence when participants completed GoPro® compared to the traditional video feedback method (Table 2). Wilcoxon Signed Rank Test revealed no significant difference in a participants’ confidence scores between traditional video or GoPro® video capture methods prior to the scenario (n=13, z=-1.129, p=0.259), following the scenario (n=13, z=-1.235, p=0.217) or following review of the video footage (n=13, z=-0.556, p=0.578). However, higher median scores were found for the traditional video condition following the scenario (GoPro® Md=40, TV Md=42) and following video review (GoPro® Md=40, TV Md=42), suggesting that students confidence may be greater when following completion of the traditional video scenario compared to the GoPro® scenario.

In addition to a comparison between GoPro® and traditional video groups, change in confidence was analyzed from pre-scenario to post-scenario to post-video review to determine if reviewing video footage elicited a change in students’ confidence. Results of the Friedman test revealed no statistically significant difference in Confidence Questionnaire scores across the three testing periods when using the GoPro® video capture method: pre-scenario, post-scenario and post-video review [$x^2$ (2, n=13)=0.140, p=0.933]. Inspection of the median values showed a possible decrease in confidence from pre-scenario (Md=42) to post scenario (Md=40), but no further change after video review (Md=40).
Similarly, there was no significant difference in Confidence Questionnaire scores across the three testing periods when using the traditional video capture method: pre-scenario, post-scenario, and post-traditional video review \( \chi^2 (2, n=13)=0.146, p=0.929 \). Further analysis indicated no change in median Confidence Questionnaires scores from pre-scenario (Md=42) to post-scenario (Md=42) to post-video review (Md=42). These findings revealed that the experience of self-evaluation and video-review did not change participants’ confidence in their athletic training clinical skills.

Further investigation of individual CQ questions revealed both positive and negative confidence trends, based on the specific question. Following SP scenarios participants’ confidence in their “abilities as an athletic trainer” (GP=2.92, TV=3.07) decreased post-scenario (GP=2.85 TV=2.92) and post video-review (GP=2.77, TV=2.77). Similarly, students’ rated “I am confident providing appropriate patient education about an injury, illness, or condition” at 3.07(GP) and 3.15(TV) prior to evaluation, 2.85(GP) and 3.00(TV) following the scenario, and 2.77(GP) and 2.92 (TV) following video review. Alternately, students’ average confidence in formulating a patient’s treatment plan improved from 2.92 to 3.00 after the scenario and to 3.15 after GoPro video review, while it remained unchanged for the traditional video condition. Other areas where confidence improved following video review included confidence dealing with difficult patients, treating diverse patient populations and using appropriate professional language.
DISCUSSION

Demographics

Surprisingly, none of the participants had any experience with being recorded using either GoPro® or traditional video in the classroom setting, while few participants had any classroom experience with video technology at all. As the athletic training profession grows and advances as a medical profession, it is important to utilize the resources available. With the onset of “smart phones,” first person point-of-view cameras, and technology in general, it will be crucial that educators in athletic training programs are using technology appropriately and in ways the benefit athletic training students.

Video Technology Questionnaire

While no significant difference was found between the two forms of video feedback, mean scores confirmed that students’ perceived both forms of video technology to be beneficial to clinical skill learning. Overall, participants reported preference for the GoPro® compared to the traditional video as a video-feedback method, but both were perceived as appropriate and beneficial methods for future clinical skills training based on VTQ scores and individual question results. The findings of the current study are similar to those of Nesbitt et al. who assessed student views on two types of video-enhanced feedback (individualized and enhanced unsupervised); students tended to feel that both forms of video-feedback were adequate, improved their subsequent performance and would be satisfied to receive that type of feedback.
for future skills training. Our findings support that educators would be wise to utilize both types of recording to enhance student learning.

**GoPro® Perceptions** Perceived strengths of the GoPro® video capture method included the first person point-of-view, allowing for an uninhibited view of what the student was doing during his or her evaluation, as well as allowing the participant to hear themselves rather than look at themselves. This is consistent with previous studies that evaluate GoPro® in education\textsuperscript{24} and medicine.\textsuperscript{25} One participant noted: “It really shows how much I looked at the patient’s injury rather than the patient, which is important for me because I have been working on looking people in the eye more.” Paro et al\textsuperscript{25} found the first-person vantage point to be useful and informative for review of operating procedures and that the GoPro® offers excellent quality video footage compared to Google Glass—another first person recording device.

