



2019

Comprehensive Knowledge Assessment for Athletic Trainers: Part I

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Recommended Citation

Eberman LE, Edler JR, Games KE. Comprehensive Knowledge Assessment for Athletic Trainers: Part I. The Internet Journal of Allied Health Sciences and Practice. 2019 Jan 01;17(4), Article 13.

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Comprehensive Knowledge Assessment for Athletic Trainers: Part I

Abstract

Purpose: Continuing education (CE) is intended to help clinicians maintain competence, develop and advance knowledge and skills, and enhance knowledge, skills, and abilities beyond the levels required for entry-level practice. Based on previous literature, the current mode of CE in athletic training does not appear to be helping clinicians maintain competence. The purpose of this research was to validate a comprehensive assessment based on the Role Delineation Study/Practice Analysis (6th ed.) through item analysis and estimates of reliability to be used to assess athletic trainers' actual knowledge. **Method:**

We conducted an instrumentation validation study using Qualtrics[®] web-based platform. Athletic trainers (n=191; age=31.5±8.1yrs; years of experience=8.9±11.1yrs) in good standing with the NATA and BOC completed both administrations of the assessment. Six experts developed 220 multiple-choice items for inclusion with broad application across the five domains of clinical practice (Injury/Illness and Wellness Protection [49 items], Clinical Evaluation and Diagnosis [63 items], Immediate and Emergency Care [29 items], Treatment and Rehabilitation [29 items], and Organizational and Professional Health and Wellbeing [50 items]). A random sample of NATA members were recruited via email, received weekly reminders, and then after four weeks, they completed a second administration of the assessment. We evaluated the assessment tool for item difficulty, item discrimination, internal consistency, item total statistics, and test-retest reliability. **Results:** We eliminated 42 items from the tool created by the experts that were too difficult (0.90). We eliminated 50 additional items due to point-biserial correlations between item performance and total domain score performance below 0.20. We identified additional weaknesses in 57 items through intraclass correlation coefficients (ICC). **Conclusions:** We developed a valid and reliable assessment tool to measure athletic trainers' actual knowledge. Future research should utilize a validated assessment of actual knowledge to guide continuing education activities.

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Comprehensive Knowledge Assessment for Athletic Trainers: Part 1

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ABSTRACT

Purpose: Continuing education (CE) is intended to help clinicians maintain competence, develop and advance knowledge and skills, and enhance knowledge, skills, and abilities beyond the levels required for entry-level practice. Based on previous literature, the current mode of CE in athletic training does not appear to be helping clinicians maintain competence. The purpose of this research was to validate a comprehensive assessment based on the Role Delineation Study/Practice Analysis (6th ed.) through item analysis and estimates of reliability to be used to assess athletic trainers' actual knowledge. **Method:** We conducted an instrumentation validation study using Qualtrics® web-based platform. Athletic trainers (n=191; age=31.5±8.1yrs; years of experience=8.9±11.1yrs) in good standing with the NATA and BOC completed both administrations of the assessment. Six experts developed 220 multiple-choice items for inclusion with broad application across the five domains of clinical practice (Injury/Illness and Wellness Protection [49 items], Clinical Evaluation and Diagnosis [63 items], Immediate and Emergency Care [29 items], Treatment and Rehabilitation [29 items], and Organizational and Professional Health and Wellbeing [50 items]). A random sample of NATA members were recruited via email, received weekly reminders, and then after four weeks, they completed a second administration of the assessment. We evaluated the assessment tool for item difficulty, item discrimination, internal consistency, item total statistics, and test-retest reliability. **Results:** We eliminated 42 items from the tool created by the experts that were too difficult (<0.20) or too easy (>0.90). We eliminated 50 additional items due to point-biserial correlations between item performance and total domain score performance below 0.20. We identified additional weaknesses in 57 items through intraclass correlation coefficients (ICC<0.5). The remaining 71 items demonstrated high internal consistency (Cronbach's $\alpha=0.843$) and each domain demonstrated good or excellent reliability between administrations (ICC=0.617-0.820). **Conclusions:** We developed a valid and reliable assessment tool to measure athletic trainers' actual knowledge. Future research should utilize a validated assessment of actual knowledge to guide continuing education activities.

