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2010
JOURNAL STATISTICS

Athletic Training Education Journal
2010 Statistics

ACCESS AND DOWNLOADS

Table 1 Displays the page downloads and visitations to the journal website. We had 1,526 more pages downloaded in 2010 as compared to 2009. Our unique and first time visitors have decreased by 5,829 and 3,358 respectively, but the number of returning visitors has increased by 1,662 from 2009.

Table 1. *ATEJ* Web Site Access and Downloads

Page Downloads	35,891
Unique Visits	8,548
First-time Visitors	8,561
Returning Visitors	4,119

SUBMISSIONS

The number of original submissions increased from 22 in 2009 to 38 in 2010. We had a total of 43 manuscripts resubmitted during the 2010 calendar year.

Table 2. *ATEJ* Manuscript Submissions

Original submissions	38
Resubmitted manuscripts	43
Total submissions	81
Number of publications*	20

*does not include editorials/letters or columns

ACCEPTANCE RATE

In 2010, the ATEJ began using *EJournalPress*, an on-line manuscript submission and review system. The system calculates the manuscript acceptance rate with the following formula:

Acceptance Rate = 100 * Accepted / (Accepted + Rejected)

Table 3 displays manuscript acceptance submission and disposition along with the acceptance rate for 2010.

Table 3. *ATEJ* 2010 Manuscript Submission, Disposition, and Acceptance Rate

Original Submissions	38
Accepted	17
Rejected	7
Pending	16
Acceptance Rate	71%

TYPES OF PUBLICATIONS

We continue to publish a blend of manuscript types including original research, commentaries/perspectives, and reviews/techniques (Table 4) and editorials, and columns (Table 5).

Table 4. Types of Publications—Excluding Editorials/Letters and Columns

	Issue				
Type	**1**	**2**	**3**	**4**	**Total**
Original Research	2	4	2	1	**9**
Commentaries/Perspectives	3	1	4	2	**10**
Reviews/Techniques	0	0	0	1	**1**
Total	**5**	**5**	**6**	**4**	**20**

Table 5. Number of Editorials/Letters and Columns

	Issue				
Type	**1**	**2**	**3**	**4**	**Total**
Editorials/Letters	1	0	0	2	**3**
Columns	4	3	3	3	**13**

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ORIGINAL RESEARCH

Athletic Training Educators' Knowledge, Comfort, and Perceived Importance of Evidence-Based Practice

Cailee E. Welch, MSEd, ATC*, Bonnie L. Van Lunen, PhD, ATC*, Stacy E. Walker, PhD, ATC†, Sarah A. Manspeaker, PhD, ATC‡, Dorice A. Hankemeier, MSEd, ATC*, Sara D. Brown, MS, ATC§, R. Mark Laursen, MS, ATC§, James A. Oñate, PhD, ATC¶

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Context: Before new strategies and effective techniques for implementation of evidence-based practice (EBP) into athletic training curricula can occur, it is crucial to recognize the current knowledge and understanding of EBP concepts among athletic training educators.

Objective: To assess athletic training educators' current knowledge, comfort, and perceived importance of evidence-based concepts.

Design: Cross-sectional survey design.

Setting: Online survey instrument.

Patients or Other Participants: 141 respondents (28.3% response rate) from a convenience sample of 498 athletic training educators.

Main Outcome Measure(s): Demographic information and knowledge, comfort, and perceived importance of 11 EBP concepts (definition of EBP, steps of EBP, reliability, validity, intra-class correlation coefficient, kappa coefficient, specificity, sensitivity, likelihood ratio, positive predictive value, negative predictive value) were obtained.

Results: Participants' overall EBP knowledge score was 64.4%. Characteristics associated with higher knowledge scores were terminal degree (69.92% ± 10.36, $P < .001$), hours of research per week (66.96% ± 12.61, $P = .029$), and hours of teaching-related tasks conducted per week (67.47% ± 12.48, $P = .002$). Overall EBP comfort was 2.37/4.0 ("uncomfortable"). Characteristics associated with higher comfort scores were terminal degree (2.51 ± 0.67, $P = .017$), hours of research per week (2.52 ± 0.69, $P = .025$), and EBP workshops previously attended (2.56 ± 0.66, $P = .002$). Overall EBP perceived importance was 3.34/4.0 ("important"). The characteristic associated with higher importance scores was hours of research per week (3.44 ± 0.45, $P = .009$).

Conclusions: Athletic training educators' current knowledge of EBP concepts needs to be improved. This study indicates that athletic training educators are uncomfortable with evidence-based concepts, yet believe it is important for curricular implementation. The future development of workshops and teaching models should focus on the varying levels of EBP concepts. Distinguishing modes for curricula implementation might also be an effective way to increase knowledge, comfort, and perceived importance levels.

Key Words: Education, didactic curricula, survey research

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Athletic Training Educators' Knowledge, Comfort, and Perceived Importance of Evidence-Based Practice

Cailee E. Welch, MSEd, ATC, Bonnie L. Van Lunen, PhD, ATC, Stacy E. Walker, PhD, ATC, Sarah A. Manspeaker, PhD, ATC, Dorice A. Hankemeier, MSEd, ATC, Sara D. Brown, MS, ATC, R. Mark Laursen, MS, ATC and James A. Oñate, PhD, ATC

Evidence-based practice (EBP) evolved over the late twentieth and early twenty-first century to become accepted practice for health care professions. Several professional organizations, including the Institute of Medicine, have refocused their standards to include a greater emphasis on the importance of evidence-based fundamentals as a means for improving the level of health care offered to patients.[1] However, one of the greatest barriers for adoption of EBP by clinicians is the lack of knowledge regarding proper integration into patient care.[2-3]

Evidence-based practice is most accurately described as the integration of the best available research evidence, patient values, and clinician expertise to make clinical decisions.[4-6] EBP is conducted in a five-step process: (a) defining a clinical question; (b) conducting a search of the most current literature; (c) critically appraising the literature; (d) relating the research back to the initial clinical question; and finally (e) evaluating the effectiveness of the outcomes.[4] Although some research evidence may shift health care away from traditional practice, evidence-based practice does not ignore the importance of the clinician's individual knowledge and clinical experience.[7]

As evidence-based practice becomes more prevalent in health care, it is important for all health care professionals to accept and implement this process in both their clinical practice and didactic education. Medicine, dental medicine, and nursing pioneered the adoption and use of evidence-based practice in everyday patient care. Over the past decade, accrediting bodies, governing agencies, and health care payers have emphasized the push towards EBP.[1,8,9] Furthermore, research on evidence-based practice has flourished in nursing education and other professional publications, as well as in newly developed journals dedicated to evidence-based practice in nursing (eg, Evidence-Based Nursing, Journal of Research in Nursing). Other health care professions, such as physical therapy, occupational therapy, and athletic training have also gradually begun to adopt and incorporate evidence-based practice into daily clinical practices and education.[10]

Athletic training educators are an important influence on the professional development of athletic training students in the classroom. Along with teaching responsibilities, however, educators are also often expected to fulfill administrative, scholarly research, service, and clinical practice demands.[11] Strenuous workloads, therefore, can make it difficult for an educator to find time to learn evidence-based practice concepts, as well as incorporate them into their curricula. Individuals with a terminal degree, or those in a tenure-track position, are more likely to conduct research on a regular basis,[12] and may be more knowledgeable of and accustomed to the critical thinking and analysis components used in evidence-based practice. Educators who have previously attended "evidence-based"-related workshops may also be more familiar with such components, and therefore may have a better understanding of EBP.

Evidence-based practice is crucial for the future advancement of the athletic training profession. Compared to a majority of other health care professions, athletic training lacks evidence-based publications identifying specific research to support its clinical practices.[6] Having scientific evidence may not only support the effectiveness of athletic training clinical methods, but may also provide a rationale for third-party financial reimbursement.[13] From an academic standpoint, it is important for educators in athletic training programs to continually prepare students with the proper skills that serve as the foundation for evidence-based practice.[14]

Creating a culture of evidence-based practice must start with didactic education. For EBP education to progress, faculty must be well versed in its fundamentals. However, athletic training educators' overall understanding of EBP principles has not been assessed. Recognition of athletic trainers' current knowledge, comfort, and perceived importance of EBP will help formulate new strategies and effective techniques to implement it into athletic training education curricula. Therefore, the purpose of this study was to determine athletic training educators' knowledge, comfort, and perceived importance of evidence-based practice concepts. We hypothesized that athletic training educators who held a terminal degree (eg, PhD, EdD), conducted more than five hours of research per week, or had previously attended "evidence-based"-related workshops would have greater knowledge, comfort, and perceived importance scores on the Evidence-Based Concepts for Clinical Practice Assessment (EBCPA). We also hypothesized that there would be no differences in knowledge, comfort, or importance scores based on weekly teaching-related tasks or patient care responsibilities.

METHODS

Participants

All registrants of the 2009 Athletic Training Educators' Conference (N=498) were solicited for participation in this study. One hundred and forty-one individuals responded to the pre-conference Evidence-Based Concepts for Clinical Practice Assessment and demographics questionnaire for a response rate of 28.3%. Subjects consisted of 62 male (age = 41.32 ± 8.92) and 79 female (age = 36.08 ± 7.91) athletic training educators. Subjects had an average of 9.81 ± 7.19 years of athletic training teaching experience. Demographics for the sample group are presented in Table 1. The Institutional Human Investigation Committee of Old Dominion University approved this study and consent was implied upon voluntary submission of the completed survey.

Table 1. Demographic Information (n = 141)

Demographic	n	%
Sex		
Males	62	44.0
Females	79	56.0
Terminal Degree		
Have	66	46.8
Do Not Have	75	53.2
Hours of Research Per Week		
More Than Five	68	48.2
Fewer Than Five	73	51.8
"Evidence-Based" - Related Workshop		
Have Attended	64	45.4
Have Not Attended	77	54.6
Hours of Academic Coursework Per Week		
More Than Forty	81	57.4
Fewer Than Forty	60	42.6
Patient Care on a Weekly Basis		
Conduct Patient Care	69	48.9
Do Not Conduct Patient Care	72	51.1

Instrumentation

Currently there are two survey instruments that have been used for the assessment of clinicians' evidence-based practice knowledge levels. The Berlin Questionnaire and the Fresno Test of Evidence-Based Medicine have both been found to be reliable and valid.[15,16] However, the Berlin Questionnaire contains scenario-based application questions to assess EBP knowledge among postgraduate medical physicians while the Fresno Test of Evidence-Based Medicine contains open-ended scenario-based questions to assess EBP knowledge among family practice residents and requires participants to use electronic databases to complete the survey. Therefore, due to the population being assessed as well as the manner of questions and level of knowledge required to successfully complete these surveys, they were deemed unsuitable for use in this research study. Thus the research team created an online survey utilizing Inquisite 8.0 Corporate Survey Builder (Catapult System Corporation, Austin, TX) to assess evidence-based practice knowledge levels among athletic training educators. Along with a knowledge section, The Evidence-Based Concepts for Clinical Practice Assessment included two calibration sections: comfort level and perceived importance. These variables were assessed to gain a more accurate perspective of athletic training educators' attitudes and beliefs towards the incorporation of evidence-based practice concepts within didactic curricula. Knowledge levels may not solely indicate whether or not these educators feel the subject matter is important or how comfortable they were with their responses (ie, low knowledge scores do not necessarily equate to low importance or comfort scores), therefore we incorporated a calibration component to the survey.

Knowledge

The knowledge section consisted of 20 multiple-choice questions evaluating 11 different evidence-based practice concepts: definition of EBP, steps of EBP, reliability, validity, intra-class correlation coefficient, kappa coefficient, specificity, sensitivity, likelihood ratio, positive predictive value, and negative predictive value. These questions were developed from information and recommendations available in the current literature as well as survey instruments used in other health care professions.[15,16] With permission, some of the knowledge questions were adopted from the Berlin Questionnaire and modified to apply to athletic training. Each question had one correct response and each participant's composite score in this section was calculated by awarding one point for the correct response and zero points for an incorrect response. Therefore, a higher knowledge composite score indicated a higher level of knowledge pertaining to the 11 evidence-based concepts.

Multiple-choice questions in the knowledge section were divided into two subsections consisting of nine foundational questions and 11 framing questions. Foundational questions included information pertaining to the introductory elements of the evidence-based practice process, literature searching, and critical appraisal, whereas framing questions evaluated components of EBP that require statistical application and understanding. Sample foundational survey questions for the knowledge section are provided in Table 2, and sample framing survey questions are presented in Table 3. Based on opinions from a panel of five experts, the 20 multiple-choice questions were additionally grouped into five smaller groups of 3-5 questions each. Each of these groups included 2-3 related evidence-based practice concepts. The evidence-based practice concepts group [EBPC] focused on the general evidence-based practice concepts including knowledge pertaining to the steps of EBP, levels of evidence, and gold standards for research study designs. The reliability and validity group [RV] included questions about interpreting reliability and validity, while the reliability coefficients group [RC] involved reliability coefficients such as intra-class correlation coefficients and kappa coefficients. The sensitivity, specificity, and likelihood ratio group [SSL] concentrated on sensitivity, specificity, and the interpretation of likelihood ratios. Finally, the predictive values group [PV] entailed questions pertaining to positive and negative predictive values. A visual representation of the instrument breakdown is provided in Figure 1. Total group and subgroup scores, as well as the composite knowledge score, were further normalized to percentages.

Table 2. Sample Foundational Survey Instrument Questions

4. Which of the following is considered the "gold standard" of experimental research design? (Choose one)

[ ] Case report	[ ] Clinical observation
[ ] Prospective cohort	[ ] Randomized controlled trial

8. Which statistical concept assesses a diagnostic test to determine its reproducibility? (Choose one)

[ ] Reliability	[ ] Validity
[ ] Sensitivity	[ ] Specificity

Table 3. Sample Framing Survey Instrument Questions

16. At the ABC University athletic training clinic, the prevalence of post-surgical ganglion cyst reccurrence is 30%. One hundred consecutive patients have been included in a study for a new non-invasive diagnostic test for detection of ganglion cysts. Of these 100 patients, 63 are recognized as truly negative (ie, truly free of a ganglion cyst). The number of false positive and false negative patients is identical. Which one of the 4 tables best describes this information?

A	Gold Standard Positive	Gold Standard Negative	
Test Positive	23	7	30
Test Negative	7	63	70
	30	70	100 Patients

B	Gold Standard Positive	Gold Standard Negative	
Test Positive	30	0	30
Test Negative	0	70	70
	30	70	100 Patients

C	Gold Standard Positive	Gold Standard Negative	
Test Positive	27	10	37
Test Negative	3	60	63
	30	70	100 Patients

D	Gold Standard Positive	Gold Standard Negative	
Test Positive	30	7	37
Test Negative	7	56	63
	37	63	100 Patients

Choose one:

[ ] Table A
[ ] Table B
[ ] Table C
[ ] Table D

---

17. Which of the following terms combines sensitivity and specificity to indicate a shift in probability? (Choose one)

[ ] Likelihood ratio
[ ] Positive predictive value
[ ] Negative predictive value
[ ] Intra-class correlation coefficient

Figure 1. Survey Instrument Breakdown

Comfort

The comfort section consisted of 11 four-point Likert scale questions concerning the 11 evidence-based practice concepts. The comfort level questions asked if the participant was comfortable with their ability to implement each of the 11 concepts within didactic curricula. The participant had four ordered choices where a score of "1" indicated the participant was "very comfortable" while a score of "4" indicated the participant was "very uncomfortable." During the statistical analysis, the researcher reversed the scale and therefore converted each response so that a score of "1" indicated the participant was "very uncomfortable" and a score of "4" indicated the participant was "very comfortable." This reverse coding allowed the researcher to display that a higher comfort composite score indicated a higher level of comfort pertaining to the eleven evidence-based practice concepts. To coincide with the knowledge section, the comfort level questions were broken down into the same foundational versus framing groups as well as the five smaller subgroups. The evidence-based practice concepts in each of the comfort groups were matched to those included in the knowledge groups. Total group and subgroup scores in each comfort group and the composite comfort score were averaged and normalized to the comfort Likert scale where a 4 is the maximum score achievable.

Perceived Importance

The perceived importance section also included 11 Likert scale questions concerning evidence-based practice concepts. The perceived importance level questions asked if the respondent believed each of the 11 evidence-based practice concepts was important to implement within didactic curricula. To match the comfort Likert scale, the participant again had four ordered choices where a score of "1" indicated the participant believed the concept was "very important" and a score of "4" indicated the participant believed it was "very unimportant." This scale was also reversed during statistical analysis and each response was converted to match the comfort scores. Furthermore, the perceived importance level questions were also broken down into the foundational versus framing subsections, as well as the five smaller groups, and were matched by the evidence-based practice concepts as previously described. Total group and subgroup scores in each perceived importance group and the composite perceived importance score were averaged and normalized to the importance Likert scale for a maximum achievable score of 4.

Along with the EBCPA, participants were also asked to complete a demographics questionnaire. This questionnaire included 34 questions requesting information related to gender, age, ethnicity, academic work, clinical practice, and research as well as information pertaining to their associated athletic training education program (Table 1).

Survey Analysis

Once the EBCPA survey was fully developed, a panel of five experts assessed the instrument for content validity. The survey tool was regarded to be a valid instrument including a representative sample of questions to appropriately assess EBP knowledge, comfort, and perceived importance levels; therefore, the research team proceeded to conduct a test-retest reliability assessment. Reliability percent agreement of the 20 knowledge questions was determined via pilot testing with a group of six athletic training educators not attending the 2009 Athletic Training Educators' Conference. Each participant of the pilot sample completed the knowledge questions twice; the retest assessment was completed three weeks following the initial assessment. The percent agreement for all questions included on the final instrument was found to be substantial with an average of 76.67% and a range from 50% to 100%. Three out of the twenty knowledge questions had a percent agreement of 50% ("moderate agreement"). Percent agreement focuses on identifying the strength of agreement from one session to the next; however, it does not account for correct answers or responses due to chance.[17] Individuals who chose incorrect responses often chose a different incorrect response during the second assessment, therefore affecting the percent agreement rate. Due to the substantial percent agreement of the knowledge section, no modifications were made after the reliability analysis was conducted.

Procedures

A list of the names and contact information of all the registrants for the 2009 Athletic Training Educators' Conference was obtained from the administrative staff associated with the Educators' Conference. Conference registrants were sent a letter via email requesting participation in the research investigation. The letter contained a description of the overall purpose and importance of the research study, the estimated time to complete the survey, the URL hyperlink directing them to the survey webpage, and a request for their participation. The email also provided contact information of the researcher for comments or questions that concerned either the research study or the survey instrument.

Once the participant completed the survey (indicated by clicking "submit"), the information was automatically sent to the Old Dominion University database system. Participants' responses were generated in Statistical Package for Social Sciences (version 16.0, SPSS Inc. Chicago, IL) and then matched with a file coding system to maintain participant confidentiality. Data collection occurred over a three-week period beginning in late January 2009 and ended prior to the Educators' Conference at the end of February 2009. Follow-up emails were sent to the participants once every week to thank those who had completed the survey instrument while simultaneously reminding those who had not yet responded.

Data Analysis

Statistical Package for Social Sciences for Macintosh (version 16.0, SPSS Inc. Chicago, IL) was used to calculate the statistical components. Descriptive statistics were used to calculate the means, standard deviations, and frequencies. One-way analysis of variances (ANOVA) and repeated measures ANOVAs were used to detect knowledge differences between groups for the data associated with terminal degree, hours of research, "evidence-based"-related workshops, hours of teaching-related tasks, and hours of patient care. Mann-Whitney U tests were used to

detect comfort and importance differences for the ordinal data associated with these variables. The significance level was set at $P \leq 0.05$.

RESULTS

We had a response rate of 28.3% (141 out of 498 survey recipients responded). Overall, athletic training educators attained composite knowledge scores of 64.90% ± 13.29. Educators denoted they were generally "uncomfortable" with the specified evidence-based concepts (2.38/4.0 ± 0.65), yet indicated that the EBP concepts were "important" for curricular implementation (3.34/4.0 ± 0.48). Descriptive statistics (mean ± SD) for all independent variables are presented in Table 4.

Educators with a terminal degree achieved higher composite knowledge scores than those without a terminal degree ($F_{1,139} = 23.96$, $P < .001$). Terminally degreed educators also felt more comfortable with the evidence-based concepts than individuals without a terminal degree ($z = -2.381$, $P = 0.017$). More specifically, these individuals felt more comfortable with the framing questions included in the RC ($z = -3.113$, $P = .002$) and SSL ($z = -1.982$, $P = .047$) groups. No differences were demonstrated for curricular implementation importance with regard to terminal degree.

Educators conducted varying hours of research, teaching-related tasks, and patient care per week. Educators who conducted more than five hours of research per week achieved higher composite knowledge, comfort, and importance scores than educators who did not. These individuals reported higher comfort levels in both the foundational ($z = -2.012$, $P = .044$) and framing ($z = -2.597$, $P = .009$) subsections; specifically in the EBPC ($z = -1.987$, $P = .047$) and RC ($z = -4.585$, $P < .001$) groups. Furthermore, educators who conducted more than five hours of research per week achieved significantly higher importance scores in the RC ($z = -2.974$, $P = .003$) and SSL ($z = -2.322$, $P = .020$) groups. Educators who conducted more than 40 hours of teaching-related tasks per week achieved higher composite knowledge scores, but had no significant differences from educators who conducted fewer than 40 hours per week in regard to composite comfort and importance scores. Finally, there were no significant differences for knowledge, comfort, and perceived importance among athletic training educators who conducted or did not conduct patient care on a weekly basis.

