

## Examination Review for 2009-10 Testing Year

### Board of Certification (BOC) Certification Examination for Athletic Trainers

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**Prepared for:**

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## Introduction

The Board of Certification (BOC) is a nonprofit credentialing agency that provides certification for the athletic training profession. The BOC was incorporated in 1989 to govern the certification program, which had then existed for nearly 20 years for entry-level athletic trainers and recertification standards for certified athletic trainers (AT). The entry-level certification program is designed to establish a common benchmark for entry into the athletic training profession. The BOC serves the public interest by developing, administering, and continually reviewing a certification process that reflects current standards of practice in athletic training.

In order to develop a credible and valid examination, the BOC contracts with Castle Worldwide, Inc. (Castle), a certification and licensure design, development, and administration service company, to develop and review the form and item statistics for the currently administered BOC examinations. Castle follows and recommends widely accepted standards and regulations (e.g., *Standards for Educational and Psychological Testing*, American Educational Research Association, 1999; *Uniform Guidelines on Employee Selection Procedures*, EEOC, 1978; *Standards for the Accreditation of Certification Programs*, National Commission for Certifying Agencies, 2005) for the development and analysis of the BOC examination.

The aim of BOC's certification is to establish that individuals have the skills and knowledge necessary to create and implement safe and effective athletic training services. The examinations are designed to test an individual's knowledge across the practice of athletic training based on a defined test blueprint.

In order to attain certification, an individual must complete an entry-level athletic training education program accredited by the Commission on Accreditation of Athletic Training Education (CAATE) and pass the BOC certification exam. In order to qualify as a candidate for the BOC certification exam, an individual must meet the following requirements:

- Endorsement of the exam application by the recognized Program Director (PD) of the CAATE accredited education program.
- Proof of current certification in emergency cardiac care (ECC) (*Note: ECC certification must be current at the time of initial application and any subsequent exam retake registration.*)

The BOC testing year runs from March 1 to February 28/29 of the following year. The BOC offers candidates five two-week testing windows during the testing year: March/April, May/June, July/August, November, and January/February. During each testing window, two forms of the examination are delivered. These two forms consist of items in common with an anchor form. Candidates who fail are not restricted in their retakes during the testing year.

### *Field-Testing and Scoring*

Part 1 of each test form contains 30 field-test items. In March/April and May/June 2009, these items included traditional multiple-choice items placed throughout the 125 scored items. Beginning in August 2009, part 1 included 15 traditional multiple-choice items placed throughout the 125 scored items, as well as 15 field-test items placed at the end of each set of five-option multiple-choice items (item locations 141 to 155). Each form contained two field-test FT of five items each (item locations 141 to

150), followed by five field-test alternative item types not associated with a testlet (item locations 151 to 155). All alternative items and focused testlets were unscored.

#### *Number of Test Forms*

Two core multiple-choice sections of 125-scored items (form family A and B) were assigned six different experimental sets for the year, creating 12 different test forms. The two sets of 125-scored items had 65 items (52%) in common.

In March/April 2009, two of the forms (3618 and 3619) contained five additional experimental items, administered to a small group of candidates. These forms are reported separately.

Test forms in form family A were administered in March/April and November 2009. Form family B test forms were administered in May/June and July/August 2009 as well as January/February 2010.

#### *Equating Test Forms*

Upon introduction of a new test form, the performance of candidates on the new form is equated to performance of candidates on a prior test form. The BOC equating follows the protocols for *common items non-equivalent groups design* using the Levine True Score Method Applied to Observed Scores using internal anchors (Kolen & Brennan, 2004). This design compares the performance of one group of test takers on one examination form to another group of test takers on an earlier examination form with a known cut-score. Ultimately, all equating is compared to the performance standard established for the base form (342) used for the current role delineation/practice analysis.

#### *Use of Scale Scores*

Since examination versions are possibly of different difficulty, providing raw scores can be misleading. As a result, many programs, including the ACT® and SAT® examinations, use scale scores. Scale scores are particularly useful at providing the basis for long-term, meaningful comparisons of results across different administrations of an examination.

Scale scores are used because, over the life of every testing program, there are situations when changes in test length occur, for example, when a decision is made to assess more or fewer areas; when the numbers of items that are scored versus experimental (field-test) changes; or different examination versions of different difficulty are being compared.

For scale scores, the passing standard (number correct) on any examination version is always reported as the same scale score.

The equated scores for the BOC examination are converted via linear transformation so that the cut-score for all test forms are reported to candidates as 500 on a scale of 200 to 800.

## ANALYSIS OF THE EXAMINATION

This section is broken into a number of parts. The first section provides a review of candidate performance for three different cohorts of candidates. The last section details form-level statistics for the examination program.

### *Candidate Performance*

Statistics reported refer to the performance of 'analyzed' candidates. Statistical reports are generated for a particular time (e.g., an examination window). Some candidates are excluded from the pool of analyzed data, specifically those candidates who completed less than 25% of their examinations. It is likely that such candidates experienced problems such as being late to the site or other issues, and therefore, their data is problematic. As of 2007, the three cohorts of candidates reported for the BOC examinations are:

1. First-time candidates – candidates reported as first-time test takers and/or recent college graduates from athletic training education programs accredited by the CAATE.
2. Retakes – candidates who re-sat the examination one or more times.
3. All – candidates who tested.