Keywords: continuing education, role delineation, educational competencies, actual knowledge

INTRODUCTION

Continuing education (CE) is the primary mechanism for health care professionals to retain their licenses or certifications and to ensure that they maintain competence while developing knowledge and skills consistent with current standards of practice.¹ Continuing education is any and all learning and knowledge acquired after formal training completion.² Continuing education is intended to promote continued competence, develop current knowledge and skills, and enhance professional skills and judgment beyond the levels required for entry-level practice.¹ Continued learning and maintaining competence as a healthcare provider is a characteristic of professionalism¹ and helps to protect the public's safety.³ Often CE is motivated by the learner's perception of his or her own knowledge, by personal preference, or by a current clinical problem, and learners are deterred from CE because of time, cost, and course relevance.⁴ Additionally, practitioners seem incapable of truly recognizing gaps in their own clinical practice (often with notable deficits in actual knowledge), both in athletic training and in other professions.⁵⁻¹⁴ As such, practitioners may not select or acquire appropriate CE to maintain competence or resolve knowledge deficits that may result in knowledge and skill gaps related to current best practices. Although this has not been measured systematically in athletic training, cases like those of Jordan McNair (University of Maryland), Ereck Plancher (University of Central Florida), and data from other healthcare professions show that inadequate knowledge and skill decay can negatively affect patients, which could have life altering results.¹⁵⁻¹⁸

In athletic training, students are trained using educational competencies, which only recently came under the direction of the Commission on Accreditation of Athletic Training Education (CAATE) in the development of the curricular content standards (previously developed by the Professional Education Committee of the National Athletic Trainers' Association [NATA]).¹⁹ Practicing clinicians help to define the practice of the profession by engaging in the Role Delineation Study/Practice Analysis (6th ed.) facilitated by the Board of Certification (BOC or Board), creating the blueprint for examining entry-level knowledge for initial Board certification.²⁰ Initial Board Certification Examination includes all domains of practice to ensure competence across all practice areas (Injury/Illness and Wellness Protection [Domain 1], Clinical Evaluation and Diagnosis [Domain 2], Immediate and Emergency Care [Domain 3], Treatment and Rehabilitation [Domain 4], and Organizational and Professional Health and Wellbeing [Domain 5]).²⁰ According to the BOC, to maintain certification one must engage in a minimum number of CE units with the goal that these CE units "promote continued competence" in the aforementioned domains.¹ Presumably, that means, athletic trainers should maintain a level of competence commensurate with that possessed when they became Board certified. Yet CE is also intended, as is stated by the BOC, to develop current knowledge and skills like those that are being taught in educational programs (educational competencies), suggesting that CE is also supposed to push practitioners to develop their knowledge and skills to current practice standards.¹ According to these stated intentions, CE should help practitioners maintain and develop current knowledge and skills.

Continuing education sessions are effective, at least in positively affecting patients, but practitioners may not be capable of recognizing where their knowledge needs exist.^{5-14,21-28} This suggests an alternative approach to maintaining competence may be needed to ensure patient safety and high quality healthcare in athletic training and other healthcare professions. Alternative approaches to CE have been explored in several health professions, but most notably in emergency and family medicine specialties where maintenance of competence is developed through four tenets: 1) standards in professional standing, 2) lifelong learning and self-assessment, 3) cognitive expertise, and 4) assessment of practice performance.²⁹⁻³⁴ We hypothesize that external feedback using a comprehensive examination to identify domain-specific knowledge deficits may be helpful in guiding practitioners to CE that will resolve knowledge deficits. Physician assistant practice, emergency medicine, and family medicine have used recertifying exams to ensure maintenance of competence.²⁹⁻³³ However, a knowledge assessment, like the one proposed in this study, not a recertifying exam, could be more formative and used to help athletic trainers identify knowledge gaps; subsequently, these individuals could then select CE that meets their knowledge needs. This theory has been preliminarily studied, whereby external feedback suggesting poor performance resulted in a stated desire to seek CE.⁵ In this study, we focused on the development and validation of a comprehensive, competency-based examination that could be used in future research and practice to maintain competency in athletic trainers. The specific aim of this study is to validate a comprehensive knowledge assessment based on the Crosswalk Analysis³⁵ that bridges the Role Delineation Study/Practice Analysis (6th ed.) and educational competencies through item analysis and estimates of reliability.^{19,20}

METHODS

Design

We developed a comprehensive knowledge assessment and then conducted an instrument validation study.

Participants

One-hundred and ninety-one athletic trainers (age=31.5±8.1 yrs; years of experience=8.9±11.1 yrs) in good standing with the NATA and BOC completed both administrations of the assessment (Table 1). Only those who completed greater than 60% of

the entire assessment were included in analysis (this is the score cut-off used by the BOC Certification Examination). All participants were informed about the study and provided consent to participate. The study was deemed exempt research by the Indiana State University Institutional Review Board.