In contrast, weaknesses of the method reported by participants included difficulty hearing the audio and the increased nervousness that was caused by wearing the GoPro® during the evaluation. Additionally, one participant indicated “I personally notice I go off feel, not sight, so most of the video was of my athlete.” For participants who tend to look up as they evaluate, the GoPro® may not offer a true view of what their hands were doing during their examination, but does provide feedback to the student of what they do look at during an assessment. While the participants in the current study didn’t make note of these, previous literature identified weaknesses of the GoPro® including the bulkiness of the device due to camera, head strap and mounting device, and equipment costs.\textsuperscript{15,25}
**Figure 2:** Side by side comparison of traditional video (left) and GoPro® (right) points-of-view.

**Traditional Video Perceptions** The greatest perceived strength of the traditional video capture method was the ability to see the “whole picture” which allowed participants to see body language and how they interacted with the patient. However, due to the selected camera and evaluation rooms, this was also a weakness, as the entire field of view was not often captured. Participants mentioned: “You can only see one side and can’t fully see how or where you are palpating” and “there were some angles where I couldn’t see all the tests I was performing.” Participants felt less nervous with this camera as it was out of the way and felt that the audio was stronger as compared to the GoPro®. This substantiates previous findings of Strand et al\textsuperscript{13} who reported that the FlipCam™ was easy to operate and anxiety levels of nursing students decreased during their evaluation. Additionally, transfer of the video file to the computer was faster than the GoPro™, while maintaining high level video and sound quality overall.
Confidence Questionnaire

No identifiable change in confidence was seen from pre-scenario to post-scenario and to post-video review under either of the video-feedback conditions. Unlike Armstrong et al\textsuperscript{2} who found a significant improvement in confidence from pre-standardized patient encounter to post-encounter, the combination of video feedback and standardized patient methods of this study showed no overall change. This likely relates to the limited time between the three episodes of administration of the confidence questionnaires; the whole scenario combined with questionnaires took only 30 minutes.

It is interesting to note, however, that while overall confidence scores did not change, there appears to be a slight trend towards a decrease in confidence for specific CQ questions and slight increase in confidence in other areas. Participants had greater confidence in formulating a treatment plan, dealing with difficult patients, treating diverse patient populations and using appropriate professional language. However, most notably, their confidence in their abilities as an athletic trainer decreased. Overall, participants showed the least confidence in selecting appropriate diagnostic tests and formulating a differential diagnoses. This is similar to the findings of Armstrong et al\textsuperscript{,2} that certain confidence rating items tended to improve post-encounter, while others showed a negative trend. Utilizing self-assessment via the Confidence Questionnaire allowed students to recognize strengths and weakness and make informed decisions about areas they need to improve. Knowledge of these areas may further assist educators in implementing lessons or review of consistently low-
rated confidence questions. Based on results of this study, students may need additional review of diagnostic tests and differential diagnosis of the lower extremity in order to build confidence in these areas.

In addition to the lack of change in confidence scores over time, there was no statistically significant change in confidence between the GoPro® and Video Technology groups, which were separated by one-week periods. Based on these findings, the method of simple self-review of video feedback does not appear to have a meaningful effect on confidence. Bobo\textsuperscript{17} who evaluated athletic training student self-efficacy when learning a clinical skill found increased self-efficacy when using a video feedback method that involved embedded written feedback. This alternative to strict video-feedback and self-review, or one that includes instructor debriefing, may have elicited a more profound change in confidence if implemented within the methods of this study.

**CONCLUSION**

Both GoPro® and traditional video capture methods are perceived by undergraduate athletic training students to be effective methods for feedback on their clinical skills as they both offered contrasting vantage points. Strengths of the two methods differed based on the point-of-view provided; participants recognized the value of the GoPro® in order to see palpations and special tests directly, while they liked the ability of the traditional video to capture the entire scene and interaction of the standardized patient with the participant. Each of the video technology methods had perceived weaknesses, most notably GoPro® sound quality and discomfort of the head strap, while traditional video weaknesses were related to the inability of the method to
capture the entire scenario. Overall, athletic training students’ confidence remained unchanged by completing the scenarios and video-review. However, further examination of specific questions showed increased confidence in some areas and decreased confidence in others; this may assist students’ and faculty in making focused decisions regarding areas of improvement.