### *Candidates Excluded from this Report*

The report does not include, except where noted, those candidates who were administered the examination via paper-and-pencil or those candidates with incomplete data. As a result, the number of candidates analyzed for this report may not match the number of candidates who took the BOC athletic trainer examination. Data from previous years may only include two of the three cohort groups.

Data prior to the introduction of the two-part examination (April 2007) are excluded from the remainder of this report, except where noted, because the program used to assess candidates is not equivalent to the revised BOC testing program.

There were 6,171 analyzable administrations of the BOC examination in 2009-10. This total was similar to the number of administrations for the previous test year, 2008-09 (6,135).

Of the 6,171 results analyzed, 2,854 (46%) were administered to first-time candidates, consistent with 2008-09.

### *Pass Rates*

In 2005-06, new test specifications and the associated passing standard were introduced. All later forms of the examination are equated back to this standard.

In 2005-06 and 2006-07, the BOC examination consisted of three components (simulation, multiple-choice, and practical), of which candidates were required to pass all three elements. From 2007-08 onward, candidates were required to pass one test administration as documented above (part 1 and part 2). Table 1 provides annual pass rates for BOC administrations from 2005-06, but only reports the pass rates for 2005-06 and 2006-07 that are associated with the multiple-choice element.

**Table 1:** Number of Candidates in Three Cohorts and Pass Rate for BOC Examinations, 2005-06 to 2009-10 (2005-06 and 2006-07 are for the Multiple-Choice Element Only).

| Year    | First-time | Pass  | % Pass | Retake | Pass  | % Pass | All   | Pass  | % Pass |
|---------|------------|-------|--------|--------|-------|--------|-------|-------|--------|
| 2005-06 | 2,074      | 968   | 46.7%  | 3,017  | 660   | 21.9%  | 5,091 | 1,628 | 32.0%  |
| 2006-07 | 2,322      | 1,125 | 48.4%  | 3,549  | 1,076 | 30.3%  | 5,871 | 2,201 | 37.5%  |
| 2007-08 | 1,495      | 584   | 39.1%  | 3,196  | 1,073 | 33.6%  | 4,691 | 1,657 | 35.3%  |
| 2008-09 | 2,762      | 1,423 | 51.5%  | 3,373  | 1,035 | 30.7%  | 6,135 | 2,458 | 40.1%  |
| 2009-10 | 2,852      | 1,235 | 43.3%  | 3,319  | 1,120 | 33.7%  | 6,171 | 2,355 | 38.2%  |

For 2005-06 and 2006-07, the three-component examination resulted in a pass rate for first-item test takers of 26.2% in 2005-06 and 31.5% in 2006-07. This was substantially lower than the pass rates for the combined examination protocol used since 2007-08.

A test of proportions indicated that the pass rate for all examinations administered in 2009-10 is significantly higher than the percentage that passed the 2007-08 examination ( $z=2.16$ ,  $p < .05$ ), but significantly lower than 2008-09 ( $z=6.08$ ,  $p < .05$ ). The pass rate for retake candidates is significantly higher for 2009-10 than the previous year ( $z=2.63$ ,  $p < .05$ ). Table 2 details the pass rates for each form by testing window.

**Table 2:** Passing Rates for Each Test Form for All Candidates for BOC Examinations, 2009-10.

| Form                    | Frequency    |              |              | Percent      |              |
|-------------------------|--------------|--------------|--------------|--------------|--------------|
|                         | Fail         | Pass         | Total        | Fail         | Pass         |
| 3618                    | 59           | 22           | 81           | 72.8%        | 27.2%        |
| 3619                    | 42           | 28           | 70           | 60.0%        | 40.0%        |
| 3620                    | 570          | 297          | 867          | 65.7%        | 34.3%        |
| 3621                    | 569          | 258          | 827          | 68.8%        | 31.2%        |
| <i>March/April</i>      | <i>1,240</i> | <i>605</i>   | <i>1,845</i> | <i>67.2%</i> | <i>32.8%</i> |
| 3622                    | 425          | 417          | 842          | 50.5%        | 49.5%        |
| 3623                    | 410          | 419          | 829          | 49.5%        | 50.5%        |
| <i>May/June</i>         | <i>835</i>   | <i>836</i>   | <i>1,671</i> | <i>50.0%</i> | <i>50.0%</i> |
| 3624                    | 330          | 152          | 482          | 68.5%        | 31.5%        |
| 3625                    | 338          | 178          | 516          | 65.5%        | 34.5%        |
| <i>July/August</i>      | <i>668</i>   | <i>330</i>   | <i>998</i>   | <i>66.9%</i> | <i>33.1%</i> |
| 3626 <sup>i</sup>       | 364          | 130          | 494          | 73.7%        | 26.3%        |
| 3627                    | 342          | 161          | 503          | 68.0%        | 32.0%        |
| <i>November</i>         | <i>706</i>   | <i>291</i>   | <i>997</i>   | <i>70.8%</i> | <i>29.2%</i> |
| 3626 <sup>ii</sup>      | 2            | 1            | 3            | 66.7%        | 33.3%        |
| 3628                    | 173          | 155          | 328          | 52.7%        | 47.3%        |
| 3629                    | 192          | 137          | 329          | 58.4%        | 41.6%        |
| <i>January/February</i> | <i>367</i>   | <i>293</i>   | <i>660</i>   | <i>55.6%</i> | <i>44.4%</i> |
| <b>ALL</b>              | <b>3,816</b> | <b>2,355</b> | <b>6,171</b> | <b>61.8%</b> | <b>38.2%</b> |