Educators who had previously attended "evidence-based"-related workshops did not have significant differences in composite knowledge and perceived importance scores when compared to educators who had not; however, they were significantly more comfortable with the 11 evidence-based concepts. More specifically, individuals who had previously attended "evidence-based"-related workshops reported they felt more comfortable with concepts included in the EBPC ($z = -2.466$, $P = .014$), SSL ($z = -2.484$, $P = .013$), and PV ($z = -2.019$, $P = .044$) groups.

DISCUSSION

Athletic training educators' knowledge of evidence-based practice concepts vary from a basic understanding to more advanced comprehension. As assessed on the Evidence-Based Concepts for Clinical Practice Assessment, athletic training educators' composite knowledge scores averaged 64.4%. Educators performed better on the foundational (EBPC & RV) questions than on the framing (RC, SSL, PV) questions; therefore, the more complex the evidence-based concepts became, the lower the scores were on the EBCPA. In a similar study, Fritsche et al[15] examined baseline EBP knowledge scores among a group of health professionals and found mean knowledge scores via the Berlin Questionnaire to be 6.3 out of 15 (42%). Additionally, Nicholson et al[16] evaluated a sample of health care clinical educators and found their baseline knowledge scores via the Fresno Test to be 57.9%.

After a baseline assessment was obtained via the Berlin Questionnaire, health professionals completed a 3-day evidence-based course and improved their EBP knowledge scores by 57% ($P < 0.001$).[15] Furthermore, following the baseline knowledge assessment via the Fresno Test, clinical educators completed nine evidence-based workshops over a one-year period; post-workshop analyses reported knowledge scores to be 78.4%, indicating a 20.5% increase ($P < 0.001$).[18] Therefore, although the baseline knowledge scores of athletic training educators may look similar to these other studies, it is important to point out that the data collected from the other health professions have since then been followed with workshops, short-courses, and programs, along with post-intervention analyses. Additionally the questionnaires utilized in these studies are more complex in content (ie, open-ended, scenario-based application questions) than what was used within our research.[15,16] Therefore, athletic training educators' current EBP knowledge scores are falling behind other health care professionals and must be improved.

As the fifth edition of the *NATA Educational Competencies* incorporates evidence-based practice concepts,[19] athletic training students will be required to understand these concepts and feel confident in implementing them within clinical practice. However, before students can be expected to comprehend evidence-based concepts, it is important to determine educators' comfort levels with their ability to implement such concepts into their didactic curriculum. Composite comfort scores assessed within this study averaged 2.4 out of 4, indicating that the majority of athletic training educators felt "uncomfortable" with their content knowledge of the 11 evidence-based concepts. Educators felt slightly more comfortable with the foundational questions such as reliability and validity. However, comfort levels decreased with more complex concepts, particularly with reliability coefficients and predictive values. Similar baseline comfort scores (2.8 out of 5) were found in health care clinical educators who were asked to assess their confidence levels of online skills for access to medical knowledge and support of EBP teaching.[18] However, the baseline comfort assessment for these clinical educators was followed with numerous EBP workshops; post-intervention comfort scores were reported to be 3.3 out of 5 ($P < 0.001$).[18]

Along with knowledge and comfort, it is also important to appraise athletic training educators' beliefs towards the importance of implementing particular evidence-based concepts within athletic training coursework. Educators reported that the 11 evidence-

Table 4. Composite Knowledge, Comfort, and Importance Scores

Variable	Knowledge (Mean ± SD)	*P* Value	Comfort (Mean ± SD)	*P* Value	Importance (Mean ± SD)	*P* Value
Terminal Degree		0.001		0.017		0.370
Have	69.92 ± 10.36		2.51 ± 0.67		3.39 ± 0.46	
Do Not Have	59.60 ± 14.11		2.27 ± 0.53		3.29 ± 0.50	
Hrs of Research/Week		0.029		0.025		0.009
More Than Five	67.06 ± 12.67		2.52 ± 0.69		3.44 ± 0.45	
Fewer Than Five	61.99 ± 13.84		2.25 ± 0.58		3.24 ± 0.49	
"Evidence-Based" Workshop		0.087		0.002		0.752
Have Attended	66.56 ± 13.62		2.56 ± 0.66		3.36 ± 0.41	
Have Not Attended	62.66 ± 13.19		2.33 ± 0.59		3.32 ± 0.53	
Hrs of Teaching Tasks/Week		0.002		0.504		0.901
More Than Forty	67.47 ± 12.48		2.43 ± 0.69		3.34 ± 0.48	
Fewer Than Forty	60.33 ± 13.80		2.31 ± 0.59		3.33 ± 0.48	
Patient Care on a Weekly Basis		0.211		0.496		0.139
Conduct Patient Care	62.97 ± 14.07		2.41 ± 0.62		3.28 ± 0.46	
Do Not Conduct Patient Care	2.35 ± 0.68		2.35 ± 0.68		3.40 ± 0.50	

based concepts evaluated were "important" for implementation; composite perceived importance scores averaged at 3.3 out of 4. Interestingly, educators believed the more framing evidence-based concepts were just as important for implementation as the basic foundation concepts. In a similar assessment of physical therapists' attitudes and beliefs towards EBP, it was found that 90% of the respondents believed evidence-based practice concepts were important and necessary.[3] It is evident that athletic training educators, along with other health care professionals, believe EBP is a necessary component for the enhancement of health care.

Enhanced Knowledge and Appreciation for Statistics

We hypothesized that athletic training educators with a terminal degree would have higher knowledge, comfort, and perceived importance scores on the Evidence-Based Concepts for Clinical Practice Assessment than athletic training educators without a terminal degree. We found that educators with a terminal degree achieved significantly higher composite knowledge scores and composite comfort scores; however, no difference in importance scores between the two groups was found. More specifically, educators with a terminal degree felt more comfortable with the framing evidence-based concepts, particularly the reliability coefficients, sensitivity, specificity, and likelihood ratios.

We also hypothesized that those athletic training educators who spend more than five hours per week on research would achieve higher scores on the knowledge, comfort, and importance sections of the survey. We found that educators who conducted more than five hours of research per week scored significantly higher composite scores on the knowledge section as well as higher composite scores on the two calibration sections. These educators felt more comfortable with both the foundational and framing subsections, particularly the evidence-based practice concepts and reliability coefficient sections. They also regarded the reliability coefficients, sensitivity, specificity, and likelihood ratios to be of greater importance for implementation than individuals who did not conduct more than five hours of research per week.

Generally, earning a terminal degree includes substantial coursework in statistical analyses, and often requires a doctoral student to conduct research on a regular basis.[12] Doctoral education programs typically include more courses in statistical concepts than CAATE-accredited professional or NATA-accredited post-professional programs, therefore giving the individual greater skill practice in data synthesis, breakdown, and critical appraisal. Furthermore, individuals with a terminal degree may often be in a position that requires continual research publications for promotion and tenure.[10,12,20] Due to the increased focus on statistical processes, individuals with a terminal degree and/or those who conduct research on a weekly basis are more likely to have a better understanding of the fundamental evidence-based concepts, and therefore perform better on the Evidence-Based Concepts for Clinical Practice Assessment. Similarly, we would expect to find that these individuals believe the incorporation of EBP concepts into the curriculum is more important.

"Evidence-Based" Related Workshops

In regard to "evidence-based" related workshops, we hypothesized that athletic training educators who had previously attended "evidence-based"-related workshops would demonstrate higher knowledge, comfort, and importance scores. In regard to overall knowledge scores, there were no significant differences found between the two groups. However, athletic training educators who had previously attended EBP workshops had significantly higher composite comfort scores. Furthermore, these individuals reported significantly higher comfort scores for the evidence-based practice concepts group, as well as the framing groups of sensitivity, specificity, likelihood ratios, and predictive values.

Finally, although no significant differences were found for composite importance scores, athletic training educators who had previously attended EBP workshops indicated significantly higher importance scores for the fundamental evidence-based concepts.

Several "evidence-based"-related workshops have been made available to athletic trainers at both the district and national levels over the past several years.[21] However, the majority of these workshops are introductory and solely focus on what evidence-based practice is and how it is needed in athletic training to help promote and further enhance the profession. While advanced-level workshops detailing higher-level statistical concepts are available, very few suggest ways to carry this knowledge over into the classroom. Although workshops typically do not change a clinician's daily practices,[22] they have been found to change attitudes and perceptions.[23]

Workload Hours Per Week

It was hypothesized that there would be no significant differences in knowledge, comfort, and perceived importance between athletic training educators who conduct more than 40 hours of teaching-related tasks per week and those who conduct fewer than forty. Contrary to our initial hypothesis, educators who conduct more than 40 hours of teaching-related tasks per week had significantly higher composite knowledge scores. However, there were no significant differences revealed in either comfort or importance sections of the instrument, which supports our initial hypothesis. In addition, we also hypothesized that there would be no significant differences in knowledge, comfort, and importance scores between athletic training educators who performed patient care on a weekly basis and those who did not. The findings support our initial hypotheses in that there were in fact no significant differences revealed in any of three survey sections assessed.

Athletic training educators are often required to balance their workload between scholarship, service, clinical responsibilities ,and teaching-related tasks (eg, mentoring and advising students, curriculum preparation, in-class instruction) as well as other administrative responsibilities.[11,24,25] Although further research needs to be conducted to specify how these educators classify teaching-related tasks, individuals who spend more than 40 hours per week may typically be more likely to examine research more frequently in order to fulfill their expected tasks. Individuals who spend fewer than 40 hours per week on teaching-related tasks generally have other responsibilities occupying their time, such as duties in the clinical setting. Previous literature indicates that barriers to learning and implementing EBP concepts in the clinical setting include lack of time, limited access to resources, and self-confidence.[3,26] Thus, athletic training educators, as well as clinicians, may carry extremely full workloads that prevent them from taking the time to learn evidence-based practice concepts as well as discover ways to implement them into their already demanding schedules.

EBP Implementation

While the assessment of the effects of the independent variables on evidence-based practice knowledge, comfort, and perceived importance scores within this study are important, the larger focus must remain on the global issues of EBP implementation within the athletic training profession. Overall, the main goal of this health care profession is to improve patient care.[27] However, such improvements require that treatment plans and clinical decisions are based on evidence and proven to be effective, timely, and cost efficient for the patient and clinician. To do so, we must produce clinicians who will routinely use evidence-based concepts during their search and appraisal of research literature for the optimal treatment methods and interventions for each patient or problem. Unfortunately, without consistent implementation of EBP into didactic and clinical athletic training education, such clinicians may never be available.

Interestingly, many athletic training educators are already implementing the tools necessary for evidence-based practice without realizing it. Problem-based learning, a teaching strategy that has been incorporated into many athletic training education programs, allows students to enhance their critical thinking and problem solving skills—two tasks essential for the evidence-based clinician.[28] With problem-based learning and various other active-learning strategies embedded into the curriculum, transformations to incorporate evidence-based concepts should be relatively easy. To further add to the simple transition, many athletic training education programs have already begun to implement research methods courses into the curriculum. Such classes also augment a student's critical thinking ability, as well as provide a basic understanding of some of the important statistical concepts within EBP. Critical thinking and analysis concepts, therefore, are crucial for the fundamental growth and development of an evidence-based clinician, and are imperative for inclusion within the classroom. Educators should not only ensure evidence-based practice concepts are included into the curriculum, but also shift critical thinking and analysis skills to the early professional program level, so that students will have more time to digest and incorporate statistical concepts and critical thinking skills into their developing practices.

Limitations

Certain limitations within this study may have affected the results. To begin, the participants in this study were not a random sample of the population. Athletic training educators registered for the 2009 Athletic Training Educators' Conference were assessed; therefore the participant group was a sample of convenience. Additionally, the length of the EBPCA may have inhibited a conference registrant's voluntary completion of the survey. The instrument consisted of 20 multiple-choice questions, 22 Likert scale questions, and 34 demographic questions. Estimated time for completion was approximately 30 minutes. The demanding schedules of athletic training educators may not have precluded completion of the EBPCA prior to the conference.

CONCLUSIONS

The purpose of this study was to determine the knowledge, comfort, and perceived importance levels of evidence-based concepts by athletic training educators. The key information presented by this study provides a baseline of athletic training educators' current knowledge, comfort, and perceived importance of evidence-based practice. This baseline is particularly important to identify the direction of and need for further research. Considering the results of this study, there is a definite need to educate athletic training educators in regards to evidence-based practice concepts, with specific focus placed on distinguishing strategies for implementation into didactic curricula.

Athletic training educators and clinicians believe evidence-based practice is a necessary component to incorporate into the profession.[13,29] Currently, focus is slowly shifting away from the basics of what evidence-based practice entails towards ways to facilitate the implementation of EBP into education.[18] However, the knowledge, comfort, and perceived importance levels for EBP implementation must steadily increase before athletic training can be considered an evidence-based profession. Future research should examine a larger population of athletic training didactic and clinical educators and athletic trainers who are not affiliated with accredited professional or post-professional athletic training education programs. Additionally, evidence-based practice teaching modules should be developed for implementation into athletic training coursework.

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ORIGINAL RESEARCH

Educational Preparation for the Clinic Job Setting: Clinical Athletic Trainers' Perspectives

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Context: Acquiring input from all stakeholders on the importance of existing competencies and suggestions for new ones is essential to competency-based pedagogical design quality.

Objective: To survey athletic trainers (ATs) employed in clinical settings to assess their perceptions of the competencies most pertinent to their settings and whether additional specific competencies are necessary.

Design: Survey.

Setting: Clinic Job Setting.

Participants: A total of 554 ATs listed under the Clinic Job Setting category.

Main Outcome Measures: The level of importance clinical ATs assign to competencies in the *Athletic Training Educational Competencies* document (4th edition) that pertain most to clinical settings, the relationship between demographic factors and the importance level clinical ATs assign to these competencies, and additional competencies suggested by clinical ATs were measured. The importance of competencies was rated on a 4-point Likert type scale ranging from not important (1) to very important (4).

Results: The average ratings of level of importance from all the competencies surveyed ranged from 2.50 to 3.87, with an overall mean of 3.27. The demographic data demonstrated significant differences in perceived importance of specific competencies between groups within factors, including gender, age, highest degree, years as a AT, years in a clinical setting, clinical practice settings, and percentage of total working hours spent within the clinic. Additional competencies related to communication and documentation skills were recommended most frequently.

Conclusion: Although not of equal importance, arguably, all the competencies included in this study are needed in athletic training education programs to prepare students for careers in clinical settings

Key Words: competency, rating, web-based survey

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Educational Preparation for the Clinic Job Setting: Clinical Athletic Trainers' Perspectives

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Athletic training educational reform incorporates an accredited competency-based education (CBE) model to ensure program quality and accountability for stakeholders, which ultimately results in state regulation of the profession, preferably in the form of licensure.[1]

Teaching faculty and clinic-based practicing athletic trainers perceive content areas[2] and the importance of specific competencies[3] differently. Coll and Zegwaard[4] argue that an understanding of all education stakeholders' views is an essential prerequisite for competency-based pedagogical design quality. All too often, the decision as to which competencies to include in CBE programs are made by only a few individuals.[5] When a variety of stakeholders participate in curriculum decisions, it is possible to reach greater understanding of others' experiences and the relevance to curricular design.[6] Not only do differences occur between stakeholders, but an investigation of physical therapy clinicians employed in various practice settings reveals that the perceived importance of competencies differed with job setting as well.[7] CBE program competencies need to be accurately linked to the duties employees actually perform.[8] For example, musculoskeletal ultrasonography professionals recently worked together to develop competency standards consensus within an evidence-based educational framework, with the hope that ownership by practicing parties would increase the likelihood of an acceptable outcome.[9] If professional competencies are to guide educational program content decisions, it is important that all stakeholders have a voice, including: employers, patients, educators, and possibly most importantly, the actual practitioners of a particular discipline.

The 4th edition of the National Athletic Trainers' Association's *Athletic Training Educational Competencies* articulated 12 content areas of professional competencies for athletic trainers (ATs).[10] This edition was developed with the assistance of members of the Entry-Level Education Committee. The process included a survey created by the National Athletic Trainers' Association (NATA) that was available to all NATA members asking them to provide feedback on the addition, modification, or deletion of competencies or clinical proficiencies. This survey resulted in 48 forms being submitted (personal communication, Dan Sedory, Entry-Level Education Committee Chair, April 8, 2006). The Role Delineation Study developed in 2004 reflects knowledge and skills necessary for competence as entry-level ATs as perceived by AT practitioners in all settings.[11] This study serves as a template for the certification exam students must successfully pass to complete the athletic training credential.[10] The study asked a panel of 20 experts to identify task domains (6) representative of knowledge and skills essential to athletic training; these were validated by surveying ATs from multiple settings who rated the 6 domains and tasks only, not individual competencies.[11] The Entry-Level Education Committee considered the results from this study when developing the competencies listed in the *Athletic Training Educational Competencies* (4th edition) document which includes 12 content areas.[10] Because these two documents were created by two separate entities for distinct, unrelated purposes, the practitioners in specific practice settings may only have had indirect input into the competencies. Because the viewpoints of practitioners who actually perform the duties required of a specific profession in particular settings would provide relevant input on competencies needed for the profession, the purpose of the present study was to determine if specific clinical setting cognitive and psychomotor competencies were perceived as important by clinical setting practitioners in the United States. To this end, those in the largest NATA membership category (clinical setting; 27.74%)[12] were surveyed to assess the perceived importance of the existing competencies and identify potential additional competencies needed by entry-level ATs employed in the clinical settings.

METHODS

Participants

NATA membership statistics divides the clinical setting into five sub-categories: Hospital-Based Clinic, Outpatient-Ambulatory-Rehabilitation Clinic, Physician Owned Clinic, Secondary School Clinic, and Other Clinic. All NATA members who indicated practicing in the clinical setting[12] in the United States were surveyed via email. Of a possible 7,031 potential subjects, only 3,693 received the survey. The remaining members either chose to block survey participation as a membership option or had spam filters on their omputers preventing them from receiving the survey. The demographic data is presented in Table 1.

Instrumentation

A web-based survey using SurveyMonkey (2007 SurveyMonkey.com) was created for participant convenience, fast response times, and cost effectiveness. While the entire 4th edition of the *Athletic Training Educational Competencies* document consists of 257 competencies (202 cognitive and 55 psychomotor) and 12 clinical proficiencies,[10] the competencies rated in this study were derived from 5 content areas in the document deemed most relevant to the clinical setting: 1) Orthopedic Clinical Examination and Diagnosis; 2) Therapeutic Modalities; 3) Conditioning and Rehabilitative Exercise; 4) Psychosocial Intervention and Referral; and 5) Health Care Administration.[10] Some competencies were combined to avoid redundancy, and others, which suggested separate competencies, were divided to maintain instrument accuracy while improving clarity and preserving the intent of the competencies. Because these content areas are based on the cognitive and psychomotor competencies, and to respect the length of the survey, they were not included. The content areas not used in this research included: 1) Risk Management and Injury Prevention; 2) Pathology of Injuries and Illnesses; 3) Medical

Table 1. Demographic Response Totals (n = 554)

Demographic Response	%	n
Gender:		
Male	51.6	286
Female	48.4	268
Age (years):		
21-30	40.6	225
31-40	37.0	205
41-50	16.6	92
51-60	5.4	30
61+	0.4	2
Highest Degree:		
Bachelors	39.2	217
Masters	56.0	310
Doctorate	4.8	27
Years as an Athletic Trainer:		
0-5	31.4	174
6-10	25.4	141
11-15	18.8	104
16-20	14.1	78
21+	10.3	57
Years in a Clinical Setting:		
0-5	44.4	246
6-10	22.2	123
11-15	19.0	105
16-20	10.6	59
21+	3.8	21
Current Clinical Practice Setting:		
Hospital-Based Clinic	12.8	71
Outpatient-Ambulatory-Rehab Clinic	28.3	157
Physician Owned Clinic	15.0	83
Secondary School Clinic	40.4	224
Other Clinic	3.4	19
Percentage of Total Working Hours Spent Within Clinic:		
0-25%	25.3	140
26-50%	22.0	122
51-75%	11.7	65
76-100%	41.0	227
Educational Route to Certification:		
Accredited Curriculum Program	56.5	313
Internship Route	43.5	241
State Regulation:		
Licensure	72.4	401
Certification	14.3	79
Registration	3.6	20
No Regulation	6.1	34
Exemption	3.6	20

Conditions and Disabilities; 4) Acute Care of Injuries and Illnesses; 5) Nutritional Aspects of Injuries and Illnesses; 6) Pharmacology; and 7) Professional Development and Responsibility. It was determined by the authors and 3 clinical experts that the competencies contained in these content areas did not best represent the knowledge and skills needed most by an entry-level AT employed in a clinical setting.

The questionnaire consisted of: 1) 99 competencies (69 cognitive and 30 psychomotor) rated on a four-point Likert type scale (not important, somewhat important, important, and very important); 2) open-ended questions asking for additional competencies perceived as needed by entry-level ATs in a clinical setting; and 3) demographic information. The participants were asked to rate each competency in the particular content area by perceived importance to an entry-level AT employed in a clinical setting. After the list of competencies for each content area was an open-ended question asking for additional recommended competencies. Demographic information included: gender, age, years as a AT, clinical practice settings, educational level, years of experience in the clinical setting, percentage of working hours within the clinic, and route to certification.

The instrument was reviewed online by three clinical and three educational experts for face and content validity. Their expert status was determined by the fact they all had a minimum of 10 years experience in the clinical and educational settings respectively. The clinical experts were asked to verify that the competencies included best represented the knowledge and skills required of a novice AT in a clinical setting. The educational experts were asked to judge whether the survey retained the intent of the NATA competencies listed in the five content areas selected for this study.

The instrument was pilot tested with a sample of 30 Hospital-Orthopedic ATs chosen randomly through the NATA membership services to obtain feedback on questionnaire clarity, length, and technical issues. These subjects were chosen due to the similarity the setting has with the majority of clinical job settings. The data from the pilot study was not included in the final results. The time to complete the survey was estimated to be approximately 20 minutes. No further changes were made as a result of the pilot study.