Barriers to implementing video technology in athletic training education discussed by Kawaguchi et al\textsuperscript{15} include cost of the recording device and associated software, as well as the time to complete all requirements necessary for recording and review. Kawaguchi estimates that this may take up to two hours for a single individual and may not be time effective for students and staff. The popularity of GoPro\textsuperscript{®} as well as advances in video technology of “smart phones” may offer easily accessible, rapid review alternatives for educators interested in the value of video-feedback.

Limitations

The overall number of study participants (n=13), as well as the demographic make-up of the cohort (12 females, 1 male) was a weakness in this study. Limited number of study participants decreased the generalizability of the study outcomes and ability to conduct any between group analyses. Due to the nature of the study and the availability of participants, the time taken for the feedback process was shorter than would likely occur in traditional athletic training education setting. In order to truly gauge how confidence changed over time, an early semester to end of semester time frame would help account for how participants’ utilized the feedback provided during their first SP encounter and implemented that feedback into clinical practice.
Additionally, while video-feedback given immediately following the scenario has been recognized to be most beneficial, participants may have benefited from additional instructor feedback, rather than simply self-assessment.⁶

Future studies should address how these video technologies are perceived when implemented into a true athletic training education model with additional instructor feedback and true assessment of clinical skills. Research on first person point of view should be encouraged in other health professions’ education programs that require clinical skill development such as medicine, nursing and physical therapy.

**FUTURE RESEARCH**

Use of the Confidence Questionnaire in conjunction and with the video-technology and Standardized Patient methods of this study elicited little change in confidence over time. It may be beneficial to make questions more specific, as to be combined with the use of video-technology, in order to elicit more meaningful responses from students. Additionally, as previously mentioned, the lack of change may be due to the time constraints of this study. Altered implementation of the confidence questionnaire throughout an evaluation course should be researched to determine what time variables may gather the most useful information regarding change in student’s confidence over time and to provide more valuable feedback regarding the pedagogical methods of this study.

Additionally, students’ perceptions of the video technology revealed that they felt nervous being recorded, disliked the bulkiness of the GoPro® and were distracted by the GoPro® being weighted on the head. A period of adjustment may be necessary for
students’ to adapt to the video technology methods and should be accounted for when using video for evaluation purposes. Future research should address the time needed for student’s to become comfortable with the specific video capture methods, in order to truly capture the most realistic depiction of athletic training student clinical skills.

**PRACTICAL APPLICATIONS**

Athletic training education programs are encouraged to utilize a variety of video-feedback methods to aid their students in clinical skill acquisition. Video-feedback may be combined with standardized patient scenarios or more easily integrated into evaluation courses and used during clinical skill practice or evaluations. In addition to providing feedback, video technology may help instructors to review students’ clinical skills following examination or tracking progress as students advance through the program. Both, GoPro® and traditional video should be used and selected based on students preference, availability and desired outcome of the situation where video is incorporated into the educational experience.

Benefits of video-technology techniques must be considered in conjunction with barriers of use. The time consuming nature of individualized instructor feedback may be combatted with methods of self-evaluation, similar to those used in this study, or peer review. Self-evaluation of clinical skills can offer students useful information regarding their strengths and weaknesses. If possible, self-review should be individualized to the given scenario and allow students to have a reference of what a “correct” evaluation would look like. Peer-review offers another valuable alternative that is not as time consuming or demanding of the instructor. Peer review allows students to compare to
another student and work together to determine areas of improvement. It also forces the students to learn to name the skill as they work back through the evaluation together. Both may be valuable alternatives, when instructor debriefing is not feasible.

While cost constraints relating to use of first-person point-of-view cameras may be valid, third person point-of-view technology is easily accessible and cost effective. “Smart phones” offer a simple video-recording method that may be easily integrated into athletic training education and clinical skill learning. For those looking to employ video methods into and athletic training program, it can be done with little additional cost and effort, but can be highly beneficial for students.
REFERENCES


APPENDIX A

University of Colorado
Colorado Springs
Institutional Review Board (IRB) for the Protection of Human Subjects

Date: 3/28/2016

IRB PROTOCOL NO.: #16-077
Protocol Title: Athletic Training Students’ Perceptions of Video-Feedback for Self-Assessment of Clinical Skills
Principal Investigator: Christina Landreth
Faculty Advisor if Applicable: Amanda Elder
Application: Report of Change (2)
Type of Review: Expedited 6
Risk Level: No more than Minimal Risk
Renewal Review Level (If changed from original approval) if Applicable: N/A No Change
This Protocol involves a Vulnerable Population: N/A (No Vulnerable Population)
Expires: 14 December 2016

*Note, if exempt: If there are no major changes in the research, protocol does not require review on a continuing basis by the IRB. In addition, the protocol may match more than one review category not listed.