### *Distribution of Candidate Scores*

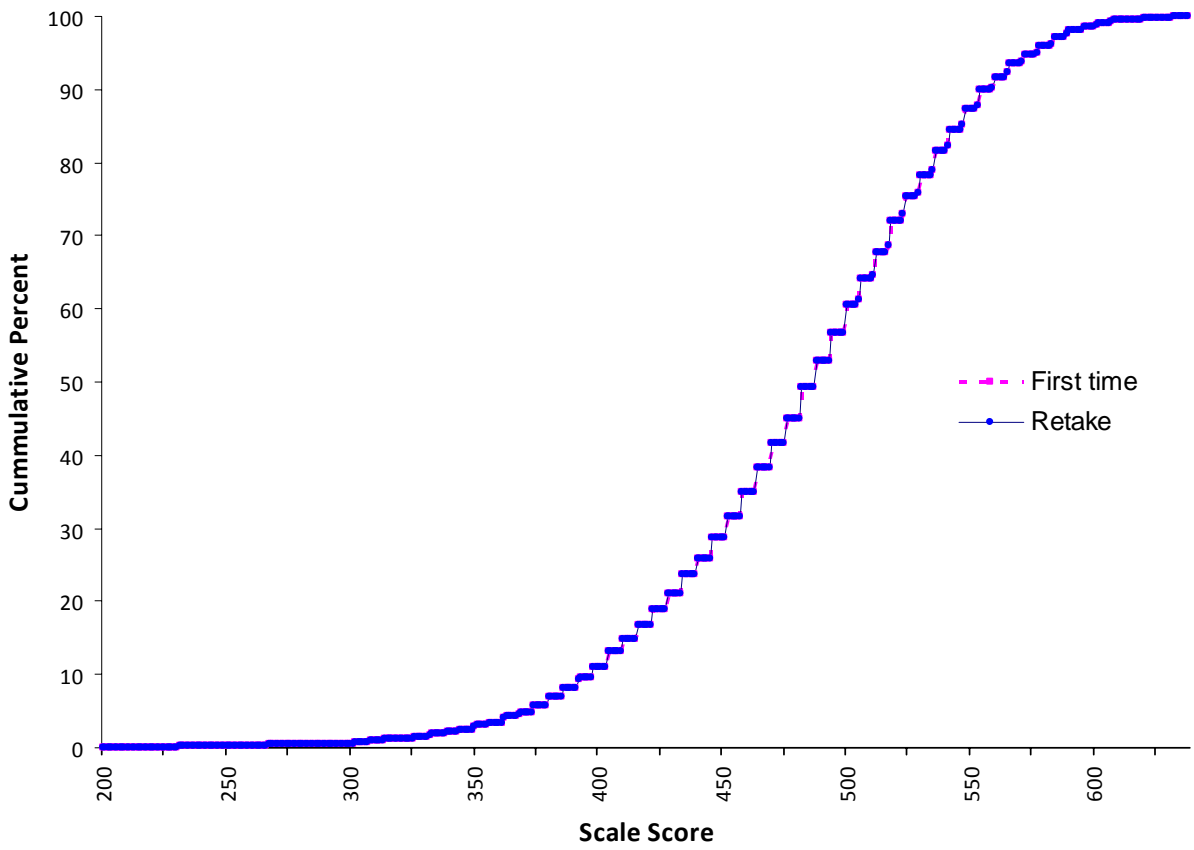
Table 3 details the overall scale score performance for the program for 2009-10 with a comparison the performance of 2008-09 candidates.

**Table 3:** Number of Candidates in Three Cohorts, Minimum, Maximum and Average Scaled Score, Median and Mode Scaled Score, and Standard Deviation (Scaled Score) for BOC Examinations, 2009-10.

| Cohort      | N     | Avg. | Median | Std. Dev. | Min | Max |
|-------------|-------|------|--------|-----------|-----|-----|
| First-time  | 2,852 | 481  | 488    | 63        | 200 | 638 |
| Retake      | 3,319 | 471  | 476    | 53        | 230 | 620 |
| All 2009-10 | 6,171 | 476  | 482    | 58        | 200 | 638 |
| All 2008-09 | 6,135 | 473  | 476    | 79        | 200 | 686 |

Similar to 2007-08 and 2008-09, a Univariate General Linear Model (GLM) test determined that there was a statistically significant, but very small, difference in the scaled scores of retake and first-time candidates [ $F(1, 6169) = 48.25, p < .001, \eta = .01$ ]. First-time candidates scored on average 10 scale points higher than retake candidates (481 compared to 471).