Table 1. Participant Demographics (N = 191)

Characteristic	Frequency (%)
Sex	
Male	53 (27.7)
Female	137 (71.7)
Genderqueer	1 (0.5)
Current Clinical Setting	
College/University	64 (33.5)
Secondary/Intermediate	66 (34.6)
Clinic/Hospital	34 (17.8)
Professional sports	2 (1.0)
Performing arts	0 (0.0)
Public Safety	0 (0.0)
Military	4 (2.1)
Occupational health	3 (1.6)
Other	18 (9.4)
Highest Degree Earned	
Bachelor's (BA, BS, etc)	47 (24.6)
Master's (MA, MS, etc)	136 (71.2)
Clinical Doctorate (DAT, DHS, DHSc, etc)	4 (2.1)
Academic Doctorate (PhD, EdD, etc)	4 (2.1)

Instrumentation

We developed our assessment tool using a process similar to the cognitive assessments used in emergency and family medicine specialties.²⁹⁻³¹ To develop the tool, we identified seven item writers from a pool of expert clinicians, educators, and researchers who were either tasked with developing the 5th Edition of the Educational Competencies (n=6) or who were referred by a member of the pool of experts (n=1). The pool of experts developed 220 multiple-choice items, referenced from the BOC Exam Reference List and NATA Position Statements, for inclusion with broad application across the five domains of clinical practice (Injury/Illness and Wellness Protection [49 items], Clinical Evaluation and Diagnosis [63 items], Immediate and Emergency Care [29 items], Treatment and Rehabilitation [29 items], and Organizational and Professional Health and Wellbeing [50 items]).^{36,37} We then used the Crosswalk Analysis to translate items from the educational competency areas to their respective domains to align with the Role Delineation Study/Practice Analysis.^{34,35} Items were entered into the Qualtrics® web-based platform, and randomization was used for item order and response order.

Procedures

Participants were solicited from a random sample of NATA members by email. We contacted individuals via email to identify interested participants, sent weekly reminders, and four weeks after the initial administration, 89% (n=177) of the participants completed a second administration of the assessment.

Statistical Analysis

We completed an industry standard, step by step analysis of the data in its entirety, more multifaceted than the item analysis conducted by the BOC.³⁸⁻⁴⁰ This process included individual item analysis, item to domain analyses, and item to total assessment analyses.^{39,40} For the item analysis, we first assessed item difficulty. To do this, we divided the number of respondents who correctly answered the item by the total number that responded to that item. Items with a difficulty score below 0.20 ("too difficult") or above 0.90 ("too easy") were eliminated.^{39,40} The item analysis for the BOC Certification Examination uses item difficulty cut-offs between 0.30 and 0.92, while allowing for accepting items outside those parameters.³⁸ We used standard cutoffs to account for the flexibility described by the BOC item analysis approach.³⁸⁻⁴⁰ Next, we assessed item discrimination which established a point-biserial correlation between item performance and total domain score performance. Items with a correlation below 0.20 were eliminated.^{39,40} Item discrimination is an index of an item's effectiveness at discriminating between those who know the content,

in relation to the overall domain score, and those who do not.³⁹⁻⁴¹ The item analysis for the BOC Certification Examination uses a positive value above 0.15 for item discrimination, which is lower than the recommended standard.³⁹⁻⁴¹

We also calculated item-total statistics that included corrected item-total correlations, squared and multiple correlations, and an “α if item deleted” analyses. These item-total statistics were considered in combination to make decisions about item elimination. Corrected item-total correlation is a correlation between an item and the rest of the assessment without that item considered part of the examination.³⁹ This correlation is intended to identify items that did not measure the same construct that the rest of the examination was trying to measure.³⁹ Squared multiple correlation was used to measure how much variability in the responses to one item can be predicted from other items on the assessment.³⁹ To determine “α if item deleted” analyzes, the overall instrument reliability coefficient (internal consistency) of the item was deleted.³⁹ Items should be considered for elimination when the α value of the item deleted is higher than the current α statistic.³⁹

We determined assessment stability between administrations for the remaining items using intraclass correlation coefficients (mixed model, consistency model with averaged measures) for each item and eliminated any items with an ICC less than 0.50.⁴¹ We then calculated ICC values for the remaining items to determine stability within the domain scores and the entire instrument (total score). Lastly, we calculated a reliability coefficient to establish internal consistency for the entire examination based on the remaining items. The acceptable range for Cronbach’s α is greater than 0.60.⁴¹ All statistical analyses were performed using SPSS (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp). Significance, where appropriate, was set at $p < 0.05$ *a-priori*.