Procedures

The institutional review board granted approval for this project prior to data collection. An email distribution list and customized invitation message were created, with the survey distributed through the web-based software in December of 2007. Two follow-up emails with survey links were sent to non-responders at 1 week intervals following the initial distribution. All responses collected were saved anonymously.

Data Analysis

The quantitative data was analyzed using Statistical Package for the Social Sciences software (version 16.0; SPSS Inc, Chicago, IL). A one-way analysis of variance (ANOVA) provided average ratings of levels of importance for each competency or questionnaire item of the survey and compared mean ratings of the demographic group data using an alpha level of .01. Tukey post hoc analysis using an alpha level of .01 was used to determine if a significant

difference existed between groups within demographic factors, including: age, years as a AT, clinical practice settings, education level, years of experience in the clinical setting, and percentage of working hours within the clinic.

The first author of this study contributed the qualitative data analysis. An inductive content analysis strategy where data was organized around common themes was used to establish categories from the recommended additional competencies. For example, responses such as, “to be able to speak professionally regarding the findings and treatment plan,” “patient education,” and “ability to effectively communicate the necessary information to people of all education levels” would be placed under the category of communication skills.

RESULTS

There were a total of 3,693 surveys distributed to the certified NATA members listed under the clinic job setting category. There were 554 surveys returned resulting in a 15% response rate.

Competency Importance Level Ratings

The average ratings of level of importance from all the competencies surveyed ranged from 2.50 to 3.87, with an overall mean of 3.27 on a 4-point Likert scale (see Table 2). The highest ratings of perceived importance came from competencies listed in three content areas, including: Conditioning and Rehabilitation Exercise, Orthopedic Clinical Examination and Diagnosis, and Therapeutic Modalities. The lowest importance ratings came from competencies in the Psychosocial Intervention and Referral and Health Care Administration content areas.

Demographic Factors

Gender

The demographic response totals are represented in table form (see Table 1). The competency statement codes and the content areas under which they are listed can be found in Table 3. The female respondents perceived seven competencies as greater in importance than the male participants. These competencies included knowledge in the areas of conducting and interpreting medical documentation, selection of proper therapeutic exercises, health care education, patient referral, management of chronic pain patients, and inspection of exercise equipment to ensure its safety.

Highest Degree

The respondents holding master’s degrees perceived competencies involved with knowing human body systems (F_2 = 5.65, *P* = .004) of greater importance than perceived by respondents holding bachelor's degrees. The respondents holding master’s degrees also perceived competencies involved with understanding further diagnostic tests in the way of imaging techniques (F_2 = 6.58, *P* = .002) of greater importance than perceived by respondents holding bachelor degrees (see Table 4).

Educational Route

Prior to 2004, athletic training students could pursue an internship or curriculum route to certification. There were no significant differences in perceived competency importance between ATs graduating from an athletic training curriculum program and those who completed the internship route to certification.

Age and Years Experience

Older respondents (F_3 = 9.25, *P* = .000; F_3 = 4.88, *P* = .002), those with more years of experience as ATs (F_3 = 10.15, *P* = .000; F_3 = 5.95, *P* = .001; F_3 = 5.10, *P* = .002), and those with more experience in clinical practice settings (F_3 = 8.41, *P* = .000; F_3 = 4.11, *P* = .007; F_3 = 4.39, *P* = .005) perceived competencies that required knowledge pertaining to the scientific principles behind passive and active therapeutic modalities along with the skills to measure joint range of motion using specific instruments as more important than younger, less experienced respondents (see Table 5, 6, and 7). The younger, less experienced practitioners perceived the knowledge involved in budgeting, inventory, and pre-participation physicals as more important than the older participants with more experience (F_3 = 4.67, *P* = .003; F_3 = 4.47, *P* = .004; F_3 = 4.34, *P* = .005) (see Table 5, 6, and 7). The participants with more experience showed a decrease in employment in Secondary School Clinic settings and an increase in the percentage of hours worked in the clinic.

Clinical Practice Setting

Respondents employed in Outpatient-Ambulatory-Rehabilitation clinics perceived the importance of knowledge in the healing

Table 2. Importance Level Ratings

Content Area	Competency Importance Level Rating Average Range	Content Area Importance Level Rating Grand Mean
Orthopedic Clinical Examination and Diagnosis	3.24-3.87	3.59
Therapeutic Modalities	2.67-3.70	3.34
Conditioning and Rehabilitation Exercise	3.28-3.81	3.61
Psychosocial Interention and Referral	2.72-3.16	2.94
Health Care Administration	2.50-3.63	2.99

Note: 1 = not important, 2 = somewhat important, 3 = important, and 4 = very important

Table 3. Content Areas and Competency Statement Coding

Content Area	Cognitive	Psychomotor
Orthopedic Clinical Examination and Diagnosis	Q1A, Q1F, Q1H, Q1J	Q2D
Therapeutic Modalities	Q4A, Q4B, Q4C, Q4H	Q5B
Conditioning and Rehabilitation Exercise	Q7B, Q7H, Q7K	Q8B
Health Care Administration	Q12A, Q12I, Q12K, Q12L	N/A

Table 4. Group Differences Using Post Hoc Analysis - Degree

Competency Statement	Between Groups Comparisons	Standard Error	*P*
(Q1A) Know the systems of the human body	Bachelor's x Master's	.050	.003*
	Bachelor's x Doctorate	.116	.309
	Master's x Doctorate	.114	.999
(Q1H) Know the use of diagnostic tests and imaging techniques for injury assessment	Bachelor's x Master's	.061	.002*
	Bachelor's x Doctorate	.142	.072
	Master's x Doctorate	.139	.730

* Statistically significant finding ($P < .01$)

process as it pertained to the selection of therapeutic modalities ($F_4 = 4.25$, $P = .002$) and skills with instruments that measure joint range of motion ($F_4 = 7.16$, $P = .000$) as greater in importance than respondents employed in Secondary School Clinics. They also perceived the budgeting process as more important than the respondents employed in physician-owned clinics ($F_4 = 4.16$, P .003) (see Table 8). On the other hand, participants employed in Physician Owned Clinics perceived the importance of knowledge in third-party reimbursement strategy ($F_4 = 4.43$, $P = .002$) as greater in importance than respondents employed in Secondary School Clinics (see Table 8).

Percentage of Total Hours within Clinic

The respondents with the greatest percentage of their working hours spent in the clinic perceived knowledge of movement terminology ($F_3 = 4.24$, $P = .006$), medical documentation ($F_3 = 5.24$, $P = .001$), skills with specific instruments to measure joint range of motion ($F_3 = 6.98$, $P = .000$), and interpretation of measurements to evaluate the progression of therapeutic exercise as greater in importance than practitioners with less time spent within the clinic (see Table 9).

Additional Competencies Recommended

Additional competencies or themes suggested by the participants of this study were grouped into categories using competency headings. Given the way the data was reported by SurveyMonkey it was not possible to determine the total number of participants who recommended additional competencies, as some individuals offered multiple suggestions. From the 130 total competencies or themes suggested by respondents, 38 categories were established. Categories that contained a minimum of eight common themes were included in the results. This refinement resulted in six categories, including: communication skills, documentation skills, functional assessment, bracing-splinting-casting skills, manual therapy skills, and knowledge of illnesses (see Table 10). The communication and documentation skill categories represented 16% and 13% of the total suggested additional themes, respectively. Each of the other four categories represented approximately 6 to 8 percent of the total number of additional themes suggested.

DISCUSSION

The primary goal of this research was to assess the perceived importance of existing competencies listed in the *Athletic Training Educational Comeptencies* document (4th edition) that were most relevant to clinical settings. This study also sought to identify potential gaps between the required competencies and the knowledge and skills necessary to work in the clinical setting.

Research investigating competency importance within athletic training education programs is limited. Two studies considered importance level ratings of content areas. The first study examined differences in the importance of 12 content areas included in the 3rd edition of educational competencies as perceived by faculty (42), and ATs (183) employed in clinic, high school, and clinic-high school settings.[2] The results found differences between groups in several content areas, including: Pharmacology, Acute Care of injury and Illness, Therapeutic Modalities, Therapeutic Exercise, and Health Care Administration. A second study exploring the importance levels of content areas included in the 2nd edition of educational competencies asked clinical directors (127) which areas were of greatest importance for ATs employed in clinical settings.[13] Those findings suggested that the areas of prevention, evaluation, and rehabilitation of athletic injuries were of greatest importance as perceived by clinical directors. This previous

Table 5. Group Differences Using Post Hoc Analysis - Age

Competency Statement	Between Groups Comparisons (years)	Standard Error	*P*
(Q4B) Know the principles of physics and basic concepts associated with the electromagnetic spectra	(21-30) x (31-40)	.078	.004*
	(21-30) x (41-50)	.100	.036
	(21-30) x (51+)	.152	.000*
	(31-40) x (41-50)	.101	1.000
	(31-40) x (51+)	.153	.027
	(41-50) x (51+)	.165	.050
(Q4H) Know the electrophysics, physical properties, and biophysics associated with commonly used therapeutic modalities	(21-30) x (31-40)	.077	.515
	(21-30) x (41-50)	.099	.879
	(21-30) x (51+)	.152	.001*
	(31-40) x (41-50)	.101	.988
	(31-40) x (51+)	.153	.012
	(41-50) x (51+)	.165	.013
(Q7B) Know the mechanical principles applied to the design and use of therapeutic exercise equipment and techniques (leverage, force, kinesiology, and biomechanics)	(21-30) x (31-40)	.062	.016
	(21-30) x (41-50)	.080	.271
	(21-30) x (51+)	.122	.007*
	(31-40) x (41-50)	.081	.956
	(31-40) x (51+)	.123	.325
	(41-50) x (51+)	.133	.235
(Q12L) Explain components of the budgeting process, including purchasing, requisition, bidding, and inventory	(21-30) x (31-40)	.087	.501
	(21-30) x (41-50)	.111	.082
	(21-30) x (51+)	.170	.006*
	(31-40) x (41-50)	.113	.582
	(31-40) x (51+)	.171	.053
	(41-50) x (51+)	.184	.384

* Statistically significant finding ($P < .01$)

research lends credibility to the current study's choice of content areas as being relevant to clinical settings.

Three other studies considered importance ratings of competencies within the content areas. The first study asked a group of 809 ATs employed in all job settings and a group of sports medicine physicians (122) their perception of the importance of the competencies listed under the General Medical Conditions and Disabilities content area of the 3rd edition competency document.[14] The results from this investigation suggested some of the competencies within this content area were considered relatively unimportant for entry-level ATs. A second study asked program directors (64) to rank the competencies listed under each of 7 content areas included in the 1st edition of educational competencies.[15] The findings from this research demonstrated the preferred sequence of competencies expressed by the athletic training program directors did not differ significantly from a random chance. The last study surveyed program directors (50), clinical instructors (71), and a random sample of ATs (179) to assess the perceived level of importance placed on all 175 competencies grouped in the seven content areas provided by the 1st edition of educational competencies.[3] The results of this research demonstrated that twelve of the 175 competencies exhibited differences between groups. Even though several demographic groups in this study demonstrated importance differences between competencies, the data from the current research indicated all the competencies included in this survey could arguably remain in the curriculum, with some of greater value than others for the clinical setting.

Competency Importance Level Ratings

Results from the demographic data indicated that 41% of the participants spend over 75% of their working hours in the clinic, with an additional 12% spending over 50% of their time in the clinic. These statistics emphasize the value of competencies most relevant to the treatment techniques commonly administered within the confines of the clinic, namely injury assessment, manual

Table 6. Group Differences Using Post Hoc Analysis - Years as ATC

Competency Statement	Between Groups Comparisons (years)	Standard Error	*P*
(Q2D) Measure the active and passive range of motion using a goniometer and inclinometer	(0-5) x (6-10)	.081	.570
	(0-5) x (11-15)	089	.551
	(0-5) x (16+)	.082	.048
	(6-10) x (11-15)	.092	.079
	(6-10) x (16+)	.086	.001*
	(11-15) x (16+)	.093	.735
(Q4B) Know the principles of physics and basic concepts associated with the electromagnetic spectra	(0-5) x (6-10)	.091	.826
	(0-5) x (11-15)	.100	.578
	(0-5) x (16+)	.092	.000*
	(6-10) x (11-15)	.104	.965
	(6-10) x (16+)	.097	.000*
	(11-15) x (16+)	.105	.004*
(Q4C) Know the principles of physics and basic concepts associated with the acoustic spectra	(0-5) x (6-10)	.092	.927
	(0-5) x (11-15)	.101	.863
	(0-5) x (16+)	.093	.000*
	(6-10) x (11-15)	.105	.997
	(6-10) x (16+)	.098	.007*
	(11-15) x (16+)	.106	.030
(Q12L) Explain components of the budgeting process, including purchasing, requisition, bidding, and inventory	(0-5) x (6-10)	.102	.073
	(0-5) x (11-15)	.111	.262
	(0-5) x (16+)	.103	.003*
	(6-10) x (11-15)	.116	.982
	(6-10) x (16+)	.108	.704
	(11-15) x (16+)	.117	.521

* Statistically significant finding ($P < .01$)

therapy skills, therapeutic modalities, and therapeutic exercise techniques. Three of the five content areas pertaining to clinical settings (Orthopedic Evaluation and Diagnosis, Therapeutic Modalities, and Conditioning and Rehabilitation Exercise), derived from the 4th edition of the *Athletic Training Educational Competencies* document, consisted of competencies receiving the highest importance level ratings. Arguably, these three content areas include the competencies most relevant to novice ATs entering clinical practice settings.

Demographic Factors

Gender

When exploring the relationship between competency importance level presented in this research and certain demographic factors, several differences between groups were discovered. First, female participants, who represented 48.4% of the population in this study, perceived the importance of seven competencies higher than the male participants for entry-level ATs pursuing careers in the clinical setting. As with previous research,[3] it seems female ATs frequently rate the importance of athletic training education program competencies at a higher level than male ATs.

Highest Degree

The participants holding a master's degree perceived competencies pertaining to the systems of the human body and gaining knowledge of specific objective diagnostic exams for injuries as being of greater importance than respondents holding a bachelor's degree. These particular competencies may pertain more to a AT in a physician extender role within a clinic where patient illnesses and viewing diagnostic scans would be more prevalent. If that presumption is true, then it may be possible that there is a greater percentage of practitioners in this study holding a master's degree who are responsible for a physician extender role within clinics.

Table 7. Group Differences Using Post Hoc Analysis - Years in Clinical Setting

Competency Statement	Between Groups Comparisons (years)	Standard Error	*P*
(Q2D) Measure the active and passive range of motion using a goniometer and inclinometer	(0-5) x (6-10)	.079	1.000
	(0-5) x (11-15)	.084	.226
	(0-5) x (16+)	.092	.006*
	(6-10) x (11-15)	.095	.386
	(6-10) x (16+)	.103	.024
	(11-15) x (16+)	.106	.543
(Q4B) Know the principles of physics and basic concepts associated with the electromagnetic spectra	(0-5) x (6-10)	.089	.773
	(0-5) x (11-15)	.094	.076
	(0-5) x (16+)	.104	.000*
	(6-10) x (11-15)	.107	.551
	(6-10) x (16+)	.116	.002*
	(11-15) x (16+)	.120	.100
(Q4C) Know the principles of physics and basic concepts associated with the acoustic spectra	(0-5) x (6-10)	.092	.927
	(0-5) x (11-15)	.101	.863
	(0-5) x (16+)	.093	.000*
	(6-10) x (11-15)	.105	.997
	(6-10) x (16+)	.098	.007*
	(11-15) x (16+)	.106	.030
(Q12L) Explain components of the budgeting process, including purchasing, requisition, bidding, and inventory	(0-5) x (6-10)	.090	.949
	(0-5) x (11-15)	.095	.478
	(0-5) x (16+)	.105	.004*
	(6-10) x (11-15)	.109	.849
	(6-10) x (16+)	.118	.041
	(11-15) x (16+)	.122	.257

* Statistically significant finding ($P < .01$)

Educational Route

No significant differences were found between participants who graduated from athletic training curriculum programs and those who became certifies via the internship route. Regardless of the educational program background, the AT would have comparable roles and experiences in the clinical setting and perceive the importance level of competencies similarly.

Age and Years Experience

The participants within the oldest age group perceived competencies pertaining to the scientific principles associated with therapeutic modalities and the mechanical principles applied to the design and use of therapeutic exercise equipment as of greater importance than participants in younger age groups. The participants with the most years as an AT and those with the most experience in a clinical setting also perceived the competencies pertaining to scientific principles associated with therapeutic modalities as of more importance than the participants classified as younger or less experienced. The older, more experienced participants may believe students would benefit from an understanding of the physics and scientific principles behind therapeutic modalities prior to working in clinical settings at the entry-level. The more experienced ATs and those with more experience in clinical settings also rated the competency pertaining to the skill in using instruments to measure joint range of motion as of higher importance than participants with less experience as ATs and less clinical experience. Perhaps experienced practitioners place more importance of objective data supplied by these instruments for comparisons and monitoring progress during the rehabilitation process, while younger participants and those with less experience perceived budgeting, purchasing, and inventory skills as more important. The younger ATs in clinical settings may be more involved in outreach responsibilities that carry with it purchasing and budgeting for supplies to service the institution they were covering.

Table 8. Group Differences Using Post Hoc Analysis - Clinical Practice Setting

Competency Statement	Between Groups Comparisons (clinic type)	Standard Error	*P*
(Q2D) Measure the active and passive range of motion using a goniometer and inclinometer	HB x OAR	.101	.880
	HB x PO	.114	.808
	HB x SS	.096	.065
	OAR x PO	.096	.146
	OAR x SS	.074	.000*
	PO x SS	.091	.620
(Q4A) Know the physiological and pathological process of trauma, wound healing, tissue repair, and their implications on the selection and application of therapeutic modalities	HB x OAR	.085	.106
	HB x PO	.096	1.000
	HB x SS	.081	1.000
	OAR x PO	.081	.114
	OAR x SS	.062	.004
	PO x SS	.076	.998
(Q12K) Describe the concepts and procedures for third-party insurance reimbursement including the use of diagnostic (ICD-9-CM) and prodedural (CPT) coding	HB x OAR	.130	.509
	HB x PO	.147	.998
	HB x SS	.124	.033
	OAR x PO	.123	.240
	OAR x SS	.095	.497
	PO x SS	.117	.005*
(Q12L) Explain components of the budgeting process, including purchasing, requisition, bidding, and inventory	HB x OAR	.128	.145
	HB x PO	.145	.869
	HB x SS	.122	.997
	OAR x PO	.122	.003*
	OAR x SS	.093	.052
	PO x SS	.115	.511

* Statistically significant finding ($P < .01$); Key: HB = Hospital-Based Clinic, OAR = Outpatient-Ambulatory-Rehabilitation Clinic, PO = Physician Owned Clinic, SS = Secondary School Clinic

Upon further examination of the demographic data, it was observed that as number of years in the clinic and years as an AT increased, there was a decrease in the number of participants employed in Secondary School Clinic setting, and an increase in the percentage of hours worked in the clinic. These results provide evidence that novice clinical ATs may spend a greater portion of their time providing outreach services and fewer working hours in the clinic than their experienced counterparts.

Clinical Practice Setting

Clinical ATs employed in Outpatient-Ambulatory-Rehabilitation clinics perceived the competencies pertaining to skills necessary in the operation of joint range of motion measuring instruments and understanding the tissue healing process as of greater importance than ATs employed in Secondary School Clinic settings. While ATs employed in Physician Owned clinics perceived understanding third-party reimbursement as being of greater importance than ATs employed in Secondary School Clinics, ATs employed in Outpatient-Ambulatory-Rehabilitation and Physician Owned Clinics are likely to be more involved in rehabilitation in the clinic and possibly the reimbursement of services provided through insurance. ATs employed in Secondary School Clinics, on the other hand, have more responsibilities related to providing outreach services to high schools and colleges under contract.

Percentage of Total Hours within Clinic

ATs who spend the greatest amount of time in the clinic (over 75%) perceived competencies containing the knowledge requirements of planes of body movement, medical terminology and documentation, and the skill acquisition of instruments that measure joint range of motion to be more important than practitioners spending less than 25% of their time in the clinic. The ATs working over 75% of the time in the clinic also perceive the importance of documenting objective measurements

Table 9. Group Differences Using Post Hoc Analysis - Percentage Working Hours in Clinic

Competency Statement	Between Groups Comparisons (%)	Standard Error	*P*
(Q1F) Know the directional terms and cardinal planes use to describe the body and the relationship of its parts	(0-25) x (26-50)	.084	.776
	(0-25) x (51-75)	.102	.627
	(0-25) x (76-100)	.073	.004*
	(26-50) x (51-75)	.104	.980
	(26-50) x (76-100)	.076	.125
	(51-75) x (76-100)	.095	.545
(Q1J) Know medical terminology and documentation	(0-25) x (26-50)	.057	.059
	(0-25) x (51-75)	.070	.109
	(0-25) x (76-100)	.050	.001*
	(26-50) x (51-75)	.071	.998
	(26-50) x (76-100)	.052	.770
	(51-75) x (76-100)	.065	.942
(Q2D) Measure the active and passive range of motion using a goniometer and inclinometer	(0-25) x (26-50)	.088	.584
	(0-25) x (51-75)	.107	.019
	(0-25) x (76-100)	.076	.000*
	(26-50) x (51-75)	.109	.259
	(26-50) x (76-100)	.080	.046
	(51-75) x (76-100)	.100	1.000

* Statistically significant finding

to monitor therapeutic exercise progress as greater than practitioners working 26% to 50% of the time in the clinic. It was understandable that ATs working the greatest number of hours in the clinic would rate competencies that pertain most to the evaluation and treatment of patients in a clinical rehabilitation setting as areas of greatest importance for entry-level ATs pursuing careers in that environment.