For 2009-10, the score distributions of first-time and retake candidates were almost identical despite this small statistical difference. This was confirmed by an examination of the distribution of scaled scores for first-time and retake candidates for whom no difference in the score distributions can be noted (Figure 1).



**Figure 1:** Cumulative Percentage of First-time New Graduates and Retake Candidates by Scaled Score, BOC 2009-10.

*Test Form Summary Statistics*

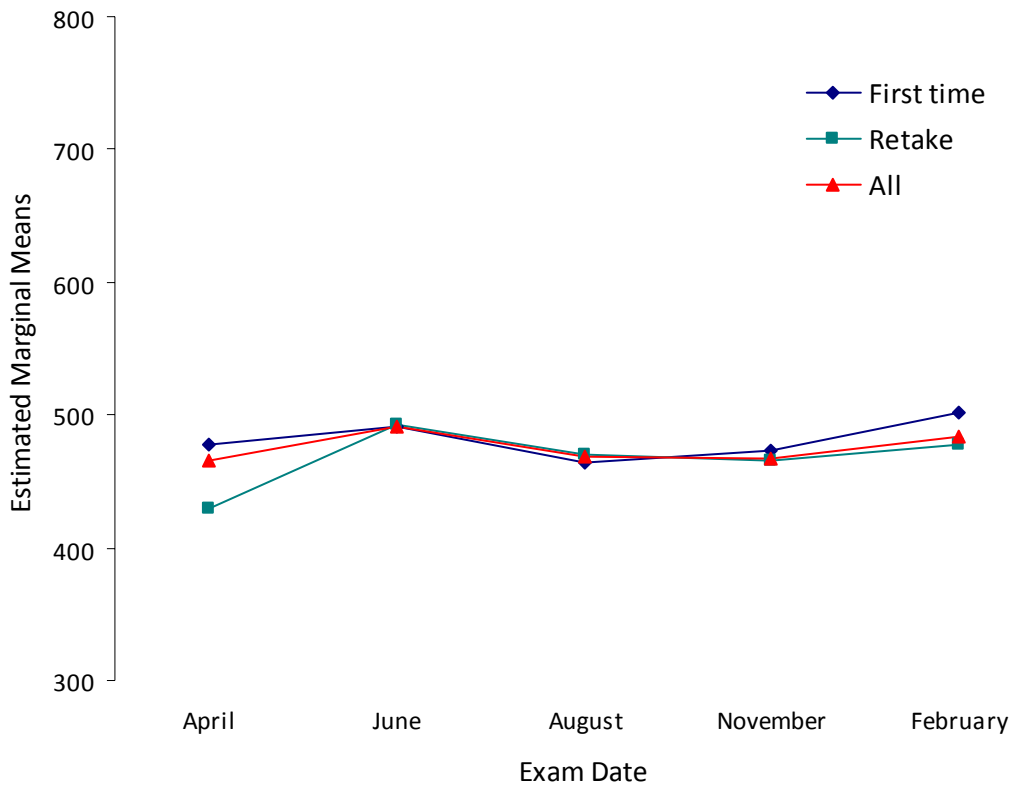
Table 4 provides form descriptive statistics for each test administration period.

**Table 4:** Summary Test Form Statistics in Scaled Scores for All Candidates for BOC Examinations, 2009-10.

| Exam                    | N           | Mean       | Median     | Std. Dev. | Min        | Max        |
|-------------------------|-------------|------------|------------|-----------|------------|------------|
| 3618                    | 81          | 466        | 458        | 61        | 350        | 626        |
| 3619                    | 70          | 481        | 488        | 57        | 308        | 590        |
| 3620                    | 867         | 465        | 470        | 63        | 200        | 620        |
| 3621                    | 827         | 466        | 470        | 60        | 230        | 614        |
| <i>March/April</i>      | <i>1845</i> | <i>466</i> | <i>470</i> | <i>61</i> | <i>200</i> | <i>626</i> |
| 3622                    | 842         | 493        | 494        | 53        | 302        | 638        |
| 3623                    | 829         | 491        | 500        | 60        | 248        | 638        |
| <i>May/June</i>         | <i>1671</i> | <i>492</i> | <i>500</i> | <i>56</i> | <i>248</i> | <i>638</i> |
| 3624                    | 482         | 466        | 470        | 56        | 231        | 613        |
| 3625                    | 516         | 471        | 476        | 57        | 249        | 619        |
| <i>July/August</i>      | <i>998</i>  | <i>469</i> | <i>470</i> | <i>57</i> | <i>231</i> | <i>619</i> |
| 3626                    | 494         | 465        | 470        | 53        | 248        | 631        |
| 3627                    | 503         | 471        | 476        | 54        | 225        | 607        |
| <i>November</i>         | <i>997</i>  | <i>467</i> | <i>476</i> | <i>54</i> | <i>225</i> | <i>631</i> |
| 3626                    | 3           | 462        | 482        | 56        | 398        | 505        |
| 3628                    | 328         | 485        | 494        | 52        | 315        | 600        |
| 3629                    | 329         | 482        | 488        | 54        | 321        | 631        |
| <i>January/February</i> | <i>660</i>  | <i>483</i> | <i>488</i> | <i>53</i> | <i>315</i> | <i>631</i> |
| <b>ALL</b>              | <b>6171</b> | <b>476</b> | <b>482</b> | <b>58</b> | <b>200</b> | <b>638</b> |