RESULTS

In determining item difficulty, we eliminated 42 items from the assessment because they scored below 0.20 or above 0.90 and were deemed “too difficult” (20 items) or “too easy” (22 items), respectively. One hundred and seventy-eight items remained and were used for the item discrimination analysis. In the item discrimination analysis, we eliminated 50 additional items because of point-biserial correlations below 0.20. The item-total statistical analysis affirmed inclusion of all remaining 128 items considering corrected-item total correlations, squared multiple correlations, and “α if item deleted” simultaneously.

Intraclass correlation coefficients analysis revealed weaknesses in an additional 57 items (ICC<0.5), which were then eliminated. The remaining items (n=71) demonstrated good or excellent reliability. The domains demonstrated good or excellent relationships between administrations: Injury/Illness and Wellness Protection (8 items, ICC=0.617), Clinical Evaluation and Diagnosis (21 items, ICC=0.807), Immediate and Emergency Care (12 items, ICC=0.712), Treatment and Rehabilitation (10 items, ICC=0.770), and Organizational and Professional Health and Wellbeing (20 items, ICC=0.820). With the remaining 71 items, the knowledge assessment demonstrated high internal consistency (Cronbach’s α=0.843). A summary of analysis by domain is included in Table 2.

Table 2. Summary of Analysis

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5	Total
Initial Items	49	63	29	29	50	220
Removed Too Easy	9	5	7	0	1	22
Removed Too Difficult	8	6	3	1	2	20
Removed Poor Correlation	12	12	4	6	16	50
Removed ICC	12	19	3	12	11	57
Total Removed	41	42	17	19	30	149
Remaining	8	21	12	10	20	71

DISCUSSION

We used content experts with experience and training in developing multiple-choice items; these were individuals who have developed items using resources endorsed by the BOC and NATA. We then field tested our items and conducted a thorough a rigorous psychometric analysis. The final pool of items was representative, but not distributed similarly to the BOC Certification Examination, of the practice domains and included both knowledge retrieval and knowledge utilization items that would challenge the clinical reasoning of the AT.²⁰ Our result is a pool of questions that can be used to test our larger hypothesis, an alternative model for maintaining competence, beyond the simple act of accumulating CE units.

Our process of using experts and an educational guide for developing this instrument is consistent with similar approaches for developing assessments for single constructs and larger exams with multiple constructs⁴²⁻⁴⁵. The American Board of Emergency Medicine uses The Model for the Clinical Practice Emergency Medicine as a guide for item development.⁴⁶ A Taskforce similar to that used to develop the educational competencies oversees that process.⁴⁶ When identifying experts, we looked to those who had been part of developing the competencies to serve as experts. In using both the educational competencies and the Role Delineation Study/Practice Analysis (translated using the Crosswalk Analysis) to guide tool development, we were aligning with the premise shared by the BOC, that for tasks to become entry-level they must first be incorporated into education programs.^{19,20,35} This is also consistent with the BOC's definition, that CE should not only provide for maintaining competence, but also elevating knowledge to current best practice.¹ When developing the Fresno, Modified Fresno, and Berlin Questionnaire for measuring competence in evidence-based practice for physicians and physical therapists, the authors developed the items themselves using current literature to drive content.⁴²⁻⁴⁴ We instructed item writers in our study to use both the BOC Exam References and NATA Position Statements to guide item development in their specified area.

Our process for item analysis is also consistent with current practices of the BOC Certification Examination,³⁸ the American Board of Emergency Medicine Continuous Certification Examination,⁴⁵ and the Maintenance of Certification for Family Physicians Examination.^{38,45,47} These organizations typically field test items and then assess for item discrimination and item difficulty.^{38,45,47} Our analyses went further to look at how the instrument would respond if the item was deleted, both for variability, predictability, and internal consistency.³⁹ We also assessed for test-retest reliability, which is not often accomplished in these tests because testing occurs in real-time with professional consequences for test takers.⁴¹

Continuing education is the acquisition of knowledge or the engagement in learning activities aimed at maintaining or developing knowledge, skills, and abilities resulting in high quality patient care.⁴⁸ It is suggested that to be effective, CE must be self-directed and must address learner needs.⁴⁹ Our theoretical framework challenges that assumption, particularly if learner needs are drawn only from self-perception, just as we challenge the assumption that simply attending CE sessions leads to continued competence. A similar process is being used by the family medicine and emergency medicine specialties in the medical profession.²⁹⁻³² These professions utilize standards across four tenets, one of which is cognitive expertise, that includes a test to recertify physicians, while we are suggesting the test be used to drive future learning opportunities. As adults, we ascribe to adult learning principles in the pursuit of lifelong learning, but CE is a mandatory process and therefore challenges the idea that CE is self-directed. Moreover, there is a substantial body of knowledge that describes the preferences, perceived needs, deterrents, and barriers, which is countered by other literature that clearly refutes the relationship between perceived needs and actual cognitive knowledge.^{4-14,48,50} As such, self-directed CE, driven by preference or perceived knowing likely fails to meet the need of the patient.