Additional Competencies Recommended

Less than 24% of the participants in this study volunteered suggestions for additional competencies needed by entry-level ATs pursuing careers in clinical settings (130 suggestions in total). All of the competency categories recommended were included in competencies from past and present athletic training competency document editions. Although not significant in number when considering the entire population, communication and documentation skills represented 16% and 13% of the total suggested additional competencies respectively making their mention a point of interest. Some of the documentation skills suggested were the ability to document the information recognized by the billing industry, the ability to use current documentation technology, and the ability to document patient treatments and outcomes. These suggestions make reference to documentation of information needed for adequate communication among colleagues and required by third-party payers. Also, the skill necessary to operate various injury recording software systems was deemed important. Specific communication skills mentioned were patient education, affectively communicating with patients, physicians, coaches, and other health care professionals. These suggest the importance of patient-practitioner rapport for patient satisfaction and compliance. The statements also suggest the need for accurate communication with other health care providers and coaches for consistent patient status and injury management. In addition to the listings of communication theories and techniques as cognitive competencies, the 4th edition competencies document also stated interpersonal communication skills as a foundational behavior of professional practice.[10]

Since the completion of this study, the 5th edition educational competencies have been published. The results of this current study continue to have relevance as the 5th edition of *Athletic Training Educational Competencies* are consistent with the 4th edition regarding communication skills.[16] There is a slightly greater emphasis on educating patients in the 5th edition, but the foundational behaviors listed under the professionalism subcategory are identical. The consistent mention of communication by the respondents could indicate that the athletic training education programs may not completely evaluate the skill.

Participants who spend over 75% of their working hours in the clinic contributed the majority of the suggestions for communication

Table 10. Recommended Additional Competencies

Competency	Frequency	Percentage of Total Additional Competency Suggested
Communication	21	16%
Documentation	17	13%
Functional Assessment	11	8%
Bracing-Splinting-Casting	9	7%
Knowledge of Illness	8	6%
Manual Therapy	8	6%

skills, further emphasizing the importance of this area of knowledge to the responsibilities of a AT in a clinical environment. Because these categories were addressed in the present and past competency documents, their mention may mean specific areas within the categories need to be addressed that are not. It may also represent possible faulty transfer of learning from didactic to clinical settings and the need for greater emphasis in athletic training education programs. The participants suggesting the addition of communication and documentation skills also rated the level of importance of the existing competencies that pertained to these skills higher than the average rating of all the participants. This could be considered a form of comparative analysis which ensures credibility, accuracy, and validity of the data while reducing measurement errors.

The importance of communication skills for clinical practitioners has been emphasized in prior research using populations of experienced and novice clinicians.[17, 18, 19] Novice physiotherapists practicing in Australia with fewer than five years experience perceived themselves as not being prepared in communication skills with clients.[17] The authors of this research suggested the educational programs for these professionals consider balancing the learning of technical and interpersonal skills. Experienced physical therapists in the United States demonstrated more patient-practitioner social interchange and gave patients a greater explanation of treatment, while inexperienced therapists were much more procedural and mechanical in their interactions with patients.[18] Physical therapists practicing in Canada with more than 15 years of experience perceived the level of importance of categories in professional ethics and attitudes, interpersonal relations, and societal awareness as higher than novice physical therapists.[19] The practitioners with up to two years of experience in this study perceived categories of evaluation, treatment, and creative thinking of higher importance than experienced practitioners. These results suggested practitioners with greater longevity in their discipline tend to emphasize the importance of ethics and communication skills, while novice practitioners express importance in more technical attributes. The results from this literature suggest that health care educational programs should consider a balance of technical skills with communication skills by highlighting the curriculum from both perspectives.

Limitations

This survey study explored the perceptions of the participants as they currently exist and not past or future perceptions. Although the survey was piloted to ensure its clarification, misunderstanding of the content or intent of a specific competency could still occur which would influence the clinical AT's perceptions creating a limitation in the importance ratings. The entire clinical setting population could not participate due to the sampling of NATA members only, filtering a portion of the total number of email addresses in the NATA database, incorrect email addresses, and spam filters on their computers.

The response rate for this survey (15%) would be considered by most to be low. Contributing factors could be the length of the survey and possibly the time of the year (December) the survey was distributed. Other factors specific to the type of survey conducted may be the novelty aspect of electronic surveys has passed and the prominence of filtering software by computer owners indicating electronic surveys as unsolicited e-mail and a viral threat to the system resulting in deletion of the message or notification. An incentive approach, such as a lottery, to help bolster response rates was not used since this could potentially undermine the credibility of the survey.

A low response rate does not necessary imply non-response error or bias.[20] The participants of a survey may not differ in any measurable way from those who chose not to respond.[20] In fact, there is evidence that surveys with very low response rates can be more accurate than surveys with much greater response rates.[21] Although the response rate in this survey was low, it is supported by a substantial population size acquired by unbiased sampling, consequently the non-responses were randomly distributed not suggesting non-response bias.

Although the potential for response bias may be greater with a low response rate, there is no specific response rate that ensures an unbiased representation of a population.[22] The potential for response bias may have a greater association with subject matter being investigated.[22] For example, sensitive topics such as abortion may result in lower response rates and increase the chance of response bias. The subject matter under investigation in the present research is noncontroversial in nature.

There may be specific competencies from other content areas that would be considered relevant to employment in clinical settings, but additional content areas would result in a cumbersome instrument. Although the clinical proficiencies contained in the content areas addressed by this study are composed of integrated psychomotor and cognitive competencies, not including them could be considered a limitation of this study.

Although the 5th edition of educational competencies is now in print, the purpose of this study was to discover if the 4th edition contained adequate competencies for the preparation of entry-level ATs seeking careers in clinic job settings as perceived by ATs employed in this setting. Information from the current study can still serve to inform the professional preparation of students who seek employment in the clinic job setting.

Future Research

This exploratory investigation suggests multiple avenues of further inquiry. A continuation of this research to include populations of ATs employed in other settings, including college-university, secondary school, professional sports, industrial, and corporate is recommended to provide specific information about differences among practice settings. A more substantial interpretation of the existing competencies requires investigating perceptions in each distinct practice setting to determine which competencies should be included or excluded. Additional stakeholder populations to survey include experts, employers, and patients in each employment setting to reach a consensus of the importance of existing and recommended additional competencies. These results could then be compared to those obtained from practitioners to inform future curricular decisions.

CONCLUSION

Because the lowest level of importance given a competency by the participants in this study was between somewhat important and important on the importance rating scale, it could be argued that all the existing competencies listed in this research are needed to prepare athletic training students for entry-level careers in clinical settings. However, the demographic data demonstrated that differences occurred between multiple groups within factors, including gender, age, highest degree, years as an AT, years in a clinical setting, clinical practice settings, and percentage of total working hours spent within the clinic. As for additional competencies needed in athletic training education curriculums, the categories of communication skills and documentation skills were most frequently recommended by the participants who volunteered suggestions. The data provided by this work could positively influence future curriculum development, continuing education programs, potential fellowships or residencies, and post-professional specialty certification programs.

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Survey Instrument Validity Part I: Principles of Survey Instrument Development and Validation in Athletic Training Education Research

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Context: Instrument validation is an important facet of survey research methods and athletic trainers must be aware of the important underlying principles.

Objective: To discuss the process of survey development and validation, specifically the process of construct validation.

Background: Athletic training researchers frequently employ the use of survey research for topics such as clinical instruction and supervision, burnout, and professional development; however, researchers have not always used proper procedures to ensure instrument validity and reliability for the data collection process.

Description: Four major methods exist to establish the validity of an instrument: face, content, criterion related, and construct. When developing a survey to measure a previously unexplored construct (eg, an athletic trainer's attitudes toward appropriate exertional heat stroke treatment), researchers should employ a four-step process: (1) defining constructs and content domain, (2) generating and judging measurement items, (3) designing and conducting studies to develop a scale, and (4) finalizing the scale.

Clinical Advantages: Establishing the validity of a survey instrument strengthens the data yielded from the data collection process, which allows for greater confidence in the interpretation of the results from the survey.

Conclusions: Construct validity, although a time-intensive process, is necessary to ensure accuracy and validity of the survey instrument.

Key Words: Scale development, scaling procedures, instrument design

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Survey Instrument Validity Part I: Principles of Survey Instrument Development and Validation in Athletic Training Education Research

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As the athletic training profession continues to expand the breadth and depth of research within the field, it is important to ensure that appropriate survey development procedures are followed as there are many research topics within athletic training that lend themselves to survey research.[1-2] In a review of the current athletic training literature, there are several studies that have utilized survey design methods for data collection: the evaluation of clinical proficiencies within athletic training education programs,[3] clinical instruction and athletic training education,[4-5] role strain and the clinical instructor,[6] job search strategies and employment issues for undergraduate programs,[7] undergraduate student burnout,[8] the assessment of student learning styles,[9] and teaching practice styles utilized to disseminate concussion related knowledge to students.[10] There are a multitude of reasons why the aforementioned studies used survey methods including allowing the researcher to gain a overview of the topic investigated,[2] access to a random sample of respondents that can allow for generalization of the results, and providing respondents with the freedom to complete the instrument when it is convenient.

An additional, and most significant, benefit to survey research is the ability to measure latent constructs. Latent constructs are variables that researchers cannot directly observe or quantify. Within athletic training, examples of surveys designed to measure latent constructs include, but are not limited to, clinical instruction and supervision,[3-6] athletic training education,[7,9] burnout,[8,11-12] work-family conflict,[13-14] concussion assessment,[15] and teaching and learning styles related to athletic training-specific content.[9-10]

Sammarone Turocy[2] introduced the basics of instrument development and implementation in a *Journal of Athletic Training* article, highlighting the specific applications of survey methods in athletic training. Therefore, the purpose of this paper is to expand upon instrument development by describing the detailed steps in establishing valid surveys for use in athletic training research.

Survey research is appealing to many athletic trainers (ATs) due to the flexibility of data collection and analysis.[2] Furthermore, survey research offers advantages in terms of economy, breadth of data collected, access to larger samples for data analysis, and anonymity, which may help to reduce socially desirable responses. Although there are some limitations to survey research, including the potential for respondents to misinterpret or misunderstand survey questions,[2] many of the potential disadvantages of survey research can be minimized by establishing valid and reliable instruments.

TYPES OF RELIABILITY AND VALIDITY

Reliability and validity are necessary entities of instrument development if researchers are to report with confidence the results obtained from the survey. Reliability refers to the consistency or repeatability of a test or measurement.[16-17] Validity refers to the degree that an instrument actually measures what it is designed or intended to measure.[16] Table 1 presents four common procedures for establishing the validity of an instrument: (1) face validity, (2) content validity, (3) criterion validity and (4) construct validity.[2] Face and content validity are qualitative measures of validity and are often employed in survey research because they are the easiest to ascertain.[16,18] Face and content validity are secured via a panel of experts who judge the survey's appearance, relevance and representativeness of its elements.[2,16] The panel of experts is comprised of individuals with expertise in the area the instrument will measure.[3,12] Face and content validity are important first steps with establishing construct validity because they establish the accuracy and connection among the questions asked and variables measured.

After establishing face and content validity, researchers must establish the instrument's criterion-related validity and construct validity before using it for quantitative analyses. Criterion-related and factorial validity are both empirical measures that follow a rigorous process with assessing the construct validity of an instrument.[18] Criterion-related validity testing demonstrates the accuracy of the measure by comparing it to a previously established and valid instrument or some other external criterion (eg, comparing scores from a short and long version of the same instrument).[16,18] Construct validity is the degree to which an operational measure correlates with the theoretical concept investigated. Construct validity provides the researcher with confidence that a survey actually measures what it is intended to measure. Construct validity allows researchers to draw legitimate conclusions from their findings when and if no criterion or content has been accepted as adequate.[2,16,19]

A review of research in the athletic training literature specifically using survey methods reveals consistent use of face and content validity. However, in the literature,[2-7,15] there is a noted lack of research that has assessed construct validity, which is a necessary and empirically rigorous validation process.[16] Although face and content validity are important considerations in establishing validity, an instrument's construct validity must also be established to enhance the psychometric properties of the instrument. Furthermore, although many of the instruments presented in the athletic training literature are established and valid measures in other populations, those same measures may not transfer to the domain of athletic training. That is, those measures may not assess the same constructs within an athletic training population that are measured in other populations (eg, nursing, coaching). Completing the steps of assessing construct validity can help ensure that the instrument is appropriate for the population investigated. Following, we present the process of construct validation using factor analysis and introduce the steps needed to determine factorial (convergent and discriminant) validity and criterion-related (concurrent and predictive) validity.

Table 1. Methods of Survey Validation

Type	Descripton	Purpose
Face	Evaluation of an instrument's appearance by a group of experts and/or potential participants.	Establishing an instrument's ease of use, clarity, and readability.
Content	Evaluation of an instrument's representativeness of the topic to be studied by a group of experts.	Establishing an instrument's credibility, accuracy, relevance, and breadth of knowledge regarding the domain.
Criterion	Evaluation of an instrument's correlation to another that is deemed unquestionable or identified as the gold standard.	Establishing an instrument's selection over another or establishing the predictability of the measure for a future criterion.
Construct	Evaluation of an instrument's ability to relate to other variables or the degree to which it follows a pattern predicted by a theory.	Establishing an instrument's ability to evaluate the construct it was developed to measure.

THE PROCESS OF CONSTRUCT VALIDATION

Construct validation is necessary to help researchers establish that the survey items actually measure the constructs they propose to measure. (Table 2 provides definitions of important terms used throughout this article.) The steps of construct validation follow the development of content validation and include the steps of factorial validity and criterion-related validity. Factor analysis is most often associated with securing construct validity.[2] It is important to mention, however, that establishing content validity involves more than just factor analysis.[16] Therefore, to adequately address the process of construct validity and to expand upon Turocy's[2] outline of the survey validation process, we will address the steps necessary for scale development and describe the steps to establish construct validity.

Steps of Instrument Development

Instrument development includes four steps.[16] Step one consists of defining constructs and determining domain content. Step two involves generating items for the survey and judging the appropriateness of the items. Step three is to design and conduct studies to test the scale. Lastly, step four involves finalizing the scale based on data collected in the third step.

Step one, defining constructs, begins with a thorough exploration of relevant literature in the domain.[4] In some cases an instrument may exist from a different domain, which may be applicable to athletic training. For example, Henning et al,[20] in their examination of peer-assisted learning, and Clapper and Harris,[12] in their examination of burnout, used pre-existing scales from other research domains to study the respective phenomena in athletic training. If using a pre-existing scale, researchers must establish the instrument's reliability and validity for their sample. In the case where an appropriate scale does not exist, researchers need to use a panel of experts to assist in developing items that measure each construct they plan to investigate. It is also necessary to provide definitions for each construct[3] before item generation begins.

The second step of the instrument development process is item generation and judgment of appropriate items for the survey. Item development, one of the more time-consuming steps for survey research,[2] warrants a strong understanding of the current literature, existing scales (eg, 5- versus 7-point Likert scale), and research agenda/purpose. The type of question researchers use (eg, open ended, close ended, positive vs. negative, double barreled, scale item) will be based on the type of information needed, such as attitudes, beliefs, or behaviors.[2] Another important consideration with item development is data analysis. Open-ended questions may require coding and interpretation due to the variety of potential responses, whereas scale-items and close-ended questions allow for a more streamlined analysis.[2] Regardless of the type of question used, it is important to ensure a logical sequencing of questions, keep language neutral and non-leading, ask only one question at a time, and not underestimate the knowledge of the respondent.[2] Once item development is complete, researchers use a group of experts to review the new instrument for clarity, readability and recommended changes. After establishing face and content validity, the next step in the development of a psychometrically sound instrument is to pilot test the instrument and reduce the number of items in the survey.

To pilot test an instrument, researchers must consider sample size, sample composition, initial item reliability estimates, and the type of validity-related surveys to include in the study's design.[16] Current sample size recommendations for pilot testing an instrument include either a minimum of 10 respondents per instrument item[17] or a minimum overall sample of 300 respondents.[21-22] This recommendation can pose a significant challenge for athletic training researchers; therefore, researchers should consider survey length and available populations early in the survey design process.

After determining the appropriate size of the sample, the next step is to identify an appropriate sample of the population. The sample should be selected from the population of interest for the survey. For example, even if researchers have easy access to athletic training students, they should not be the sample used for pilot testing an instrument whose population of interest is professional ATs. The level of experience and education of students does not

Table 2. Operational Definitions and Instrument Validity

Term	Operational Definition
Latent Construct	Outcomes that are not directly measurable.
Factor	Measure used to understand a latent construct.
Exploratory Factor Analysis	Statistical technique used to explore the possible underlying factor structure of a set of observed variables.
Confirmatory Factor Analysis	Statistical technique used to verify the factor structure of a set of observed variables.
Principle Factor Analysis	A factor extraction method that assumes items in the analysis can be calculated by the extracted factors.
Principle Axis Factoring	A factor extraction method that compares squared multiple correlations (R^2) of each item to all other items included in the analysis.
Maximum Likelihood Method	A factor extraction method that assumes the distribution for each item is normal and all eigenvalues are greater than zero.
Criterion Related Validity	Accuracy of a measure or procedure by comparing it with another measure or procedure that is valid.
Factorial Validity	A form of construct validity that is established through factor analysis.
Orthogonal Rotation	Factor rotation method that assumes factors are independent of each other (ie, uncorrelated).
Oblique Rotation	Factor rotation method that assumes factors are not independent of each other (ie, correlated).
Unidimensionality	A single item is helping the researcher to understand only one latent construct being examined in the survey or assessing only a single construct or latent factor.
Eigenvalue	A single value that represents the amount of variance in all of the items that can be explained by a factor.
Item-to-Total Correlations	Correlations of one item to all remaining items in the instrument.
Inter-item Correlations	Correlations between all items within an instrument.

match the experience and education of professional ATs; therefore, use of students may compromise the instrument's validity.

After pilot testing the instrument, researchers must analyze individual survey items to examine whether the items are unidimensional. Survey item unidimensionality means a single item is helping the researcher understand or assess only one latent construct measured by the survey. A survey item should be unidimensional and help to explain only one construct, not multiple constructs. For example, if the intent of a survey is to address peer education as part of the athletic training education experience, the items designed to examine peer education must address only peer education and not another aspect of the educational experience (eg, interaction with clinical instructors).

Researchers can assess unidimensionality by inspecting inter-item correlations and corrected item-to-total correlations. Inter-item correlations for items intended to measure the same construct should be moderate but not too high (ie, between .30-.60).[23] Inter-item correlations that are high suggest that each of the items are not contributing something unique to the construct, and therefore, are not unidimensional. The concept of unidimensionality also applies to the latent construct the instrument is measuring. To assess unidimensionality of constructs in an instrument, researchers should use confirmatory factor analysis, which is beyond the scope of this article. After assessing dimensionality of items in the pilot study, researchers will use exploratory factor analysis to establish construct validity of the instrument. We discuss exploratory factor analysis (EFA) as a tool to assess construct validity in the next section.

Process of Exploratory Factor Analysis

After assessing the dimensionality of survey items, researchers can use factor analysis as one analytic tool to assess construct validity. Again, construct validity provides evidence that the items in the survey actually measure the constructs they are proposed to represent. Researchers use factor analysis to "examine empirically the interrelationships among the items and to identify clusters of items that share sufficient variation to justify their existence as a factor or construct to be measured by the instrument."[19(p108)] One of the objectives of survey research is to develop a parsimonious survey that will best explain the constructs under investigation. EFA is an important tool for instrument development because it allows researchers to develop a survey that contains the minimum number of items needed to understand the constructs

best. That is, EFA provides the researcher with information that will help reduce the number of items in a proposed survey so that the remaining items can best explain the constructs under investigation. As an example, EFA can help the athletic training education researcher develop a survey that uses the fewest number of questions to measure and understand those factors that contribute best to the athletic training education experience. A second benefit of EFA is to examine the underlying factors that structure the instrument.[19] Using the example above, EFA helps researchers determine the most important factors contributing to the athletic training education experience.

Before moving forward in factor analysis, there are options with EFA the researcher must resolve in accordance with the objectives of the particular study. These options include what type of extraction method to use (eg, principle component analysis, principle axis factoring, maximum likelihood), the number of factors to extract, the rotation method to use (eg, orthogonal or oblique), and which items to retain and remove from the instrument (Figure 1).

Decisions in Factor Analysis

Principle component analysis (PCA) is the desired method of EFA to use when researchers are interested in reducing the number of items for an instrument.[16] PCA is useful when researchers have initially developed a survey with several questions (items) and want to reduce the number of questions to best measure the constructs with the fewest number of questions. PCA maximizes all variance in the items, so those items that do not contribute to the understanding of the factor (ie, those with little explained variance) are evaluated for deletion. Another extraction method is principle axis factoring (PAF), which researchers may use when they want to determine the underlying factors related to a set of items.