As shown in Table 4, there appears to be some difference in the scaled scores for each month and for each form. A statistical test (a Univariate General Linear Model) was undertaken to examine whether there was any statistical difference in the scaled scores for candidates based on the month they tested, whether they were retake or first-time candidates, and the form they received. There was a significant, though small, interaction between the candidate's month and retake status [ $F(4,6161) = 101.43$ ,  $p < .05$ ,  $\eta = .06$ ]. The major difference was in the month the candidate took the examination [ $F(4,6161) = 49.05$ ,  $p < .05$ ,  $\eta = .03$ ]. As with previous years, first-time candidates who took the examination earlier in 2009 or 2010 outperformed other candidates. (See Figure 2 for comparison of scale score means.)





**Figure 2:** Scale Score Means for First-time, Retake, and All Candidates for Each of Five Testing Windows, BOC 2009-10.

*Difficulty and Discrimination*

Average difficulty and discrimination was computed for all test forms. Table 5 contains the average, minimum, and maximum values for difficulty and discrimination.

**Table 5:** Average Difficulty and Discrimination Statistics for Each Test Form for All Candidates for BOC Examinations, 2009-10.

| Test Form  | Statistic             | Number of Candidates | Average     | Min          | Max         |
|------------|-----------------------|----------------------|-------------|--------------|-------------|
| 3618       | Difficulty            | 81                   | 0.70        | 0.06         | 1.00        |
|            | Discrimination        | 81                   | 0.21        | -0.21        | 0.54        |
| 3619       | Difficulty            | 70                   | 0.72        | 0.07         | 1.00        |
|            | Discrimination        | 70                   | 0.18        | -0.30        | 0.51        |
| 3620       | Difficulty            | 867                  | 0.70        | 0.06         | 0.99        |
|            | Discrimination        | 867                  | 0.22        | -0.06        | 0.50        |
| 3621       | Difficulty            | 827                  | 0.70        | 0.05         | 0.99        |
|            | Discrimination        | 827                  | 0.20        | -0.18        | 0.41        |
| 3622       | Difficulty            | 842                  | 0.70        | 0.23         | 0.99        |
|            | Discrimination        | 842                  | 0.17        | -0.21        | 0.42        |
| 3623       | Difficulty            | 829                  | 0.70        | 0.24         | 1.00        |
|            | Discrimination        | 829                  | 0.21        | -0.13        | 0.46        |
| 3624       | Difficulty            | 482                  | 0.66        | 0.06         | 0.99        |
|            | Discrimination        | 482                  | 0.18        | -0.17        | 0.39        |
| 3625       | Difficulty            | 516                  | 0.67        | 0.05         | 1.00        |
|            | Discrimination        | 516                  | 0.19        | -0.08        | 0.46        |
| 3626       | Difficulty            | 494                  | 0.66        | 0.04         | 0.99        |
|            | Discrimination        | 494                  | 0.18        | -0.15        | 0.43        |
| 3627       | Difficulty            | 503                  | 0.67        | 0.04         | 1.00        |
|            | Discrimination        | 503                  | 0.19        | -0.03        | 0.42        |
| 3628       | Difficulty            | 328                  | 0.69        | 0.22         | 0.99        |
|            | Discrimination        | 328                  | 0.17        | -0.04        | 0.46        |
| 3629       | Difficulty            | 329                  | 0.69        | 0.21         | 1.00        |
|            | Discrimination        | 329                  | 0.19        | -0.07        | 0.53        |
| <b>ALL</b> | <b>Difficulty</b>     | <b>6,169</b>         | <b>0.69</b> | <b>0.04</b>  | <b>1.00</b> |
|            | <b>Discrimination</b> | <b>6,169</b>         | <b>0.20</b> | <b>-0.17</b> | <b>0.54</b> |

Analysis was conducted on the difficulty and discrimination statistics obtained for the first large-scale administration of each of the two sets of 125-scored items (forms 3620 and 3622). A Multivariate GLM using Wilks' criterion test showed no significant difference in the discrimination between the two sets of 125-scored items [ $F(1, 248) = 0.10, p = 0.75, \eta = 0.00$ ]. Discrimination was statistically different [ $F(1, 248) = 6.06, p = 0.02, \eta = 0.69$ ], with the 125 scored items on form 3620 being slightly more discriminating than the scored items on form 3622.

Overall throughout the year, discrimination statistics for the items were within an acceptable range of 0.1 to 0.3. Average difficulty for the forms was slightly high for a five-option multiple-choice examination (ideally it should be around 0.6).

### *Domain Performance*

Test validity is a concept that refers to how well a test measures what it is designed to measure. Test forms for the BOC examinations were constructed according to test specifications that were based on the results of a role delineation study completed in 2004. This study was undertaken to define the job-related activities, knowledge, and skills required of entry-level athletic trainers. To ensure that test items account for the content areas presented in the test specifications, each item has been classified by content experts according to its application to the practice domains and tasks of the role delineation study.