OSF #: Sponsor:

Thank you for submitting your Request for IRB Review of a proposed change to your original IRB protocol to recruit additional participants from Colorado Mesa University Athletic Training Department. Per your application, no more than 19 participants in total may be recruited from the two study sites. The protocol identified above has been reviewed according to the policies of this institution and the provisions of applicable federal regulations. The review category is noted above, along with the expiration date, if applicable.

Once human participant research has been approved, it is the Principal Investigator’s (PI) responsibility to report any changes in research activity related to the project:
- The PI must provide the IRB with all protocol and consent form amendments and revisions.
- The IRB must approve these changes prior to implementation.
- All advertisements recruiting study subjects must also receive prior approval by the IRB.
- The PI must promptly inform the IRB of all unanticipated serious adverse (within 24 hours). All unanticipated adverse events must be reported to the IRB within 1 week (see 45CFR46.103b). Failure to comply with these federally mandated responsibilities may result in suspension or termination of the project.
- Renew study with the IRB prior to expiration.
- Notify the IRB when the study is complete.

If you have any questions, please contact Research Compliance Specialist in the Office of Sponsored Programs at 719-255-3903 or irb@uccs.edu

Thank you for your concern about human subject protection issues, and good luck with your research.

Sincerely yours,

Melissa J. Benton
Melissa Benton, PhD

www.uccs.edu/irb/compliance/  1420 Austin Bluffs Parkway Colorado Springs, CO 80918  719-255-3321 phone  719-255-3706 fax
APPENDIX B

University of Colorado Colorado Springs (UCCS)

Consent to be a Research Subject

**Title**: Athletic Training Students’ Perceptions of Video-feedback for Self-assessment of Clinical Skills

**Principal Investigator**: Christina Landreth, ATC

**Funding Source**: None

**Study Overview** This study intends to learn more about video technology and its role in Athletic Training Education. The study will assess athletic training students’ perceptions of different types of video technology as tools for self-assessment of their clinical evaluation skills.

**Procedures** You are being asked to be in this research study because as an athletic training student, your feedback is very important to the future of athletic training education. During the study you will be asked to participate in two 30 minute skill assessments while being videotaped using either a GoPro® camera or traditional video camera. Following completion of the simulated task, you will be asked to fill out a questionnaire, review your video footage and fill out additional questionnaires based on your video footage.

**Other people in this study**: Up to 20 individuals will participate in this study.

**Risks and Discomforts**: Minimal risks will be incurred by the subject. However, during the clinical skill evaluation period, you will be video-recorded which may cause anxiety. This video footage will be used entirely for research purposes and will not be shared beyond the scope of this study. Additionally, any footage that is to be published or viewed will be blinded for the participants’ privacy.

**Benefits** This study is designed for the researcher to learn more about student perceptions of athletic training education. It will provide information concerning the role video technology may play in the acquisition of clinical skills, as well as students’ confidence in those clinical skills. The outcome of the study will help to lay a foundation for future Athletic Training Education Programs’ use of video technology and what technologies may provide the “best” feedback for athletic training students.

**Compensation**: Athletic training students participating in the study will not receive any compensation for study participation.

**Confidentiality**: All hard copies of research information will be kept in a secure file and blinded to conceal participants’ identity. Any video footage will be kept on the investigator’s password protected laptop and saved by participant identification number. Any sharing of video footage will blind the participants face to conceal identity.

Certain offices and people other than the researchers may have access to study records. Government agencies and UCCS employees overseeing proper study conduct may look at your
study records. These offices include the UCCS Institutional Review Board, and the UCCS Office of Sponsored Programs and Research Integrity. UCCS will keep any research records confidential to the extent allowed by law. A study number rather than your name will be used on study records wherever possible. Study records may be subject to disclosure pursuant to a court order, subpoena, law or regulation.