Following selection of the appropriate extraction method, researchers must evaluate the adequacy of the sample prior to interpreting the EFA output. Sampling adequacy provides the researcher with information regarding the grouping of survey items. Grouping items into a set of interpretable factors can better explain the constructs under investigation. Measures of sampling adequacy evaluate how strongly an item is correlated with other items in the EFA correlation matrix. Measures of sampling adequacy help researchers assess whether the items used in the survey have some type of relationship to one another. Researchers can assess sampling adequacy by examining the Kaiser-Meyer-Olkin (KMO) output provided in the factor analysis. A KMO correlation above .60-.70 is considered adequate for analyzing the EFA output.[16] In addition to examining KMO for sampling adequacy, researchers must also evaluate the correlation matrix of all survey items to determine if the matrix can be analyzed using factor analysis. If the correlation matrix is an identity matrix (ie, there is no relationship among the items),[24] it cannot be analyzed. Bartlett's test of sphericity provides a chi-square output that must be significant, which indicates the matrix is not an identity matrix. If the KMO correlation indicates sample adequacy and Bartlett's test of sphericity indicates the item correlation matrix is not an identity matrix, researchers can move forward with the factor analysis.[16]

The next decision researchers need to make in conducting an EFA is selection of a factor rotational method. Rotational methods (orthogonal or oblique) are tools used within EFA to help make factors in the instrument easier to interpret.[16] The overall goal for instrument development is for the instrument to have a simple structure. A simple structure indicates that each item in the survey helps to explain one and only one particular construct. Using the example of assessing the athletic training education experience, the survey should examine only those factors that are relevant to the athletic training education experience (eg, peer education, clinical instructor interaction, in-class instruction). The questions used in the survey should examine only the factor(s) they are intended to measure. For example, a question about peer education should measure only the factor peer education and not other factors in the survey (eg, clinical instructor interaction). Varimax rotation is the most common form of orthogonal rotation for EFA and will often provide a simple structure.[23] Oblique rotation (Oblimin with Kaiser Normalization) is another option that will provide a simple structure, but it also allows factors to remain correlated in the analysis. Both methods of rotation will provide researchers with information regarding which survey items to retain or delete. Researchers should use both rotational methods to determine the most meaningful solution.[19] After selecting the appropriate method of rotation, researchers will identify the best number of factors to investigate the latent constructs in the instrument.

Factor identification is the process used to ascertain the number of factors to keep in a survey. During the early stages of instrument development, researchers may have an understanding of how many factors are necessary to explain the latent constructs the instrument will measure. Therefore, researchers may determine *a priori* the number of factors in the survey, which can serve as a guide to factor selection. EFA, in addition to the researcher's knowledge prior to instrument development, can identify the number of factors that best explain the latent constructs the survey will measure. EFA provides information regarding the combination of instrument items whose shared correlations explain the greatest total variance (ie, Factor 1). The first factor identified will provide the most information to the researcher regarding the latent constructs the survey measures. For example, EFA can help to identify what is the most important factor to understanding the athletic training education experience.

EFA continues to identify the combination of items that explains the greatest total variance remaining (ie, Factor 2) until it accounts for all item shared correlations.[16] Each subsequent factor will contain additional information to help explain the latent constructs the survey will measure. However, the researcher must decide how many factors should be used to measure the latent constructs. Again, researchers may have determined *a priori* the appropriate number of factors to explain the latent constructs. For example, researchers could have determined during survey development that peer education, clinical instructor interaction, and in-class instruction interaction are the three most important factors to assessing the athletic training education experience. This *a priori* information will assist with determining the appropriate number of factors to retain in the instrument, but researchers have additional tools to help make this decision.

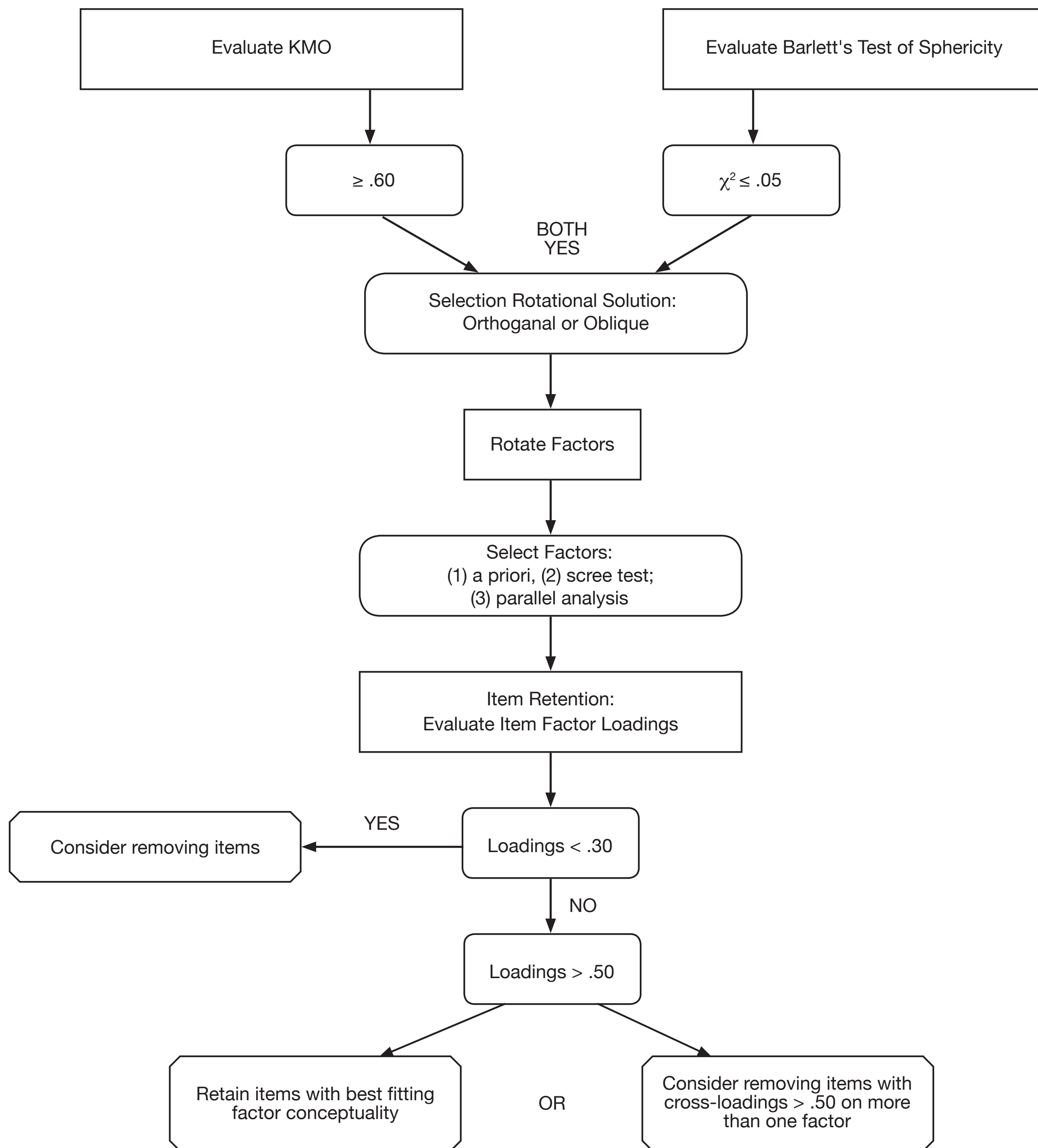

Figure 1. Selection of Principle Component Analysis (PCA) or Exploratory Factor Analysis (EFA)

There are three tools available to researchers to help determine the appropriate number of factors to retain. The first tool is the Kaiser criterion,[24] which recommends that researchers select factors with eigenvalues greater than 1.0. A second tool is the scree test. The scree test examines the scree plot, which is a plot of the eigenvalues along an x-y axis. The point at which the curve decreases and straightens out (ie, the "elbow" of the graph) is the point where researchers should include all factors before and at the elbow (Figure 2). Parallel analysis is the third tool that researchers can use to graphically represent factors to consider retaining in the instrument. For additional information regarding parallel analysis, we recommend reviewing the article on factor retention by Hayton, Allen, and Scarpello.[25] There is not one method of factor retention recommended over the others, and researchers are encouraged to use all three methods when determining the number of factors to retain in the instrument.

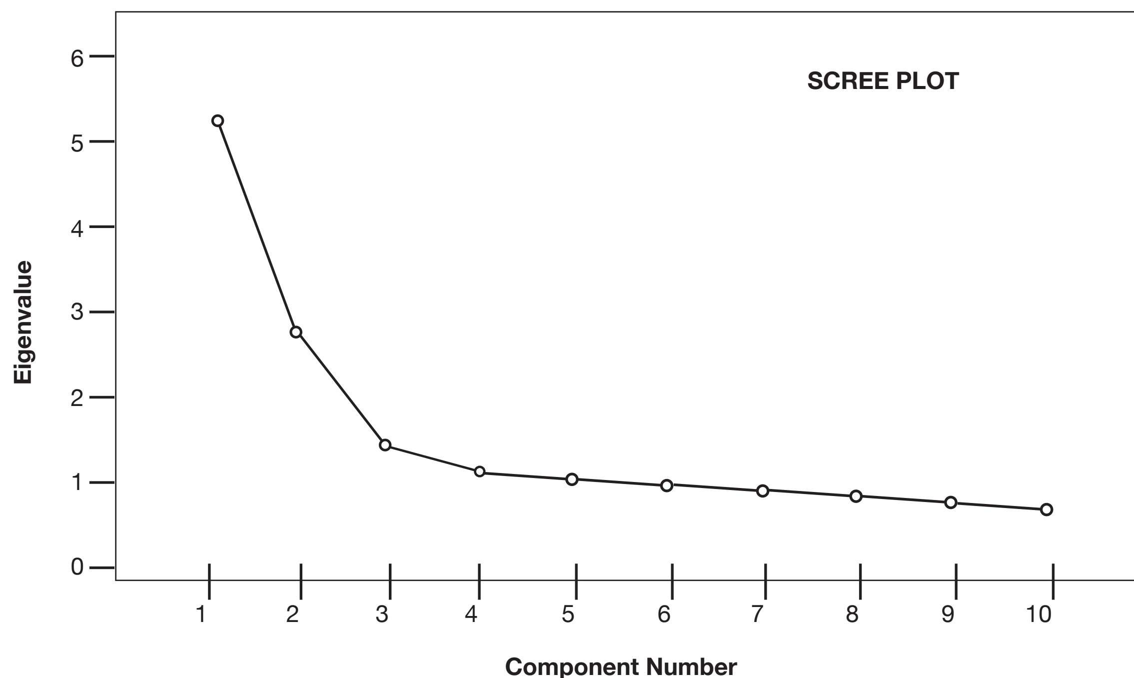

Figure 2. Factor Selection Using a Scree Plot. A three factor solution is suggested by the scree plot. The curve of the line ends at the third factor.

After researchers select an appropriate number of factors for retention (based on a prior theory, eigenvalues, scree test, and parallel analysis), they must use item trimming and item retention to move the survey into its final form. Researchers will review the output for factor loadings to determine which items should remain in the survey and which items should be reviewed for deletion. Using the assessment of athletic training education experiences as an example, if the survey contains eight items intended to measure peer education, the researcher will evaluate the loading of these items on the peer education factor. Instrument items should load on only one factor at .50 or higher with no cross loadings (ie, loading on more than one factor) of >.30.[21] Returning to the athletic training education example, items that measure peer education but fail to load on the peer education factor per this criteria should be considered for deletion.

If researchers select an oblique rotation (as described earlier) to help simplify the instrument, they will review the pattern matrix output of factor loadings to determine which items to retain or delete from the survey. However, if researchers use an orthogonal rotation, they will use the factor matrix output to determine which items to retain or delete. In addition to examining item loadings in the pattern matrix or factor matrix output, researchers should also consider both the face and content validity of each item. Researchers may consider some instrument items important enough to analyze further regardless of their loadings in either the pattern or factor matrix output. Researchers may also use reliability analysis to determine item retention or deletion.[16] An additional analytical tool available to researchers is the corrected item-to-total correlation provided in the survey reliability procedures.[16] These correlations reflect how correlated one item is to the remaining items in the set of items. Researchers should consider removing items with low corrected item-to-total correlations because these items may not provide meaningful information to help explain the latent constructs under investigation.

In addition to an examination of factor loadings of individual instrument items, researchers must also consider the number of items in a survey to complete the item selection process. The number of items appropriate for a survey will depend on the content domain examined. For example, instruments assessing a broad domain (eg, AT behavior regarding diagnosis and treatment of exertional heat stroke) will require more items to adequately investigate the domain.[16] As a general rule, each factor within a survey should contain a minimum of four items. The quality of survey items should guide this process, however. Researchers should write items in such a way that each item assesses a distinct aspect of the factor it represents. Items worded too closely will not improve the content validity of the instrument even though closely worded items can yield higher inter-item correlations and an increased coefficient alpha (reliability).[16]

Sample size must always be an important consideration in EFA. If the sample size is inadequate, researchers may be unable to interpret the results of the factor solution or may not be able to repeat the solution when using a different sample. As aforementioned, an adequate sample should contain at least 10 respondents per survey item or a minimum of 300 respondents. Researchers will use the measure of sampling adequacy (KMO) to evaluate sample size.

Researchers should also be aware of unstable factor solutions that may occur in exploratory factor analysis. Statistical programs (eg, SPSS) provide information, specifically the number of iterations

needed to reach a solution, on the output analysis of factor analysis. A high number of iterations (more than 200) needed to reach a solution implies a potentially unstable solution, which suggests not interpreting the factor analysis output. An additional process researchers may use to examine the stability of the factor solution is to run both a principle component analysis and a principle axis factoring. Different solutions from these extraction methods may indicate an unstable solution. When using a smaller sample (ie, samples of less than 300 participants), it is beneficial to run both extraction methods to evaluate the stability of the factor solution.[19]

Exploratory factor analysis is an important statistical analysis that researchers can use to evaluate an instrument's construct validity. The next section highlights additional measures researchers may use to examine construct validity further.

ADDITIONAL FORMS OF CONSTRUCT VALIDITY

Convergent and Discriminant Validity

Convergent validity measures how closely related the developing survey is to a preexisting survey that measures a similar construct. Researchers can determine convergent validity by selecting a survey that is similar to the survey under development and then administer both surveys to the same sample. Within athletic training education, researchers could use surveys developed in allied health education (eg, physical therapy, nursing) to evaluate convergent validity. The survey under development will demonstrate convergent validity if there are significant and strong correlations between its measures and the measures from a previously validated survey that assesses a similar construct. For example, in a study investigating undergraduate burnout by Riter et al,[8] the researchers utilized the Mashalch Burnout Inventory to collect data. Using the same sample, the researchers could administer the Athletic Training Burnout Inventory (ABTI) to assess convergent validity.

In contrast, discriminant validity requires that the instrument not be highly correlated with the measures from another instrument that is supposedly different conceptually.[16] To measure discriminant validity, researchers can follow the same procedures as convergent validity but administer a survey that is known to measure a different construct. The multitrait-multimethod matrix technique (MTMM technique) is the method most often used by researchers to assess convergent and discriminant validity. For additional information regarding the procedures for the MTMM technique, we encourage readers to review survey development texts.[16,19]

Predictive and Concurrent Validity

Predictive and concurrent validity are measures of criterion-related validity, which address the question "What is the relationship between scores on the instrument and some external criterion that provides a more direct measure of the targeted characteristics?"[19(p189)] Both types of validity help researchers evaluate how well the instrument under development is able to measure its intended constructs. Researchers can assess concurrent validity by administering the instrument to a specific sample and use additional data from the same sample to measure the construct under development.

Predictive validity refers to the ability of the instrument to predict future behavior. To establish predictive validity, the instrument is administered to a sample with additional measures of a different predictive external criterion obtained at a point later in time.[19] Researchers administer this predictive measure to the sample at a time following the administration of the instrument under development. Measures from the new instrument and the predictive criterion are compared to determine how well the new instrument predicted the respective behavior.

REPORTING RESULTS OF EFA

A final step in the process of instrument development is reporting the results of the process in a peer-reviewed journal. When writing up the results of the EFA to support construct validity of the survey, there are specific output tables and results to report in the manuscript. To begin, researchers should report in one table individual item descriptive statistics including means and standard deviations. In addition, researcher should report the KMO and Bartlett's test of sphericity results. An additional table should report eigenvalues and variance explained by each factor. Finally, researchers should report the pattern or structure matrix (rotated matrix) with factor loadings for each item retained in the survey, as well as the correlations among the factors. It is important that researchers report the findings of construct validity in peer-reviewed journals because this step will improve the instrument development process within the respective domain.

CONCLUSION

Construct validity, as one method of survey validation, is a necessary step in the research process to ensure that a multi-item survey instrument accurately measures the constructs under investigation. The survey development articles presented in the athletic training literature have used less rigorous, qualitative measures (face validity and content validity) to determine validity. To ensure a psychometrically sound instrument, however, researchers must also establish construct validity. To demonstrate construct validity in an instrument with established validity in other populations, not all steps of instrument development process must be completed as outlined in this paper. At a minimum though, researchers should use factor analysis to establish one aspect of the instrument's construct validity with the intended population. While securing construct validity may appear to be a daunting process, it is a necessary process.

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Survey Instrument Validity Part II: Validation of a Survey Instrument Examining Athletic Trainers' Knowledge and Practice Beliefs Regarding Exertional Heat Stroke

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Context: Instrument validation is an important component to sound survey research methods.

Objective: The purpose of this article is to discuss the process of developing and validating an instrument to investigate an athletic trainer's attitudes and behaviors regarding the recognition and treatment of exertional heat stroke.

Background: Following up from our initial paper, which discussed the process of survey instrument design and validation, we present the practical application of those general guidelines as described by Netemeyer and colleagues.

Description: There are four basic steps to developing a valid survey instrument: (1) defining the construct, (2) item development and judgment, (3) designing and conducting studies to develop a survey, and (4) finalizing the instrument. Following these steps, we present our survey instrument used to evaluate an athletic trainer's knowledge and practice beliefs regarding exertional heat stroke.

Conclusions: Following the process of survey development and validation, we were able to develop an instrument to help understand attitudes held by athletic trainers regarding appropriate clinical practice behaviors in the treatment of exertional heat stroke.

Key Words: environmental illnesses, evidence-based medicine, instrument design

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Survey Instrument Validity Part II: Validation of a Survey Instrument Examining Athletic Trainers' Knowledge and Practice Beliefs Regarding Exertional Heat Stroke

Laura J. Burton, PhD and Stephanie M. Mazerolle, PhD, ATC

Exertional heat stroke (EHS) is a serious medical condition marked by an elevated core body temperature (>104°F, 40°C) and central nervous system (CNS) dysfunction.[1-2] The condition, although preventable and treatable, has continued to be a leading cause of death for athletes.[3-4] Two key factors, early recognition via an accurate core body temperature assessment (rectal) and immediate treatment by rapid cooling, have been documented as the most effective ways to prevent sudden death from the condition.[1-2,4-7] Despite the documented success of these two strategies,[8-9] athletes continue to die from the condition.[4] These unnecessary deaths are often due to a failure of the medical care provider to accurately diagnosis the condition or the delay in cooling the patient.[3-5]

Athletic trainers (ATs) are often the first responders to exertional heat illness situations in sports; therefore, they play an important role in the recognition and treatment of EHS. Research has demonstrated that ATs possess a strong knowledge base regarding EHS, particularly with the prevention, detection, and treatment of EHS.[10] Unfortunately, ATs rarely assess rectal temperature or employ cold-water immersion (CWI) treatment[10] in spite of actively taking steps to prevent the condition and knowing the recommendations of the National Athletic Trainers' Association (NATA).[1] The data presented by Domek et al[10] was the first to investigate the practice beliefs of ATs as it pertains to EHS; however, the results were reflective of only a small portion of ATs limited to the high school clinical setting. In addition, the researchers did not use a validated instrument, which limited the applicability of their findings. Therefore, our purpose was to develop and validate an instrument to investigate the attitudes and behaviors of ATs regarding the recognition and treatment of EHS regardless of clinical setting. Additionally, our presentation regarding the survey instrument validation process is a follow-up and supplement to **Part I** of our manuscript on survey development and validation in athletic training research.

STEP ONE: DEFINING THE CONSTRUCT

Initially, we conducted a large, structured focus group to develop constructs that were most appropriate for evaluating an AT's knowledge and practice beliefs regarding the prevention, recognition, and treatment of EHS. Members of the focus group included ATs with 5 years of clinical experience, three EHS researchers with more than 15 years of research and educational experience, and four exercise science doctoral students with experience in EHS research. A sport management researcher with a strong understanding of survey development, item generation, and a basic understanding of the topic led the focus group (n = 12). Utilization of a panel of experts is important when a pre-existing scale is not available,[11] as was the case for this research project.

The focus group discussions centered on what influences an AT regarding the implementation of best practices for EHS. The panel agreed upon 3 major constructs: knowledge, preference, and actual behavior regarding best practices. An important step to survey development and validation is to define each construct. The panel of experts discussed and defined each construct during these deliberations (Table 1).[11]

STEP TWO: ITEM DEVELOPMENT AND JUDGMENT

The second step in scale development, as outlined by Netemeyer et al,[11] includes two distinct procedures: item drafting and judgment. In a separate, smaller focus group (n=6), select individuals drafted questions while taking into consideration the existing literature, question style, data analysis, and development of our initial constructs.[11-12] This panel, as described above, collectively agreed to develop a set of Likert-scaled questions. We scaled all questions within each of the 3 main constructs using the most commonly employed 5-level Likert scale (1=strongly disagree, 3=neither agree nor disagree, 5=strongly agree).[11,13] We also selected this style of questioning because Likert scales are effective in measuring attitude and providing a range of responses to a given question or statement,.[11,13]

It is important to note that the selection of a qualified panel of experts is a significant part of the instrument development process because the panel will also determine the appropriate number of instrument questions to fully explore each construct. As a rule of thumb, the panel should attempt to develop a minimum of ten questions for each construct.[14] Table 2 provides examples of the

Table 1. Initial Constructs Defined

Construct	Definition
Knowledge Base Regarding EHS	An AT's level of understanding regarding prevention strategies, recognition of clinical signs and symptoms, diagnostic tools, and treatment options.
Clinical Preference	An AT's first choice regarding the prevention, recognition and treatment of EHS (ie, temperature assessment or cooling modality).
Actual Clinical Practice	An AT's actual daily clinical use regarding the prevention, recognition and treatment of EHS.