Each multiple-choice test item has been linked to a specific content area of the test specifications, and items meet minimum standards of criticality to entry-level work as an athletics trainer. Thus, the procedures used to construct the test support the inference that the test has been built to achieve its stated purpose. Consistent with the objectives of the BOC examination program, the test is designed to separate candidates into two distinct groups: candidates whose knowledge and skill levels are deemed acceptable for entry-level certification as a practitioner and candidates whose level of knowledge falls below the minimum requirements for certification. The BOC examinations are not intended as predictors of future success within the profession.

There are six performance domains in the content framework for the BOC examination, consistent with the role delineation study upon which the examination is based (2004). The domains are *Prevention; Clinical Evaluation and Diagnosis; Immediate Care; Treatment, Rehabilitation, and Reconditioning; Organization and Administration; and Professional Responsibility*. Table 6 reports descriptive statistics at the domain level for the multiple-choice/part 1 examinations using raw score.

**Table 6:** Multiple-Choice/Part 1 Portion Domain Level Statistics for Each Test Form for All Candidates for BOC Examinations, 2009-10 (Based on Raw Scores).

| Form | Statistic      | Prevention | Clinical Evaluation and Diagnosis | Immediate Care | Treatment Rehabilitation and Reconditioning | Organization and Administration | Professional Responsibility |
|------|----------------|------------|-----------------------------------|----------------|---|---------------------------------|-----------------------------|
| 3618 | N              | 81         |                                   |                |   |                                 |                             |
|      | Minimum        | 7          | 15                                | 11             | 11  | 6                               | 1                           |
|      | Maximum        | 18         | 29                                | 22             | 28  | 14                              | 10                          |
|      | Mean           | 11.8       | 21.7                              | 16.7           | 18.8  | 10.7                            | 7.4                         |
|      | Std. Deviation | 2.3        | 3.5                               | 2.5            | 3.7   | 1.6                             | 1.6                         |
|      |                |            |                                   |                |   |                                 |                             |
| 3619 | N              | 70         |                                   |                |   |                                 |                             |
|      | Minimum        | 8          | 9                                 | 9              | 11  | 8                               | 3                           |
|      | Maximum        | 17         | 28                                | 21             | 27  | 14                              | 10                          |
|      | Mean           | 12.6       | 22.9                              | 16.5           | 19.3  | 11.2                            | 7.4                         |
|      | Std. Deviation | 2.1        | 3.5                               | 2.6            | 3.5   | 1.4                             | 1.7                         |
|      |                |            |                                   |                |   |                                 |                             |
| 3620 | N              | 867        |                                   |                |   |                                 |                             |
|      | Minimum        | 3          | 8                                 | 7              | 5   | 3                               | 2                           |
|      | Maximum        | 19         | 29                                | 22             | 27  | 14                              | 11                          |
|      | Mean           | 12.1       | 21.8                              | 16.2           | 18.5  | 10.7                            | 7.5                         |
|      | Std. Deviation | 2.4        | 3.6                               | 2.6            | 3.5   | 1.8                             | 1.6                         |
|      |                |            |                                   |                |   |                                 |                             |
| 3621 | N              | 827        |                                   |                |   |                                 |                             |
|      | Minimum        | 4          | 8                                 | 8              | 7   | 3                               | 2                           |
|      | Maximum        | 18         | 29                                | 22             | 28  | 14                              | 11                          |
|      | Mean           | 12.2       | 21.9                              | 16.2           | 18.5  | 10.7                            | 7.6                         |
|      | Std. Deviation | 2.3        | 3.4                               | 2.6            | 3.4   | 1.8                             | 1.6                         |
|      |                |            |                                   |                |   |                                 |                             |
| 3622 | N              | 842        |                                   |                |   |                                 |                             |
|      | Minimum        | 5          | 12                                | 7              | 10  | 3                               | 2                           |
|      | Maximum        | 19         | 29                                | 22             | 27  | 14                              | 10                          |
|      | Mean           | 13.2       | 22.5                              | 16.2           | 18.5  | 10.5                            | 6.9                         |
|      | Std. Deviation | 2.2        | 3.3                               | 2.6            | 3.2   | 1.7                             | 1.4                         |
|      |                |            |                                   |                |   |                                 |                             |
| 3623 | N              | 829        |                                   |                |   |                                 |                             |
|      | Minimum        | 5          | 8                                 | 5              | 7   | 3                               | 2                           |
|      | Maximum        | 19         | 30                                | 22             | 28  | 14                              | 10                          |
|      | Mean           | 13.1       | 22.4                              | 16.0           | 18.4  | 10.5                            | 7.0                         |
|      | Std. Deviation | 2.3        | 3.4                               | 2.8            | 3.6   | 1.8                             | 1.4                         |
|      |                |            |                                   |                |   |                                 |                             |
| 3624 | N              | 482        |                                   |                |   |                                 |                             |
|      | Minimum        | 5          | 8                                 | 6              | 4   | 3                               | 3                           |
|      | Maximum        | 18         | 29                                | 21             | 26  | 14                              | 11                          |
|      | Mean           | 11.6       | 20.9                              | 15.4           | 17.3  | 10.4                            | 7.3                         |
|      | Std. Deviation | 2.2        | 3.5                               | 2.6            | 3.3   | 1.8                             | 1.7                         |
|      |                |            |                                   |                |   |                                 |                             |