By using a comprehensive knowledge assessment to measure knowledge needs, athletic trainers may change their beliefs and attitudes about what they know. Instead of considering what they think they know or need, they would have objective data to plan CE. The change in what they know about their own knowledge would likely change their intentions and subsequent behaviors relating to CE activities.⁵ This is the theory of planned behavior that suggests attitudes and norms shape intentions and eventual action.⁵¹ A standard process with data to drive intention and action are exactly what is needed to reshape the current environment that allows the simple acquisition of credit to meet the expectation for CE.

Limitations

We aimed to develop a large pool of items for a comprehensive knowledge assessment to measure the actual knowledge of athletic trainers. Although there is a committee of item writers used by the BOC, this information was unattainable, which led to our use of those that developed the educational competencies. Their qualifications were vetted and they were instructed to use content consistent with developing the BOC Certification Examination, but verifying their item writing capacity occurred through the psychometric analysis, not prior to the validation process.

The final pool of items is not equally distributed of items guided by the Role Delineation Study/Practice Analysis and BOC Certification Examination. This suggests more items may need to be developed or refined for inclusion in a future iteration of the assessment. Further, AT performance on the assessment of knowledge was low, even after item difficulty analyses were performed. Although that is consistent with the previous research in athletic training, where actual knowledge has been low, regardless of the content area, retesting among high performers or validated group of test takers may serve to better inform us about the validity of the tool.⁴⁷ Identification of this group of test takers may be difficult, but in other professions and with smaller constructs, educators and students have been used for this kind of comparative analysis.³³⁻³⁵ Questions similar to those represented in Figure 1, were eliminated as too difficult. It is possible, that with improved overall performance, more items would have remained within the final pool of items.

<p>Individuals with the following medical condition are 37 times more likely to die than those without the condition during sport</p> <ol style="list-style-type: none"> Hypertrophic cardiomyopathy (131, 68.6%) Sickle cell trait (34, 17.8%) Wolf parkinson's white syndrome (16, 8.4%) Anomalous coronary arteries (7, 3.6%) <p>Missing responses (3, 1.6%)</p>
<p>What is the usual, randomly taken, blood sugar level of a person?</p> <ol style="list-style-type: none"> 67 mg/dl (28, 14.7%) 102 mg/dl (114, 59.7%) 126 mg/dl (43, 22.5%) 185 mg/dl (4, 2.1%) <p>Missing responses (2, 1.0%)</p>
<p>Provided there is the appropriate number of clinicians to assist, which is the best evidence-based method of spine-boarding for an athlete that is prone?</p> <ol style="list-style-type: none"> 8+ lift (79, 41.4%) Log roll (62, 32.5%) Prone log roll push (15, 7.8%) Prone log roll pull (33, 17.3%) <p>Missing responses (2, 1.0%)</p>
<p>The proportion of people with a positive diagnostic test who do actually have the disease (or injury)</p> <ol style="list-style-type: none"> Positive predictive value (37, 19.4%) Positive probability (9, 4.7%) True positive (135, 70.7%) Prevalence (6, 3.1%) <p>Missing responses (4, 2.1%)</p>

Figure 1. Items Deemed Too Difficult During the Item Difficulty Analysis

CONCLUSIONS

Medical specialties have determined that neither recertification nor singularly self-directed approaches to maintaining competence have been effective at mitigating errors in patient care. As such, a multi-faceted approach that includes an assessment of cognitive competence has been used. Although we are not suggesting we use a knowledge assessment as a means to recertify, we do believe the process is consistent with the move toward the practice improvement processes currently being integrated into medical specialties. Our current processes in athletic training are neither measuring nor ensuring maintenance of competence. We have developed a valid and reliable pool of items and entire tool that represent the domains of athletic training practice. Future research should focus on developing and validating additional items so that the test can be consistent with the BOC Certification distribution of items by domain. In the big picture, we should also consider incorporating a comprehensive knowledge assessment, in conjunction with other measures of professionalism and competence to better maintain competence in athletic trainers. In the meantime, to influence CE planning behavior, we should use a knowledge assessment to more objectively guide CE activities.

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