Table 2. Likert-Scale Questions

Construct	Statement
Knowledge Base Regarding EHS	1. Assuring adequate hydration status will prevent the occurrence of exertional heat stroke.
	2. Reducing exercise intensity on a hot day will prevent the occurrence of exertional heat stroke.
	3. When obtaining core body temperature, oral thermometers provide the most accurate measure.
	4. Whole body cooling via cold/ice water immersion for the acute treatment of exertional heat stroke is considered the best practice.
Clinical Preference	5. When treating an athlete with exertional heat stroke I would prefer to use cold/water immersion.
	6. I would prefer to use an oral temperature when assessing an athlete for exertional heat stroke.
Actual Clinical Practice	7. When treating an athlete with exertional heat stroke, I would immediately use rest in a cool/shaded area.
	8. When assessing an athlete for exertional heat stroke, I would use rectal temperature as an accurate measure.

questions.

The panel also decided to ask questions not related to the 3 major constructs. These questions were open-ended as this type of questioning is encouraged in exploratory research or when soliciting personal information or beliefs.[12] The panel also composed a set of demographic questions pertaining to years of experience, geographic location, work setting, and experience with EHS.

Upon completion of the item development process, we recruited a set of judges, independent to the panel that established the questions, to assess the instrument's content and face validity. Our judges (n = 10) included a team physician working in the collegiate setting and ATs working in the high school (n = 4) and NCAA settings (n = 5). We excluded these judges from study participation, but they did complete the survey in its entirety. We instructed the judges to determine whether the items "represented"[11] the constructs and if the items were understandable. Each panel member took notes of the judges' feedback, comments, and concerns as they completed the survey. Panel members also noted the time to complete the survey. We processed and discussed the judges' criticisms and common concerns to further revise the survey prior to pilot testing.

For this step in the validation process, at least 4 judges defined "common concerns/feedback." The judges raised no major concerns regarding face or content validity of the survey; however, the judges provided consistent suggestions to improve grammar and the time to complete the survey. In addition, we removed questions that asked participants to indicate their preferred clinical practice and kept only those questions regarding their actual clinical practice.

STEP THREE: DESIGNING AND CONDUCTING STUDIES TO DEVELOP A SURVEY

After securing face and content validity, the instrument contained 40 close-ended Likert-scale questions and 6 open-ended questions. The survey was transferred from the document format to the electronic format on SurveyMonkey.com™. We used a five-point system for the close-ended Likert scale and anchored the scale with strongly disagree (1) and strongly agree (5). Example items include: (1) "When treating a suspected EHS, continual dosing with cold water does not provide effective cooling;" (2) "The sports medicine budget prevents me from purchasing equipment necessary to assess rectal temperature;" and (3) "Axillary thermometers provide an accurate measure of core body temperature with a suspected EHS." Open-ended questions focused on the respondents' actual clinical practice regarding the recognition and treatment of EHS and barriers to implementation if their current clinical practice did not match the evidence. We placed all demographic items at the start of the survey. We randomly allocated survey questions with the exception of the 6 open-ended questions, which we positioned at the end of the instrument. We designed the format of the survey so participants had to answer each question before moving on to the next question, and we did not allow participants to return to previous questions to make changes.

We used a random sample of NATA members for the study. Sample size recommendations for testing an instrument include either a minimum of 10 respondents per item[15] or a minimum overall sample of 300 respondents.[16-17] We sent each NATA member an e-mail containing an electronic link to the survey on SurveyMonkey.com™. We invited 600 NATA members, 300 from the collegiate setting and 300 from the high school setting, to participate in the pilot study. We sent reminder e-mails to participants three times over a three-month period, with the first one month after the initial email. Prior to the third reminder e-mail, we acquired a random sample of 400 additional participants from the NATA to obtain an adequate number of completed surveys for validating the instrument because we had a low return rate from the previous sample. This additional sample received the same invitation e-mail we sent the first sample. We also sent a reminder e-mail to the sample of 400 additional participants one month after we sent

our initial invitation. We closed the survey to all subjects after a period of one month following the reminder e-mail to the sample of 400 participants. Of the 1000 NATA members we invited to participate in the pilot study, 200 members responded for a 20% response rate. Of these 200 participants, we used 175 complete responses for our factor analysis and validation of the instrument. The sample did not reach the recommended minimum number of participants for exploratory factor analysis (EFA); however, we continued with the analysis and examined particular tests to be sure our sample met adequate requirements for EFA as detailed by the Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity.[11]

STEP FOUR: FINALIZING A SURVEY

Exploratory Factor Analysis

Using EFA to validate an instrument investigating the AT's attitudes and behaviors regarding the recognition and treatment of EHS, we included items that evaluated an AT's knowledge of the assessment of EHS, knowledge of the treatment of EHS, actual practices with the treatment of EHS, and perceived external constraints regarding the prevention and treatment of EHS. We followed EFA techniques and conducted four iterations of the survey before reaching a final solution. To reduce confusion in describing the process of EFA, we discuss the final iteration (fourth iteration) in detail; however, all EFA iterations followed this process.

The final iteration of EFA consisted of 22 close-ended Likert scale questions (1-strongly disagree to 5-strongly agree) that assessed the initial constructs (Table 1). We selected principle component analysis (PCA) as the method of factor analysis because we were interested in reducing the number of items in this survey. After selecting PCA, we entered all 22 items into SPSS 17.0 (Chicago, IL) and analyzed the correlation matrix for the items. Prior to evaluating the matrix, we determined it was not an identity matrix (ie, that there is no relationship among the items) by evaluating Bartlett's test of sphericity, which was significant (χ^2 = 1191.36, $df = 171$, $P < .001$). Bartlett's test of sphericity provides information regarding whether items in the correlation matrix are sufficiently correlated, which indicates the items have some relationship and will support the purpose of the instrument.

Inspection of the correlation matrix helped us determine unidimensionality for the items.[14] Inter-item correlations for items intended to measure the same construct should be moderate but not high (ie, between .30-.60).[18] Inter-item correlations that are high suggest that the items are contributing something unique to the construct, and therefore, they are not unidimensional. Initial inspection of the item correlation matrix indicated that items in the proposed factor were related (approximately .30) but were not significantly high (approximately .60). We have provided an example of the SPSS output of a correlation matrix (Appendix 1) and an example of the correlation matrix presented in a manuscript for one factor following final analysis (Table 3).

Following inspection of the item correlation matrix, we needed to determine if we reached sample adequacy in order to continue the factor analysis. Measures of sampling adequacy evaluate how strongly an item is correlated with other items in the correlation matrix and help researchers assess whether the items used in the survey are related. Researchers can assess sampling adequacy by examining the KMO output provided in the factor analysis. A KMO correlation above .60-.70 is considered adequate to move forward with an analysis of the EFA output.[11] We calculated a KMO correlation of .83; therefore, we moved forward with the analysis of the EFA output. We selected a varimax rotation as it is the most common form of orthogonal rotation for EFA and provides clear information regarding which items best correlate with a particular factor.[14] The rotation method (ie, varimax rotation) provides researchers with information regarding the items to retain or delete from the instrument.

We then conducted factor retention to move forward with the analysis. We identified factors to retain based on the Kaiser criterion[18] recommendation of retaining factors with eigenvalues greater than 1.0 and by examination of the scree plot. Eigenvalues represent the amount of variance in all of the items that can be explained by a particular factor.[14] Six factors had eigenvalues greater than 1.0 and the scree plot indicated a drop off following the sixth factor (see Appendix 2 for an example of the SPSS output for the total variance explained). After selecting these six factors for retention (based on a prior theory, eigenvalues, and scree test), we used item trimming and item retention to move the survey into its final form. Appendix 3 provides an example of the scree plot from the final iteration (five-factor solution) of the survey.

Table 3. Correlation Matrix for Factor 1 (Attitudes toward Use of Cold Water Immersion)

Item*	1	2	3	4	5	6	7	8
1	1.00							
2	.548	1.00						
3	.754	.446	1.00					
4	.536	.437	.527	1.00				
5	.504	.366	.601	.454	1.00			
6	.419	.234	.426	.406	.224	1.00		
7	.481	.236	.451	.262	.273	.391	1.00	
8	.466	.318	.346	.309	.392	.290	.278	1.00

* Item is the term used to refer to a question in the survey.

We evaluated the output for factor loadings on the varimax rotated component matrix to determine which items should remain in the survey and which items we should review for deletion. Based on this inspection, we identified items with high factor loadings (>.40) on more than one factor for potential deletion. We also evaluated for deletion those items that failed to load on at least one factor at >.30 . We placed those items identified with multiple high factor loadings with the factor that made the best sense conceptually (see Appendix 4 for an example of the SPSS output for the rotated factor matrix).

Finally, we decided to either retain the item or remove it by conducting an alpha reliability analysis on all items for the particular factor. If the alpha coefficient for the factor was positively impacted by removing the questionable item (ie, the alpha coefficient would increase if the item was removed) we removed the respective item. As an example, item 6 (“Because of potential contamination of equipment and water with bodily fluids, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.”) loaded on two factors at >.30. Therefore, we placed the item with the factor that made the best sense conceptually (ie, Attitudes toward Use of Cold Water Immersion) and conducted

Table 4. Correlation Matrix for Factor 1 (Attitudes toward Use of Cold Water Immersion)

	Item	Mean ± SD
1.	Because we cannot simultaneously use intravenous fluids, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	2.82 ± 1.7
2.	When exertional heat stroke is identified, the current course of action as my definitive treatment is cold/ice water immersion.	2.75 ± 1.5
3.	Because it causes peripheral vasoconstriction, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	2.06 ± 1.5
4.	Because of the possibility of an athlete drowning, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke	3.10 ± 1.9
5.	Because I would not be able to continuously monitor core temperature, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	2.85 ± 1.6
6.	Because of potential contamination of equipment and water with bodily fluids, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	3.24 ± 1.8
7.	Because it causes cardiovascular shock, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	1.90 ± 1.2
8.	Transportation of an athlete into an immersion tub requires multiple persons. Because of lack of staffing, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	3.32 ± 1.6
9.	Coaches at my institution or job setting are not supportive of my suggestions regarding the progression of heat exposure during heat acclimatization.	3.54 ± 1.5
10.	Coaches at my institution or job setting are not supportive of my suggestions regarding modifying time of practice based on risk of exertional heat stroke.	3.16 ± 1.5
11.	Coaches at my institution or job setting are supportive of my suggestions regarding uniform/sport specific protective equipment utilized depending on risk of exertional heat stroke.	2.43 ± 1.5
12.	My state practice act prevents me from assessing body temperature using rectal temperature.	2.72 ± 1.6
13.	I would prefer not to use rectal temperature to assess body temperature when assessing an athlete for exertional heat stroke.	2.97 ± 1.7
14.	The sports medicine budget prevents me from purchasing equipment necessary to assess rectal temperature.	4.89 ± 1.9
15.	When exertional heat stroke is identified, the current course of action as my definitive treatment is the use of a cold shower on the athlete.	4.46 ± 2.9
16.	When exertional heat stroke is identified, the current course of action as my definitive treatment is continual dousing with cold water.	4.49 ± 1.3
17.	When exertional heat stroke is identified, the current course of action as my definitive treatment is spraying the athlete with water in conjunction with the use of a fan.	4.55 ± 1.2
18.	Sleep deprivation is an important risk factor in the cause of exertional heat stroke.	2.86 ± 1.5
19.	Monitoring proper sleeping habits and conditions of athletes will help to decrease the occurrence of exertional heat stroke.	4.81 ± 3.0

the alpha reliability analysis for the factor with the respective item included. In this specific instance, results of the analysis indicated the reliability was higher (α = .87) with the item included than with it removed (α = .86) (see Appendix 5 for the SPSS output for the alpha reliability analysis for this factor). Therefore, we retained this specific item with the factor. In other situations, we removed the questionable item and conducted a new EFA in SPSS.

We followed the steps for factor identification and item selection for each new EFA. Our fourth iteration of the EFA provided the best solution for the study. Later in this article, we present the results of the fourth EFA as an example of appropriate steps for writing up an EFA in a published manuscript.

EFA Write-up: Evaluation of Clinical Practice Attitudes toward the Treatment of Exertional Heat Stroke

The purpose of the study was to develop and validate an instrument to investigate the attitudes held by ATs regarding appropriate clinical practice behaviors in the treatment of EHS regardless of clinical setting. We used exploratory factor analysis to develop construct validity for this new instrument. The final survey contained 19 items loading onto five factors. We have provided in Table 4 the means and standard deviations for each item. Our assessment of the item correlation matrix indicated that the matrix was not an identity matrix; Bartlett's test of sphericity was significant (χ^2 = 1191.36, *df* = 171, *P* < .001). Measures of sampling adequacy were acceptable (KMO = .83). We used a varimax rotation to rotate the factors and determine items for retention in the final survey. We selected a final solution with five factors accounting for 66.16% of the total variance explained by the survey. We present eigenvalues and variance explained by each factor in Table 5.

The first factor (Attitudes toward Use of Cold Water Immersion) accounted for 26.79% of the variance, and items loading to factor 1 ranged from .812-.611. The second factor (Coaches' Support of EHS Prevention) accounted for 11.17% of the variance, and items loading to factor 2 ranged from .855-.683. The third factor (Attitudes Regarding Rectal Temperature in EHS Evaluation) accounted for 9.11% of the variance, and items loading to factor 3 ranged from .822-.732. Factor 4 (Attitudes toward Use of Other "Cold" Methods) accounted for 7.46% of the variance, and items loading to the factor ranged from .774-.696. The final factor (Perceptions Regarding Non-Exertional Influences on EHS) accounted for 7.11% of the variance, and items loading to factor 5 ranged from .859-.799.

SUMMARY

Following the process of survey development and validation, we developed an instrument to help understand the attitudes held by ATs regarding appropriate clinical practice behaviors in the treatment of EHS. The four steps of survey development

Table 5. Factor Loadings*, Eigenvalues, and Percent Variance Explained for the EHS Attitudes Survey

Item**	Factor 1: Attitudes toward Use of Cold Water Immersion	Factor 2: Coaches' Support of EHS Prevention	Factor 3: Attitudes Regarding Rectal Temperature in EHS Evaluation	Factor 4: Attitudes toward Use of Other "Cold" Methods	Factor 5: Perceptions Regarding Non-Exertional Influences on EHS
1	.812	---	---	---	---
2	.766	---	---	---	---
3	.761	---	---	.274	---
4	.738	---	---	---	---
5	.726	---	---	.257	---
6	.655	---	.255	---	---
7	.639	---	---	.204	---
8	.611	---	---	---	---
9	---	.855	---	---	---
10	---	.842	---	---	---
11	---	.683	---	---	---
12	---	---	.822	---	---
13	---	---	.787	.203	---
14	---	---	.732	---	---
15	---	---	---	.774	---
16	---	---	---	.743	---
17	.273	---	---	.696	---
18	---	---	---	---	.859
19	---	---	---	---	.799
Eigenvalue	5.09	2.12	1.73	1.42	1.35
% Variance	26.79	11.17	9.11	7.47	7.11

* Factor loadings < .20 were not included in this table.
** Item is the term used to refer to a question in the survey.

and validation as outlined by Netemeyer et al[11] include defining the constructs of the survey, developing items to measure each construct, designing and conducting studies to develop a survey, and finalizing the survey using EFA. When a survey has reached its final form, a researcher can calculate items into a mean score for each factor measured by the instrument. The researcher may use these mean scores to examine differences in responses for participants representing diverse populations (eg, experienced ATs, athletic training clinical instructors, newly certified ATs, and students). Parametric statistical techniques (eg, analysis of variance, t-tests, multiple regression) can be used to analyze differences in factor mean scores among various populations. Further analysis of the stability of the survey's factor structure can be tested using confirmatory factor analysis. The process of survey development and validation is lengthy and requires diligence, but it ultimately enhances the quality and richness of the data collected.

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APPENDIX 1. Correlation Matrix Output

Fourth Iteration of EFA.spv [Document1] – PASW Statistics Viewer

Correlation Matrix

		Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10	Item11	Item12	Item13	Item14	Item15	Item16	Item17	Item18	Item19
Correlation	Item1	1.000	.581	.733	.535	.545	.457	.529	.465	.002	-.005	.005	.241	.235	.275	.206	.204	.339	.011	-.040
	Item2	.581	1.000	.520	.482	.472	.444	.400	.437	-.013	-.055	-.103	.177	.202	.243	-.017	.080	.130	-.022	-.037
	Item3	.733	.520	1.000	.509	.552	.419	.488	.353	-.008	-.049	-.066	.177	.213	.191	.250	.260	.339	-.028	-.064
	Item4	.535	.482	.509	1.000	.467	.451	.392	.347	.071	-.033	-.045	.215	.181	.130	.061	.094	.159	.085	-.074
	Item5	.545	.472	.552	.467	1.000	.433	.403	.473	.144	.071	-.017	.166	.216	.141	.159	.272	.388	.045	-.074
	Item6	.457	.444	.419	.451	.433	1.000	.446	.412	.160	.102	.009	.288	.266	.251	.100	.198	.208	.007	-.033
	Item7	.529	.400	.488	.392	.403	.446	1.000	.342	.077	.025	.050	.179	.185	.182	.239	.193	.240	-.042	-.062
	Item8	.465	.437	.353	.347	.473	.412	.342	1.000	.097	.118	.067	.189	.231	.193	.139	.223	.217	-.015	-.119
	Item9	.002	-.013	-.008	.071	.144	.160	.077	.097	1.000	.635	.415	.059	.097	.123	.131	.125	.063	.008	-.149
	Item10	-.005	-.055	-.049	-.033	.071	.102	.025	.118	.635	1.000	.360	.064	.019	.090	.031	.043	-.059	-.005	-.190
	Item11	.005	-.103	-.066	-.045	-.017	.009	.050	.067	.415	.360	1.000	.064	.000	.012	.055	.005	.013	-.035	-.055
	Item12	.241	.177	.177	.215	.166	.288	.179	.189	.059	.064	.064	1.000	.593	.446	.205	.187	.160	.020	-.029
	Item13	.235	.202	.213	.181	.216	.266	.185	.231	.097	.019	.000	.593	1.000	.420	.256	.249	.199	.036	.002
	Item14	.275	.243	.191	.130	.141	.251	.182	.193	.123	.090	.012	.446	.420	1.000	.155	.157	.141	-.087	.017
	Item15	.206	-.017	.250	.061	.159	.100	.239	.139	.131	.031	.055	.205	.256	.155	1.000	.439	.365	.054	.034
	Item16	.204	.080	.260	.094	.272	.198	.193	.223	.125	.043	.005	.187	.249	.157	.439	1.000	.381	-.040	-.034
	Item17	.339	.130	.339	.159	.388	.208	.240	.217	.063	-.059	.013	.160	.199	.141	.365	.381	1.000	.038	-.018
	Item18	.011	-.022	-.028	.085	.045	.007	-.042	-.015	.008	-.005	-.035	.020	.036	-.087	.054	-.040	.038	1.000	.400
	Item19	-.040	-.037	-.064	-.074	-.074	-.033	-.062	-.119	-.149	-.190	-.055	-.029	.002	.017	.034	-.034	-.018	.400	1.000

Communalities

	Initial	Extraction
Item1	1.000	.709
Item2	1.000	.645
Item3	1.000	.673
Item4	1.000	.559
Item5	1.000	.600
Item6	1.000	.512
Item7	1.000	.459
Item8	1.000	.429
Item9	1.000	.749
Item10	1.000	.720
Item11	1.000	.469

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A screen shot of the SPSS output of the correlation matrix for the exploratory factor analysis. Each item represents a question in the survey.

APPENDIX 2. Total Variance Explained

Fourth Iteration of EFA.spv [Document1] – PASW Statistics Viewer

Output
- Log
- Factor Analysis
  - Title
  - Notes
  - Active Dataset
  - Descriptive Statistics
  - Correlation Matrix
  - KMO and Bartlett's Test
  - Communalities
  - Total Variance Explained
  - Scree Plot
  - Component Matrix
  - Rotated Component Matrix
  - Component Transformation Matri
- Log
- Log
- Factor Analysis
  - Title
  - Notes
  - Active Dataset
  - Correlation Matrix
  - Communalities
  - Total Variance Explained
  - Component Matrix
  - Rotated Component Matrix

Total Variance Explained

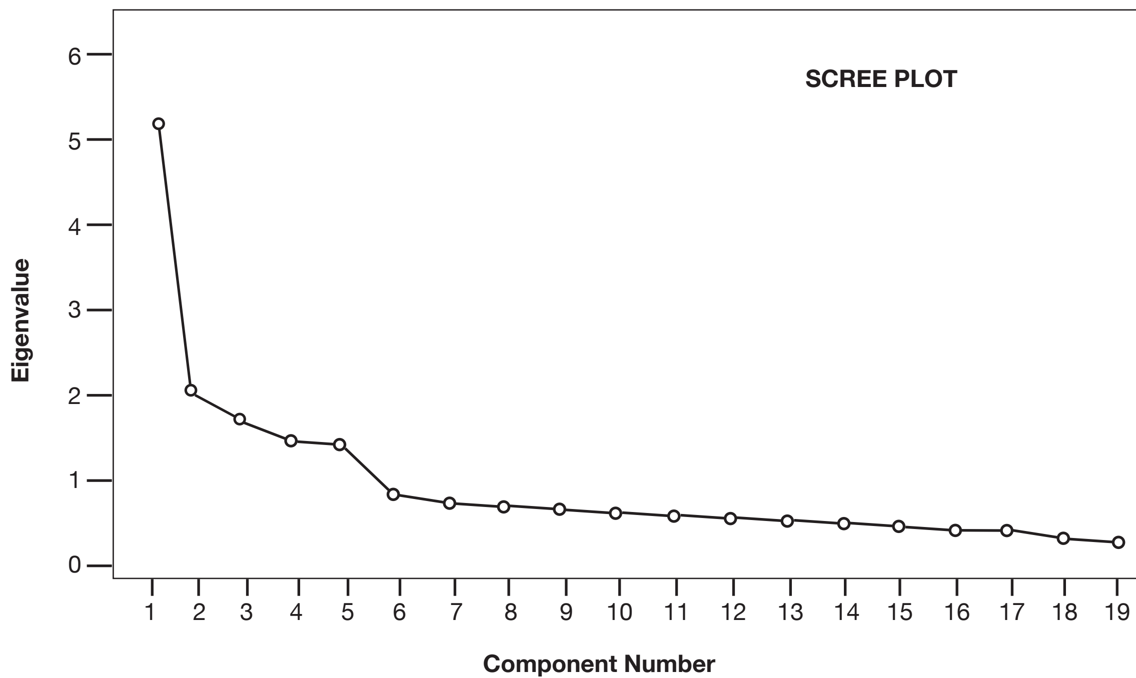
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.090	26.792	26.792	5.090	26.792	26.792	4.294	22.598	22.598
2	2.122	11.171	37.963	2.122	11.171	37.963	2.027	10.671	33.268
3	1.731	9.111	47.074	1.731	9.111	47.074	2.020	10.630	43.898
4	1.421	7.478	54.552	1.421	7.478	54.552	1.952	10.276	54.173
5	1.351	7.111	61.662	1.351	7.111	61.662	1.423	7.489	61.662
6	.816	4.297	65.960						
7	.728	3.829	69.789						
8	.715	3.764	73.553						
9	.684	3.599	77.152						
10	.619	3.259	80.411						
11	.574	3.020	83.431						
12	.503	2.647	86.078						
13	.473	2.487	88.566						
14	.453	2.387	90.953						
15	.429	2.256	93.208						
16	.387	2.039	95.247						
17	.382	2.012	97.260						
18	.287	1.510	98.770						
19	.234	1.230	100.000						

Extraction Method: Principal Component Analysis.