| Form       | Statistic             | Prevention   | Clinical Evaluation and Diagnosis | Immediate Care | Treatment Rehabilitation and Reconditioning | Organization and Administration | Professional Responsibility |
|------------|-----------------------|--------------|-----------------------------------|----------------|---|---------------------------------|-----------------------------|
| 3625       | N                     | 516          |                                   |                |   |                                 |                             |
|            | Minimum               | 4            | 7                                 | 8              | 7   | 3                               | 2                           |
|            | Maximum               | 18           | 29                                | 22             | 26  | 14                              | 11                          |
|            | Mean                  | 11.8         | 21.1                              | 15.5           | 17.4  | 10.5                            | 7.3                         |
|            | Std. Deviation        | 2.3          | 3.5                               | 2.7            | 3.3   | 1.8                             | 1.6                         |
| 3626       | N                     | 494          |                                   |                |   |                                 |                             |
|            | Minimum               | 4            | 12                                | 5              | 6   | 3                               | 3                           |
|            | Maximum               | 19           | 28                                | 21             | 25  | 14                              | 11                          |
|            | Mean                  | 11.5         | 20.8                              | 15.5           | 17.2  | 10.2                            | 7.3                         |
|            | Std. Deviation        | 2.2          | 3.3                               | 2.5            | 3.2   | 1.9                             | 1.5                         |
| 3627       | N                     | 503          |                                   |                |   |                                 |                             |
|            | Minimum               | 4            | 5                                 | 7              | 7   | 4                               | 2                           |
|            | Maximum               | 18           | 29                                | 22             | 27  | 14                              | 11                          |
|            | Mean                  | 11.8         | 21.1                              | 15.7           | 17.1  | 10.4                            | 7.5                         |
|            | Std. Deviation        | 2.2          | 3.4                               | 2.6            | 3.3   | 1.8                             | 1.6                         |
| 3628       | N                     | 328          |                                   |                |   |                                 |                             |
|            | Minimum               | 5            | 10                                | 8              | 11  | 4                               | 3                           |
|            | Maximum               | 18           | 29                                | 21             | 27  | 14                              | 10                          |
|            | Mean                  | 13.1         | 22.2                              | 15.7           | 18.1  | 10.5                            | 7.0                         |
|            | Std. Deviation        | 2.0          | 3.5                               | 2.6            | 3.1   | 1.7                             | 1.3                         |
| 3629       | N                     | 329          |                                   |                |   |                                 |                             |
|            | Minimum               | 8            | 9                                 | 8              | 8   | 2                               | 3                           |
|            | Maximum               | 19           | 30                                | 21             | 25  | 14                              | 10                          |
|            | Mean                  | 13.0         | 22.2                              | 15.6           | 17.6  | 10.4                            | 7.1                         |
|            | Std. Deviation        | 2.1          | 3.4                               | 2.5            | 3.3   | 1.8                             | 1.5                         |
| <b>All</b> | <b>N</b>              | <b>6171</b>  | <b>6171</b>                       | <b>6171</b>    | <b>6171</b>                                 | <b>6171</b>                     | <b>6171</b>                 |
|            | <b>Minimum</b>        | <b>3</b>     | <b>5</b>                          | <b>5</b>       | <b>4</b>                                    | <b>2</b>                        | <b>1</b>                    |
|            | <b>Maximum</b>        | <b>19</b>    | <b>30</b>                         | <b>22</b>      | <b>28</b>                                   | <b>14</b>                       | <b>11</b>                   |
|            | <b>Mean</b>           | <b>12.35</b> | <b>21.78</b>                      | <b>15.89</b>   | <b>18.03</b>                                | <b>10.55</b>                    | <b>7</b>                    |
|            | <b>Std. Deviation</b> | <b>2.36</b>  | <b>3.48</b>                       | <b>2.65</b>    | <b>3.41</b>                                 | <b>1.81</b>                     | <b>1.56</b>                 |

Correlations in candidate performance between the six domains ranged from 0.18 to 0.50, indicating that the domains were assessing somewhat different constructs. These correlations are consistent with the results obtained for 2008-09.

*Test Form Internal Reliabilities*

Reliability is assessed using the Brennan-Kane statistic (Brennan & Kane, 1977), a measure typically used for estimating decision consistency for criterion referenced tests, and the Standard Error of Measurement (presented in Scale Score units). The Brennan-Kane reliability estimate accounts for the more constrained dispersion of candidate scores and the use of a passing standard and is consistent with reporting standards for accreditation purposes (Table 7).