**Voluntary Participation and Withdrawal from the Study**
Taking part in this study is voluntary. You have the right to leave a study at any time without penalty. You may refuse to complete any procedures you do not feel comfortable with, or answer any questions that you do not wish to answer. If you withdraw from the study, you may request that your research information not be used by contacting the Principal Investigator listed above and below.

**Contact Information**
Contact (PI’s info): clandret@uccs.edu

- if you have any questions about this study or your part in it,
- if you have questions, concerns or complaints about the research, or
- if you would like information about the study results when they are prepared.

Contact the Research Integrity Specialist at 719-255-3903 or via email at irb@uccs.edu:

- if you have questions about your rights as a research participant, or
- if you have questions, concerns or complaints about the research.

**Consent**
A copy of this consent form will be provided to you.

I understand the above information and voluntarily consent to participate in the research. By signing this consent, I am confirming that I am 18 years of age or older.

Signature of Participant

Date
APPENDIX C

VIDEO USE CONSENT FORM

As part of this research project, we will be recording you during your injury evaluation assessment. We would like you to indicate what uses of this videotape you are willing to consent to by initialing below. You are free to initial any number of spaces from zero to all of the spaces, and your response will in no way affect your credit for participating. We will only use the videotape in ways that you agree to. In any use of this videotape, your name will not be identified. Additionally, in the case of any portion of the video being published, your face will be blinded to public view. If you do not initial any of the spaces below, the videotape will be destroyed.

- The videotape can be studied by the research team for use in the research project.
  
  please initial: ____

- The videotape can be used for scientific publications.
  
  please initial: ____

- The videotape can be shown in public presentations to nonscientific groups.
  
  please initial: ____

FOR QUESTIONS ABOUT THE STUDY
Please contact Chrissy Landreth at clandret@uccs.edu

I have read the above description and give my consent for the use of the videotape as indicated above.

_________________________________ _________________________________
Signature of Participant     Date
APPENDIX D

Dear (Subject Name),

My name is Chrissy Landreth and I am a graduate athletic training student at the University of Colorado Colorado Springs. I am hoping to gain information regarding perceptions of different video types used during an athletic training scenario experience.

This is where you come in. I am seeking volunteers to go through two clinical scenarios while being recorded with a regular video camera and a GoPro® camera as part of my Masters thesis research. This opportunity will provide you two chances to practice and improve your lower extremity clinical skills with video feedback.

If you choose to participate, you will sign up for two 30 minute time slots for the end of January where you will go through two clinical scenarios with a standardized patient and complete surveys before and after each experience. The research study will be conducted entirely at CSU-Pueblo.

If you are interested in learning more or to sign up to participate, please reply directly to this email.

Look forward to hearing back from you,

Chrissy Landreth, ATC
Graduate Student
University of Colorado Colorado Springs
clandret@uccs.edu | 847.987.6129
APPENDIX E

Athletic Training Student Demographics

This questionnaire and the following questionnaires are intended to determine athletic training students’ perceptions of video technology. You have a right to elect not to answer these questionnaires, or any of the questions within. All information gathered will be used and analyzed as part of this research study. This questionnaire is anonymous and you will not be identified in any manner. Thank you for your willingness to participate. **If you have any questions, comments or concerns, please contact Chrissy Landreth at clandret@uccs.edu.**

1. **Gender:** (please circle one)  
   - Male  
   - Female  
   - Prefer not to disclose

2. **What year are you in school?** Check the answer that applies.  
   - ⬜ Junior  
   - ⬜ Senior

3. **What is your date of birth?** ___/____/ ____  
   For example, for January 7, 1999 write 01/07/1999

4. **Have you ever used a GoPro® camera in class or recreationally?** Check the best answer.  
   - ⬜ In class  
   - ⬜ Recreationally  
   - ⬜ Both  
   - ⬜ Neither

5. **Have you ever used a traditional video in class or recreationally?** Check the best answer.  
   - ⬜ In class  
   - ⬜ Recreationally  
   - ⬜ Both  
   - ⬜ Neither

6. **Have you ever been recorded while performing an injury evaluation or clinical skills?** Check the best answer.  
   - ⬜ Yes  
   - ⬜ No

7. **Have you ever reviewed video footage of your own performance?** Check the best answer.  
   - ⬜ Yes  
   - ⬜ No
APPENDIX F