PASW Statistics Processor is ready | H: 445, W: 882 pt.

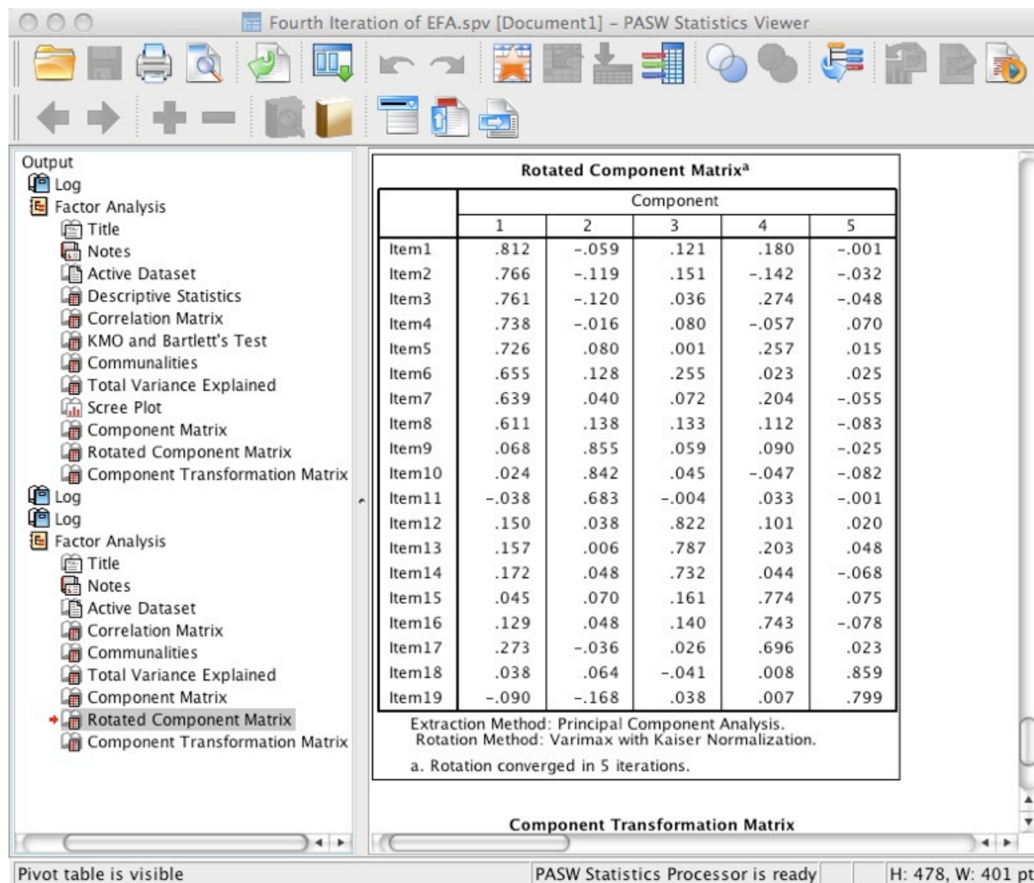
A screen shot of the SPSS output for the total variance explained in the exploratory factor analysis. Components represent the factors extracted in the analysis.

APPENDIX 3. Scree Plot of the Final EFA Solution for the EHS Attitudes



Scree plot provided in the SPSS exploratory factor analysis output.
X-axis = factor number; Y-axis = eigenvalues for each factor

APPENDIX 4. Rotated Factor Matrix



Rotated Component Matrix[a]

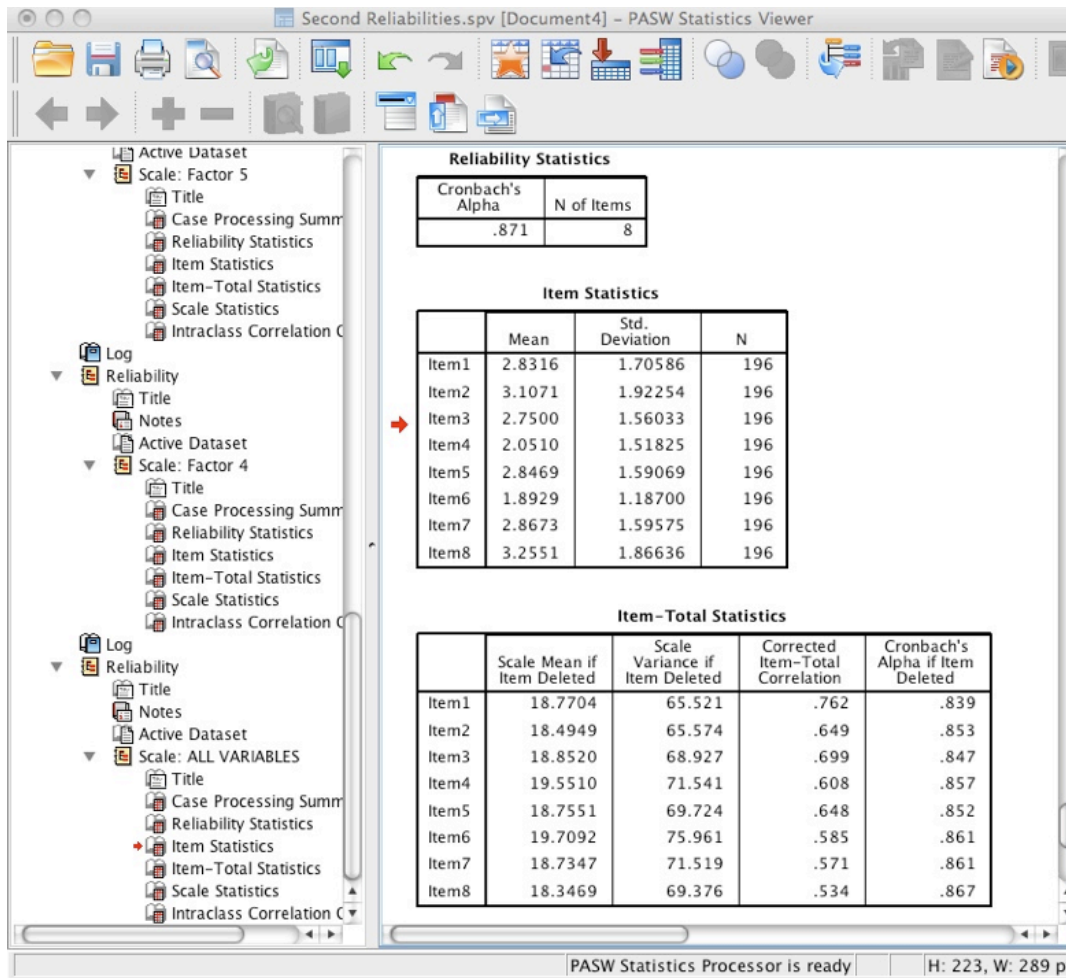
	Component				
	1	2	3	4	5
Item1	.812	-.059	.121	.180	-.001
Item2	.766	-.119	.151	-.142	-.032
Item3	.761	-.120	.036	.274	-.048
Item4	.738	-.016	.080	-.057	.070
Item5	.726	.080	.001	.257	.015
Item6	.655	.128	.255	.023	.025
Item7	.639	.040	.072	.204	-.055
Item8	.611	.138	.133	.112	-.083
Item9	.068	.855	.059	.090	-.025
Item10	.024	.842	.045	-.047	-.082
Item11	-.038	.683	-.004	.033	-.001
Item12	.150	.038	.822	.101	.020
Item13	.157	.006	.787	.203	.048
Item14	.172	.048	.732	.044	-.068
Item15	.045	.070	.161	.774	.075
Item16	.129	.048	.140	.743	-.078
Item17	.273	-.036	.026	.696	.023
Item18	.038	.064	-.041	.008	.859
Item19	-.090	-.168	.038	.007	.799

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Component Transformation Matrix

A screen shot of the SPSS output for the rotated component matrix. Each component represents a factor and each item represents a question in the survey.



Reliability Statistics

Cronbach's Alpha	N of Items
.871	8

Item Statistics

	Mean	Std. Deviation	N
Item1	2.8316	1.70586	196
Item2	3.1071	1.92254	196
Item3	2.7500	1.56033	196
Item4	2.0510	1.51825	196
Item5	2.8469	1.59069	196
Item6	1.8929	1.18700	196
Item7	2.8673	1.59575	196
Item8	3.2551	1.86636	196

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Item1	18.7704	65.521	.762	.839
Item2	18.4949	65.574	.649	.853
Item3	18.8520	68.927	.699	.847
Item4	19.5510	71.541	.608	.857
Item5	18.7551	69.724	.648	.852
Item6	19.7092	75.961	.585	.861
Item7	18.7347	71.519	.571	.861
Item8	18.3469	69.376	.534	.867

A screen shot of the SPSS output for the alpha reliability analysis. Each item represents a question in the survey.

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Self-Directed Learning and the Millennial Athletic Training Student

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Athletic training educators (ATEs) have a responsibility to remain aware of our current student population, particularly how they learn and give meaning to what they have learned. Just as clinical athletic trainers (ATs) must adapt to ever changing work schedules and demands, so too must athletic training educators. In addition to adapting to students' learning behaviors, athletic training educators must prepare students to become life-long learners through an introduction of adult learning theories that strengthen their educational and professional future. Therefore, the purpose of this column is to present a basic working model of self-directed learning and explain how educators can use this theory to ensure the professional success of Millennial students and, ultimately, strengthen the profession.

The Millennial Student in Athletic Training

As society sees new generations grow and develop, we as ATEs also see how each subsequent generation influences our profession. Just as the the Baby Boomers, and Gen Xers have all had a hand in influencing professional practice, so too will the next generation of ATs: Gen Y, better known as the "Millennial Generation." By having a better understanding of who these future professionals are and how ATEs can guide their professional practice, we can provide insight and affect how student can grow as a professional for years to come. This understanding can foster new ways of reaching our future leaders and create ways of enriching their professional development.

Born between 1982 and 2002, the Millennial Generation or Millennial student, like generations before them, already have a wealth of literature reflecting on the characteristics that define them, even within AT.[1-4] Monaco and Martin[5] were one of the first to provide a conceptual framework and describe how the athletic training Millennial student functions in the classroom, during clinical education experiences, and in the professional practice setting. They also provided ATEs with a comparative working outline of who these students are relative to their peers, their innate characteristics, and what one can expect from them due to their life experiences. Most specifically, the authors suggest these students will excel when given (1) clear definitions and paths to success in class, (2) specific and clear expectations of course assignments, (3) positive and timely feedback, (4) creative and varied multimedia delivery, and (5) the ability to link "real life" application to the course content and evidence-based practice knowledge from their instructors.

Additional research examining Millennial students presents ATEs with even more characteristics of this generation as learners. Described as a group of learners who are high achievers, Millennial students often take a team oriented approach to learning, are under pressure to achieve, and confident, but are often sheltered from the harsh realities of life and the real world.[5,6] The Millennial student is different in nature from those of previous generations who chose to work alone, were power driven, but had a sense of working their way up the professional ladder.[6] Other ways in which these students differ from past generations include: (1) smaller family units and fewer siblings, (2) more educated parents, (3) higher median family income, and (4) more cultural awareness.[6]

To the ATE who must interact with these students, understanding their educational needs plays a large role in ensuring student success. In an era immersed in electronic media, one author suggests that educators must be willing to use as many electronic devices as possible in the delivery of course content as the best way to communicate with students.[7] In support of that argument, others believe that in order to keep a student motivated in the 21st century, internet and multimedia access must be used in all facets of education including such methods as electronic textbooks.[8] They also believe that some traditional teaching methods, such

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as the lecture only approach, will quickly cause students to lose interest and disengage them from the subject matter. Due to the ubiquitous nature of electronic media in today's culture, it is imperative for ATEs to adapt to the ever-changing classroom environment and incorporate even more multimedia devices in all areas of our student's education experience.

Millennial students also differ in their classroom relationships with peers. By having a highly team oriented approach to learning, the Millennial student is one who learns well within groups where collaborative and cooperative group learning is emphasized.[5,9] By incorporating properly structured group assignments, students are free to explore alternative learning strategies and encouraged to work with others outside of the formal classroom developing the necessary characteristics for success such as respect, accountability, and responsibility.[10] With group learning as a major force in their learning experience during their formative school years, these students have little experience learning in isolation, which is what they will mostly likely experience in the classroom on their first day on a college campus unless this is specifically addressed within the curriculum.[1]

Another important characteristic includes the need for this generation of students to have a supportive learning environment through mentoring and coaching in all aspects of their education that continues even into the professional workplace.[5,11-12] This has become a growing trend for these students as a defining trait of their life experiences, including that of a sheltered upbringing with very attentive parents.[6]

However, up to this poin, very little, if any, classroom or clinical education in athletic training has focused on the andragogical method with the Millennial student. ATEs should consider how the inclusion of this method could have a profound impact upon student success and achievement. Here, ATEs could include and emphasize seminal andragogical tenants such as (1) immediate application of knowledge, (2) increased performance of gained knowledge (ie, taking their educational experiences back to clinical experiences or practice setting to facilitate practice behaviors), and (3) the facilitation of a student's growing reservoir of knowledge in a value appreciative environment such as the classroom or clinical education experiences.[15] (ie, addressing the needs of the patient on a personal and societal level as described in the disablement model).

The Millennial Student and Adult Learning Theories

To gain an even greater perspective on how ATEs can influence students to become successful professionals, ATEs must consider where they will be as credentialed professionals soon after becoming athletic trainers. One avenue that can guide ATEs in this venture is to become well versed in adult education theories which include the andragogical teaching method and one of its major tenants, self-directed learning.

Andragogy

Although the origin of the term andragogy can be traced back as early as 1833, American adult education scholar Malcolm Knowles is credited with bringing the term to the United States in the late 1960's, early 1970's.[13-14] As Knowles conducted research on this topic, he discovered that andragogy is of the utmost relevance to the concept of adult learning. Knowles first defined andragogy as an "emerging technology for adult learning."[15(p58)] He later refined andragogy to mean "the art and science of helping adults learn."[16(p43)] Andragogy has also been seen as "the single most popular idea in the education and training of adults."[17(p91)] The concept is based on the premise that adult learners (including ATS and AT professionals) process information differently than children. Table 1 outlines Knowles[11] six basic assumptions pertaining to this notion.

The andragogical model assumes adult learners are active engagers in their own learning process and information gathering. Through andragogy, the instructor of adults now serves as a facilitator or coach such as is the case of Approved Clinical Instructors (ACI) rather than as a traditional lecturer. The andragogy model of learning also allows adult learners more responsibility for individual learning and application of new information. The experience of an adult learner also plays a role in the learning process and the accumulation of knowledge. However, this often comes at a cost. Many ATEs may feel they need to give up control of the flow of information, a challenge for many who are trying to meet all of the defined clinical education competencies or who struggle with how to engage and reach the Millennial student.[18]

Traditionally, instructors have commonly used teacher centered, directed-instruction, which Knowles refers to as pedagogy.[16] In this pedagogical model or ideology[13] instructors assume the role of information leader, controlling the learning environment. Here instructors deliver information from their own perspective and control what information is presented to and practiced by the learner. The instructor (ATE) controls the tempo of the course, emphasizing individual strengths and hiding weaknesses. The ATE remains within his/her comfort transferring knowledge that is meaningful for them, while forcing ATS to learn and work in a zone unfamiliar to or uncomfortable for them. Today, though the andragogical method (which is viewed as a program of

Table 1. Six Basic Assumptions Pertaining to the Concept of Andragogy

1. Self-concept moves from one of being a dependent personality toward one of being a self-directed being.
2. One accumulates a growing reservoir of experience that becomes an increasing resource for learning.
3. Readiness to learn becomes oriented increasingly to the development task of social skills.
4. Time perspective changes from one of postponed application of knowledge to immediacy and, accordingly, orientation toward learning shifts from one of subject-centeredness to one of performance-centeredness.
5. Motivation to learn becomes internal.
6. Adults need to know why they need to learn something before undertaking to learn it.

elective assumptions)[13] is being implemented more often for the adult learner since it respects the students' experiences and individuality and allows them to take ownership for the transfer of information, thereby allowing them to learn within their zone of comfort. This can be clearly defined in our current state of CPE for the AT in how they are free to pick and choose individual CPE activities that may not necessarily address any areas of weakness or a lack of knowledge in a performance domain.

Because athletic training students are performing many tasks in their clinical education experiences that are near or at professional caregiver status, ATEs should consider and respect these students as adults who have a direct link to patient care and patient outcomes. By being educators to students who conduct themselves as mature adults and meaningful professionals, ATEs must realize that integrating adult-learning principles and allowing supervised autonomy can only assist students in becoming more refined healthcare providers.

Self-Directed Learning

Self-directed learning is a critical facet of adult learning. Though the idea of self-directed learning paints a picture of learning and practicing in isolation, this is quite the contrary to the implementation of learning on one's own intuitiveness. "To many practitioners, the term self-directed learning conjures up images of isolated individuals busily engaged in determining the form and content of their learning efforts and controlling the execution of these efforts in an autonomous manner."[17 (p56)] Knowles[19 (p18)] made the distinction that "self-directed learning usually takes place in association with various kinds of helpers, such as teachers, tutors, mentors, resource people and peers."

Self-directed learning can be viewed in a wide array of terms and definitions. It is described as "a major deliberate learning effort which the learner himself or herself is responsible for most of the day-to-day planning of what and how to learn"[20(p2)] or a process where individuals take the initiative in designing learning experiences, diagnosing needs, locating resources, and evaluating learning.[19,20] Believing that self-directed learning is an essential concept in the andragogical model, Knowles[19] insisted that self-directed learning was imperative to both the learner and teacher. Knowles[13] made a clear distinction between the two main tenets in self-directed learning. First, self-directed learning is self-teaching. This occurs when learners take it upon themselves to seek out the necessary instruments and resources to teach themselves the needed skills or knowledge. Second, self-directed learning is personal autonomy in which learners begin "taking control of the goals and purposes of learning."[13(p135)] Of these two concepts, Knowles believes that the latter is more important to the adult learner.

Knowles[19] offers five basic assumptions regarding self-directed learners. First, learners become more self-directed as they mature and develop. Second, self-directed learning includes the learner's experiences as an important learning resource. Because all adult learners bring different experiences and perspectives to the table, their experiences play a major role in creating the necessary information pertinent to the learner. Third, self-directed learners exhibit a natural tendency to learn by focusing on tasks and problems unique to them. Fourth, self-directed learners assume that their learning orientation is a result of their previous conditioning in school. Therefore, they feel their learning experiences should be organized as task accomplishing or problem solving projects. Finally, self-directed learners are motivated by internal inspiration such as self-esteem, the desire to accomplish and grow personally, professionally, and with curiosity. Steven Brookfield, another prominent researcher in self-directed learning, discovered that facilitation between learner and instructor was necessary for successful completion of any project.[17] He believed that self-directed learning is a "matter of learning how to change our perspectives, shift our paradigms, and replace one way of interpreting the world of another."[17(p19)] Brookfield further outlined six basic principles for effective facilitation in self-directed learning (Table 2).[17]

By introducing the self-directed learning approach, a concept that might be unfamiliar to the Millennial student, special attention must be made on how ATEs implement this practice. Up to this point in their educational careers, Millennial students have most likely been protected and sheltered by parents and teachers where little to no self-direction and freedom of choice has ever taken place in respect to their educational endeavors. However, from what decades of research has shown us related to self-direct learning,

Table 2. Six Basic Principles for Effective Facilitation in Self-Directed Learning

1. Participation is voluntary; adults engage in learning as a result of their own volition. It may be that the circumstances prompting this learning are external to the learner, but the decision to learn is the learners.

2. Sense of mutual respect among participants. Effective practice is characterized by a respect among participants for each other's self-worth. Foreign to facilitation are behaviors, practices, or statements that belittle others or that involve emotional or physical abuse.

3. Collaboration between members. Facilitators and learners are engaged in a cooperative enterprise in which, at different times and for different purposes, different group members will assume leadership and facilitation roles.

4. A praxis of theory and practice. Praxis is placed at the heart of effective facilitation. Learners and facilitators are involved in a continual process of activity, reflection upon activity, collaborative analysis of activity, collaborative analysis, and so on.

5. Critical reflection of prior assumptions. Through educational encounters, learners come to appreciate that values, beliefs, behaviors, and ideologies, are culturally transmitted and that they are provisional and relative.

6. Nourishment of self-directed empowerment. These adults will see themselves as provocative, initiating individuals engaged in a continuous re-creation of their personal relationships, work worlds, and social circumstances.

the Millennial student will be well suited to evolve into this type of learner due its supportive mentoring and relationship between teacher and learner, collaborative peer learning environment, and an internal motivation to achieve one's goals. In addition, as ATEs we have the unique opportunity to teach our students how to take ownership of their professional continuing education obligations by showing them how self-directed learning can have a positive influence on their learning experience and interests when they previously had no voice in their educational future.

At this point in the discussion we must note that somewhere in our formal interaction with students, possibly imbedded into the curriculum (hopefully early on), a process to demonstrate to the importance of becoming familiar with and engaging in meaningful education should be addressed and modeled.[10] For example, in an introductory athletic training course discussing the concepts of continuing professional education (CPE) within the framework of professional growth and development and meaningful learning could be initiated. Here, we could have the capabilities to familiarize our students not only with the mechanics of CPE, but also how they, as future practitioners and self-directed learners can guide their own learning needs now and into the future.

Application

Having outlined a working model for incorporating adult leading theories with that of the learning style preferences of today's ATS, several inferences can be drawn from the finding. The most apparent of these inferences is that Millennial students are capable of ownership of their work; they also want to link "real life" application to the course content and are very capable learners who are reliant upon electronic media as a major means for their educational needs. Therefore, the athletic training education community needs to consider the use of activities to facilitate these skills. This may consist of the inclusion of more electronic multimedia activities where students are allowed to take control of the goals and purposes of learning. For example instructors can design on-line quizzes requiring students to first search for specific content information to discover the correct response; with the activity completed on the student's timeline rather than on the instructor's timeline. Another example may be the use of increased on-line database searchers examining current athletic trainings trends and emphasizing evidence-based practice; but allowing the student to present the information in a way that is meaningful for them rather than for the instructor. Finally, consider the inclusion of an electronic discussion thread owned by the students where they focus on patient problems (instructor identified with clear guidelines) that must be addressed using learned information and in a collaborative approach where students assume the role of different healthcare providers.

Summary

It is apparent this generation of learners has already made an impact upon our profession. A decade of students and young professionals age 18-28 have either entered the profession as athletic trainers, or are in the process of becoming eligible to become one. In addition, ATEs have recognized the obligation to address the educational needs of this generation by dedicating the 2009 Athletic Training Educator's Conference to the topic of "Reaching Our Millennial Students."[21] However, we must keep in mind that while this generation has been identified as being very intelligent and technologically savvy, they are, in fact, adults. They should be afforded the opportunity to be active engagers in their own learning process and information gathering, rather than being fed the information. Beginning this process early will hopefully allow students to realize they have control of their own learning process and will demonstrate to them the importance of engaging in a meaningful education.

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Social Media Tools for Teaching and Learning

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According to Wikipedia, "social media is the media designed to be disseminated through social interaction, created using highly accessible scalable techniques. Social media is the use of web-based and mobile technologies to turn communication into interactive dialogue."[1] Social networks, such as Facebook and Twitter, contain millions of members who interact to create social media. The ubiquitous nature of Facebook and Twitter has the attention of educators. In this column I will present tips on using Facebook and Twitter for teaching and learning.

THE PROBLEM

An athletic training instructor is challenged with utilizing Facebook and Twitter for educational purposes. Unlike other universities where she has worked, Facebook and Twitter are embraced at all levels of her current university. Recently the university president has charged each department to develop a strategy to expand and enhance cutting edge learning technologies. Her students are loyal users of Facebook and Twitter. The instructor seeks to understand the mechanics of Facebook and Twitter and their educational implications.

GETTING STARTED WITH FACEBOOK

Facebook is a social networking service that allows users to connect with friends, family, co-workers and others who have a similar interest and backgrounds. To get started using Facebook, follow this step-by-step process:

Set up your Facebook account. Direct your browser to www.facebook.com. You are required to enter your name email address, gender, and birthday. Unlike other social networking sites, Facebook has strict privacy policies. Upon logging into your account you can change or hide your email address, gender, and birthday. You can even change your name. I recommend using your real name, especially if your goal is to use Facebook for professional purposes.

Set up your profile. Before logging into Facebook for the first time, you must complete email verification, find friends, edit your profile information, and upload a personal profile picture. In your profile, you may add information on work experiences, education and special interests. Setting up a thorough profile will allow others to find you on Facebook. I strongly encourage you to create an account for personal use and one for your classes and educational program.

Edit your privacy settings. By default, Facebook shares certain information about you to everyone, even users who do not have Facebook accounts. There are three levels of privacy: Everyone, Friends of Friends, and Friends Only. For example, you may set your spring break photo album to only be shared with Friends. To access your privacy settings, log in and then click on the Account > Privacy hyperlink in the top right hand header of the page.

Create groups. Setting up groups allows you to separate your personal and professional content. For example, you may want to create an "Athletic Training Student" group. In doing so you will be able to engage the athletic training students in a professional environment while also staying in touch with your friends and family. You do not want your personal information to be a distraction to your students. An alternative to groups is to create a Facebook account specifically for education purposes.

FIVE FACEBOOK IDEAS FOR TEACHING AND LEARNING

1. **Use as learning management system (LMS).** If you do not have access to Blackboard, Moodle, Desire to Learn or other LMS, you can use Facebook to share documents, poll/quiz your students, and conduct group discussions.

2. **Reference citations.** Facebook has hundreds of applications (apps) that can be used for educational purposes. Worldcat.org's CiteMe is an app that provides formatted citations for books. Currently, CiteMe provides APA, Chicago, Harvard, MLA, and Turbian formats.

3. **Announcements.** Send out reminders, upcoming, events and schedule changes.

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4. **Post class notes.** Post documents with descriptions in any file format on Facebook.

5. **Create group discussions.** Split your class in to smaller study groups for class projects. You can keep track of student's participation, provide guidance, and monitor progress.

GETTING STARTED WITH TWITTER

Twitter is a social networking service that allows users to connect via microblogs, also known as tweets. A tweet is a text-based message up to 140 characters in length. Twitter is the most popular microblogging service, allowing users to connect by posting short messages called "tweets." To get started using Twitter, follow this step-by-step process:

Setup your Twitter account. Direct your browser to www.twitter.com. You will be prompted to enter your full name, username, password and email. You can use any username as long as it does not include "twitter."

Setup your profile. Your Twitter profile is limited to your picture, location, name, webpage and brief bio.

Setup your mobile device. Twitter is a mobile application that is designed for use anytime and anywhere. You may use your mobile phone to send and receive messages. There is also a host of third party applications designed to work on iPhone, Android, and Windows Mobile devices. To setup your mobile device, click on Setting > Mobile. You will be asked to enter and verify your mobile number.

Find and follow people. In order to interact with other Twitter users you must "Follow" them. If you are logged into Twitter, you can follow a user by clicking on the Follow icon located directly beneath the profile picture. Alternatively if you are using a mobile device you may send a text message to Twitter with "follow username" as the message. You will not receive tweets (messages) if you do not follow other users.

Learn the Twitter lingo. Understanding the following terms will enhance your twitter experience:

a. **@(username) -** symbol used to refer to a twitter user (ie, @drronwagner).
b. **Tweet** – to send a message.
c. **Retweet (RT)** – to forward a message from someone else to your followers.
d. **Message** – a private message sent to one of your followers.
e. **Hashtags (#)** – used to identify topics. For example if you are posting a tweet related to athletic training education programs, you may tweet "Athletic training programs are cool #ateps." A search on the #ateps will reveal all tweets tagged with #ateps.

FIVE TWITTER IDEAS FOR TEACHING AND LEARNING

1. **Log a teachable moment.** Athletic training students can tweet about variations of skills they learn during their clinical experiences, such as modifications to a Lachman's test.

2. **Quiz.** Send quiz questions to your class and provide bonus points to students who respond within a given timeframe.

3. **Track a concept.** Present a concept in class and ask students to tweet about the concept when they read about it in the professional literature.

4. **Track time.** Athletic training students can use Twitter to keep track of their time spent in their clinical settings.

5. **Learning Diary.** Students can keep a journal of the things that they learn during their clinical rotations. At the end of the week, a weekly reflection journal exercise can be submitted.

**Note: Be sure students remember patient confidentiality and to not tweet about current athletes or their conditions at their site.

OVERALL IMPRESSIONS

Facebook and Twitter are two applications that have educational implications. One may challenge the value of using these applications for educational purposes; however, before doing so it is important to consider your students first. Today's students have grown up with Facebook and Twitter. They are comfortable using them and are using them in their daily lives. Facebook and Twitter offer an opportunity to connect with students outside of the classroom in a way that is unprecedented. The days of sifting through stacks of reflection journals weeks after the student logged the experience are behind us. Facebook and Twitter allow for real-time collaboration and everyday teaching and learning.

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COLUMN: EDUCATION LITERATURE

Current Literature Summary

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Simulation is a teaching or training technique that is used to replace real patient experiences with intentional, interactive, real-enough virtual patient experiences. Clinical simulation is an effective teaching/training strategy used in medicine, nursing, and other health care professions. Simulation experiences provide opportunities for one to acquire knowledge, confidence, and critical thinking skills in a risk-free, experiential learning environment. We will provide brief synopses of current research on simulation and discuss possible applications to athletic training.

Kaddoura M. New graduate nurses' perceptions of the effects of clinical simulation on their critical thinking, learning, and confidence. *J Contin Educ Nurs.* 2010;41(11):506-516.

Reviewed by Christine A. Lauber, University of Indianapolis

Summary of research context and methods: Nurse educators are challenged to develop critical thinking skills in nursing students that will prepare them to provide safe and effective patient care. According to the American Association of Colleges of Nursing, critical thinking must be integrated into nurse education programs. Hospital-based nurse educators have used clinical simulations as a tool to improve nursing practice, enhance patient safety, present evidence-based practice guidelines, and to promote critical thinking. This exploratory, descriptive study investigated graduate nurses' perceptions of the effect of clinical simulations on their critical thinking skills, learning, and confidence. The clinical simulations were conducted every three weeks for one, 8-hour day (total 8 days, 64 hours) as a component of a 6-month hospital-based critical care training program. The clinical simulations incorporated skill practice on simulated patients and role-play activities. Once the training was complete, a convenient sample of 10 graduates participated in a semi-structured interview.

Summary of research findings: The graduate nurses perceived clinical simulation to develop their critical thinking, leadership, and communication skills as well as provided them with the ability to manage stressful situations. Three main themes emerged from the interviews: (1) just-in-time learning of cognitive and psychomotor skills, (2) fostering of critical thinking and leadership skills through feedback on simulation, and (3) safety in a nonthreatening learning environment. The participants reported that the simulations portrayed real-life patients, helped to develop holistic patient care with other healthcare practitioners, and bridged the gap between theory and practice (theme 1). The participants indicated that their critical thinking skills were enhanced through reflection and video feedback of their performance and that their leadership and teamwork skills were improved as a result of the simulations (theme 2). The participants stated that the simulations promoted patient safety, gave them confidence when providing patient care in a critical situation, and enhanced their ability to manage stress in serious situations.

Implications for athletic training education/research: Clinical simulation is an effective teaching tool for promoting critical thinking, learning, and confidence; therefore, athletic training educators should consider designing and implementing clinical simulation teaching-learning strategies into their curricula. Simulations using high-fidelity manikins, role playing, or standardized patients provide students with the opportunity to develop critical thinking, confidence, and patient care skills in a non-threatening, controlled environment. Additionally, simulations give educators the opportunity to provide immediate feedback to the student thus promoting student reflection of his/her performance. Research in athletic training has begun to address the use of interactive and innovative teaching-learning strategies, such as standardized patients, yet more research is needed to evaluate their effectiveness in developing critical thinking, leadership, and communication skills to enhance clinical practice and patient safety.

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Blum CA, Borglund S, Parcells D. High-fidelity nursing simulation: impact on student self-confidence and clinical competence. *Inter J Nurs Educ Schl.* 2010;7(1): Available at: http://www.bepress.com/ijnes/vol7/iss1/art18. Accessed: March 15, 2011.

Reviewed by Brian J. Hughes, University of Central Missouri

Summary of research context and methods: In the effort to better prepare entry-level nursing students for professional practice, nursing educators are researching new avenues to strengthen their students' future success while in their clinical courses. By incorporating new teaching techniques, such as high-fidelity simulationinto the curricula, nursing educators could examine two important learning characteristics critical to professional practice: self-confidence and clinical competence. The purpose of this study was to determine (1) if student ratings of self-confidence and faculty ratings of student competence correlate between midterm and final assessment and (2) if enrollment in a traditional or simulated-enhanced laboratory course impacts student self-confidence and clinical competence.

Fifty-three entry-level Bachelor of Science nursing students in their junior year of education participated in this study. The final sample of students were predominantly female (n=47, 89%), Caucasian (n=36, 68%), and non-traditional (mean age=30, SD=9.63). Using a quasi-experimental study design, student self-confidence and clinical competence were observed in the control group (n=16) using traditional teaching methodologies and the experimental group (n=37) using the Laerdal's SimMan® high-fidelity manikin. Both participants and instructors utilized the Lasater Clinical Judgment Rubric (LCJR) at the semester mid-term and final to assess perceived levels of student self-confidence and clinical competence. The four levels of development used as descriptors in the LCJR included: (1) Beginning, (2) Developing, (3) Accomplished, and (4) Exemplary.

Summary of research findings: The LCJR had good reliability for assessing student self-confidence and clinical competence. Self-confidence and clinical competence also improved significantly in both the control and experimental groups from midterm to final. Crosstabulations revealed that 27 students rated their self-confidence "exemplary" in the final assessment as compared to 16 at midterm and that 38 students rated themselves "exemplary" in clinical competence at final assessment as compared to 16 students at midterm. Participants in the control group had a greater increase in both self-confidence and clinical competence scores from midterm to final as compared to the experimental group. The lack of statistical significance across groups suggests the student self-confidence and clinical competence improved regardless of the mode of teaching.

Implications for athletic training education/research: In the field of athletic training, athletic training educators are constantly seeking new and innovative methods to better educate and prepare entry-level athletic training students prior to their professional practice. As a possible method of ensuring a greater sense of self-confidence and clinical competence, high-fidelity simulation has the potential of accomplishing this in a controlled environment before skills are transferred to professional clinical application. As described in this article, high-fidelity simulation can be used in several clinical aspects of the curriculum including the novice learning of basic of skills to the advanced refinement of complicated skills. Athletic training educators should consider more research and the potential implementation of high-fidelity simulation models in the clinical aspect of the curriculum as another avenue to increase student self-confidence and clinical competence.

Schlairet MC, Pollock JW. Equivalence testing of traditional and simulated clinical experiences: undergraduate nursing students' knowledge acquisition. *J Nurs Educ.* 2010;40(1):43-7.

Reviewed by Gianluca Del Rossi, University of South Florida

Summary of research context and methods: As educational programs struggle with faculty shortages, increasing student enrollment, patient safety concerns, and the decreasing number of clinical instructors and clinical sites, educators have begun to incorporate human patient simulators to overcome these barriers. By using human patient simulators, undergraduate students are able to engage in realistic clinical environments or situations that are tailored to their specific educational needs. Replicating what students may be exposed to in clinical practice allows students to refine their psychomotor skills, as well as their decision-making process, without the fear of causing harm to patients. Although the literature describes a number of positive outcomes associated with the use of simulation in clinical education, the benefits of this teaching method over traditional clinical experiences are lacking. Therefore, in this study, researchers compared the acquisition of nursing fundamentals following traditional and simulated clinical experiences. They also evaluated whether the sequential order in which these methods are introduced to the student might impact the student's overall knowledge gains should both methods be used in succession.

Summary of research findings: In this study, a 100-point knowledge test was created to capture quantitative data. Tests were administered before the intervention (knowledge pretest) and following the intervention (post-test 1). All participants then crossed over into the opposite intervention arm and completed the final test (post-test 2). Statistical tests revealed significant knowledge gain following both simulated and traditional experiences. The data revealed significant test score differences in both study groups from pretest to post-test 1; post-test 1 to post-test 2; and pre-test to post-test 2. Additionally, there were no statistically significant differences for intervention sequences (simulated-traditional and traditional-simulated).

Implications for athletic training education/research: Based on the findings of this investigation, it appears that simulated clinical experiences using high-fidelity simulators may be beneficial to student learning, particularly in those situations when access to traditional patient care settings are limited or when patients with specific clinical conditions are not available. However, educators should keep in mind that simulation learning cannot meet the needs of all learners, thus, before this type of teaching strategy is integrated within a student's learning environment, the role of simulation within the educational program needs to be delineated. For example, when teaching some clinical skills it may be necessary to introduce simulation only as an adjunct to traditional methods, whereas with other skills this teaching strategy may replace altogether the traditional methods of instruction. This will ensure that students continue to have well rounded clinical experiences and meet core educational competencies.

Additionally, before simulation experiences are incorporated

within athletic training curricula, more research is necessary to determine whether the knowledge acquired via simulation actually helps the student achieve clinical competence, and whether that competence can then be transferred from a simulated setting to a real clinical environment. Finally, it would be helpful to establish some of the secondary benefits of simulation (such as the potential for this educational technology to increase a student's confidence or comfort level when delivering patient care) in order to provide further support for integrating this teaching strategy within an athletic training education program.

Elfrink VL, Kirkpatrick B, Nininger J, Schubert C. Using learning outcomes to inform teaching practices in human patient simulation. *Nurs Educ Perspectives*. 2010;31(2):97-100.

Reviewed by Eva Frank, Florida International University

Summary of research context and methods: Nurse educators are challenged to prepare competent practitioners despite reduced clinical sites, nursing faculty, and clinical supervisors. In an effort to meet this challenge, nurse educators are implementing innovative teaching strategies, such as human patient simulations, to efficiently achieve clinical learning outcomes in a safe environment. Human patient simulation meets the criteria of pedagogical situated learning in that it gives the student an opportunity to apply their knowledge (content) in an interactive scenario (context) while working with others in a common learning environment (community) in which exchange of knowledge (participation) occurs. Additionally, human patient simulation involves the mastery learning approach in which the learner is presented with a scenario, they are taught a number of strategies to successfully complete the scenario, and they are coached through the experience, evaluated on their achieved learning, and provided with a summary to establish scenario closure.

The purpose of this study was to assess students' knowledge acquisition and retention following a human patient simulation experience. Using situated and mastery learning as a framework, the researchers developed human patient simulation scenarios to evaluate nursing students' knowledge before (pretest) and after (posttest 1) the simulation, and again at the end of the academic term (posttest 2). Knowledge was assessed using NCLEX-RN study questions relevant to the human patient simulation.

Summary of research findings: Students performance improved significantly from pretest to posttest 1 suggesting that knowledge was acquired; however, the data revealed that knowledge was retained (posttest 2) by only 50% of the students.

Implications for athletic training education/research: Human patient simulation is gaining increased popularity in nursing curricula to promote clinical learning. This study found that human patient simulation is beneficial to students' knowledge acquisition if the instructor is trained in giving appropriate pre-simulation instructions and cues. Integrating human patient simulation into athletic training curricula may be beneficial as it allows for increased exposure to different, and perhaps rare, illnesses and injuries. Practicing with human patient simulators will give athletic training students multiple opportunities to correct and refine their clinical skills following feedback from the instructor. Since the instructions and cues given by the educator are so essential, athletic training educators would need proper simulation training prior to implementing this teaching strategy into the curricula. Further research is needed to examine students' knowledge retention following simulation and the impact of instructors' simulation teaching experience on learning outcomes.

Kaplan B, Ura D. Use of multiple patient simulators to enhance prioritizing and delegating skills for senior nursing students. *J Nurs Educ.* 2010;49(7):371-7.

Reviewed by Jennifer L. Doherty-Restrepo, Florida International University

Summary of research context and methods: Providing nursing students with clinical experiences that foster the development of leadership skills in prioritizing and delegating care is difficult. While in the clinical setting, nursing students focus on becoming proficient at patient care skills. However, upon entering the profession, nursing students are expected to transition to a practicing nurse capable of implementing advanced leadership skills to effectively care for numerous patients simultaneously. Simulation-based learning (SBL) is an effective teaching strategy that allows nursing educators to create scenarios that require students to utilize advanced skills, such as leadership, to care for simulated patients. In this study, nursing educators created a SBL experience for 97 students to assess their ability to safely and effectively prioritize, delegate, and implement care for three patient simulators.

Summary of research findings: Sixty-nine percent (n=67) of nursing students reported that the SBL experience increased their understanding of how to prioritize and delegate care. Seventy-eight percent (n=76) of nursing students reported increased confidence in working with teams and 55% (n=52) reported increased confidence in prioritizing and delegating care.

Implications for athletic training education/research: This study suggests that SBL experiences may be an effective teaching strategy to develop student confidence in working with teams and critical thinking skills, such as prioritizing and delegating care. Similar to nursing, athletic training students are expected to transition from a student to an autonomous clinician. The development of critical thinking skills and confidence in athletic training students can be a challenge due to clinical supervision requirements; however, these skills are essential for the autonomous clinician. Research on critical thinking skills and confidence of athletic training students following SBL experiences is warranted. Additionally, research on the transfer of these skills from the simulated to the clinical setting is needed.