VIDEO TECHNOLOGY QUESTIONNAIRE

For each of the following statements, please circle how much you agree or disagree with the statement: 1-strongly disagree, 2-disagree, 3-agree, 4-strongly agree.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The image quality of the video footage was clear and details could be</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>seen.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The sound quality of the video footage was clear and I could understand</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>the conversations.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The video camera was easy to use and operate.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. The video camera interfered with my clinical assessment.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. The video camera made me nervous when conducting my evaluation.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. The video footage provided allowed me to adequately assess my skills.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. Reviewing the video footage provided will improve my future clinical</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>skills.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Reviewing the video footage was beneficial to my growth as an athletic</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>trainer.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Reviewing the video footage was a worthwhile experience.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. I would be highly satisfied with this form of feedback for future</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>clinical skills training.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F (cont.)

For the following questions, please write your answer in the space provided below. If you do not have enough space, please use room on the back of the questionnaire to complete your response.

11. Please describe any strengths of the GoPro® first person point-of-view provided.

12. Please describe any weaknesses of the GoPro® first person point-of-view provided.

13. If given the option, would you rather use the GoPro® or traditional video camera for feedback on your clinical skills? Why?
APPENDIX G

STANDARDIZED PATIENT TRAINING MATERIALS- CASE 1- Sesamoiditis

HISTORY OF THE PRESENT ILLNESS

Chief Complaint/Reason for Visit:
Toe has been hurting

Onset:
The ball hit the bottom side of foot yesterday during practice

Duration:
Aches all the time, especially when standing

Location:
Pain on the plantar aspect of the 1st MP

Character:
Pain that aches

Radiation:
None

Intensity: (on a scale of 1-10)
4/10

Aggravating factors:
Hurts more when I stand on it and hurts at the end of the day

Alleviating factors:
None except keeping off the foot

Course: (Getting better or worse?)
Neither, not getting better, or worse

Context: (What was the setting/context of the onset?)
Being hit

Associated Symptoms:
None

Physical Findings:
Pt tender over sesamoid bones
Pain with active/resisted great toe flexion and passive extension
Painful when palpated between 1st and 2nd metatarsal heads but no numbness or tingling
(-) Squeeze test, percussion test, tapping test (although percussion and tapping are a little tender over the sesamoids)

Response to Symptoms:
Patient has worn different shoes thinking that may be the problem. She was wearing tennis shoes and changed to a different pair. The patient hasn’t noticed any change but it has only been a day

Consequences
Painful when walking up hills and steps. Painful when standing
APPENDIX G (cont.)

LOWER EXTREMITY INJURY ASSESSMENT - CASE 2- Lisfranc (midfoot sprain)

Chief Complaint/Reason for Visit:
Foot hurts when walking

Onset:
During soccer practice yesterday, landed funny after kicking the ball

Duration:
Aches all the time; is worse with standing and walking; has been one day

Location:
Dorsal midfoot pain, specifically over the 2\textsuperscript{nd} and 3\textsuperscript{rd} tarsometatarsal joint

Character:
Pain that aches all the time; is sharp when standing or walking

Radiation:
None

Intensity:
6/10

Aggravating factors:
Hurts more when I stand on it and even worse when walking

Alleviating factors:
Keeping off the foot

Course: (Getting better or worse?)
Feels like it is getting worse; Pain every time I put pressure on it.

Context: (What was the setting/context of the onset?)
Stumbling after taking a shot; felt immediate pain after landing on kicking foot

Associated Symptoms:
None

Physical Findings:
Pt tender on midfoot (dorsal pain over the 2\textsuperscript{nd} and 3\textsuperscript{rd} tarsometatarsal joint)
Mild dorsal swelling over 2\textsuperscript{nd} and 3\textsuperscript{rd} tarsometatarsal joint
Painful when palpated over midfoot, but no numbness or tingling
Pain with metatarsal glides of 2\textsuperscript{nd} and 3\textsuperscript{rd} metatarsal
No AROM or RROM restrictions, but dorsiflexion and toe extension are painful
PROM of metatarsal on tarsal causes pain at the midfoot
Pain with single limb heel raise

Response to Symptons:
Patient stuck foot in the ice bath after practice and thought that pain would go away.
Took ibuprofen this morning, but feels as though walking around is making it worse.

Consequences:
Painful when landing on the foot and worse when pushing off. Pain is made worse with running or cutting, but athlete wants to know if she can have foot taped and play