**Table 7:** Internal Reliability Estimates for Multiple-Choice Section for Each Test Form for All Candidates for BOC Examinations, 2009-10.

| Form       | N           | Std. Error   | Brennan-Kane Estimate |
|------------|-------------|--------------|-----------------------|
| 3618       | 81          | 8.19         | 0.98                  |
| 3619       | 69          | 8.05         | 0.98                  |
| 3620       | 867         | 9.41         | 0.98                  |
| 3621       | 827         | 8.92         | 0.98                  |
| 3622       | 841         | 9.43         | 0.97                  |
| 3623       | 828         | 10.32        | 0.97                  |
| 3624       | 482         | 12.70        | 0.95                  |
| 3625       | 516         | 12.79        | 0.95                  |
| 3626       | 497         | 11.43        | 0.95                  |
| 3627       | 504         | 12.60        | 0.95                  |
| 3628       | 328         | 13.98        | 0.93                  |
| <b>ALL</b> | <b>6169</b> | <b>10.97</b> | <b>0.96</b>           |

Data presented in Table 7 show that the multiple-choice portion for each testing window meets general guidelines for a Brennan Kane statistics of greater than 0.70 and is consistent with previous years. Standard Errors of Measurement also are consistent with previous years.

*Summary test form data*

Data presented in the following table summarizes the performance of the test forms used for the BOC examination and is consistent with reporting requirements for NCCA/ICE Accreditation (Table 8). The data is also presented for each form family (A and B) that represents the common set of 125 scored items.

**Table 8:** Summary Statistics for the 2009-10 Administrations of BOC Athletic Trainer Test Forms.

| Form #               | Total # of Candidates Tested | % of Candidates Passing Each Form | Passing Point | Average Score | Standard Deviation | Standard Error of Measurement | Reliability Estimate | Total # of Items on Form |
|----------------------|------------------------------|-----------------------------------|---------------|---------------|--------------------|-------------------------------|----------------------|--------------------------|
| <b>Form Family A</b> |                              |                                   |               |               |                    |                               |                      |                          |
| 3618                 | 81                           | 27.2%                             | 500           | 466           | 61.2               | 8.19                          | 0.98                 | 160                      |
| 3619                 | 69                           | 39.1%                             | 500           | 481           | 56.9               | 8.05                          | 0.98                 | 160                      |
| 3620                 | 867                          | 34.3%                             | 500           | 465           | 63.3               | 9.41                          | 0.98                 | 155                      |
| 3621                 | 827                          | 31.2%                             | 500           | 466           | 59.8               | 8.92                          | 0.98                 | 155                      |
| 3626                 | 497                          | 26.4%                             | 500           | 465           | 52.8               | 12.70                         | 0.95                 | 155                      |
| 3627                 | 504                          | 32.1%                             | 500           | 471           | 54.4               | 12.79                         | 0.95                 | 155                      |
| Total A              | 2845                         | 31.5%                             |               | 467           | 58.8               | 10.22                         | 0.97                 |                          |
| <b>Form Family B</b> |                              |                                   |               |               |                    |                               |                      |                          |
| 3622                 | 841                          | 49.5%                             | 500           | 493           | 53.2               | 11.43                         | 0.97                 | 155                      |
| 3623                 | 828                          | 50.6%                             | 500           | 491           | 59.6               | 12.60                         | 0.97                 | 155                      |
| 3624                 | 482                          | 31.5%                             | 500           | 466           | 56.1               | 9.43                          | 0.95                 | 155                      |
| 3625                 | 516                          | 34.5%                             | 500           | 471           | 57.2               | 10.32                         | 0.95                 | 155                      |
| 3628                 | 328                          | 47.3%                             | 500           | 485           | 51.6               | 13.98                         | 0.93                 | 155                      |
| 3629                 | 329                          | 41.6%                             | 500           | 482           | 53.8               | 13.08                         | 0.94                 | 155                      |
| Total B              | 3324                         | 43.8%                             |               | 483           | 55.8               | 11.57                         | 0.96                 |                          |
| <b>TOTAL</b>         | <b>6169</b>                  | <b>38.2%</b>                      | <b>500</b>    | <b>476</b>    | <b>57.1</b>        | <b>11.20</b>                  | <b>0.96</b>          |                          |

Data presented Table 8 is in scale score units for passing point, average score, standard deviation, and standard error of measurement.

## Conclusion

Statistics concerning the quality of the BOC examination as a measurement device indicate that the examination complies with psychometric requirements that pertain to certification and licensure tests. Notably, estimates of reliability and equivalence across forms for the various parts of the examination are very strong. Likewise, candidate performance on all parts of the examination is consistent with the public protection mission of the BOC.

<sup>i</sup> One candidate was administered the form in paper-and-pencil format and was excluded from this analysis.

<sup>ii</sup> This form was administered to three candidates in paper-and-pencil format.

## REFERENCES

- American Educational Research Association, American Psychological Association, National Council on Measurement in Education (1999). *Standards for Educational and Psychological Testing*. Washington, D.C.: AERA.
- Brennan, R. L., & Kane, M. T. (1977). An index of dependability for mastery tests. *Journal of Educational Measurement, 14*, 277–289.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297–334.
- Equal Employment Opportunity Commission (EEOC), U.S. Civil Service Commission, U.S. Department of Labor, and U.S. Department of Justice. (1978). Uniform Guidelines on Employee Selection Procedures. *Federal Register, 43* (166), 38290-38315.
- Kolen, M.J., & Brennan, R.L. (2004) *Test Equating, Scaling and Linking: Methods and Practices Statistics for Social Science and Behavioral Sciences* (2 ed.). Springer-Verlag New York Inc.
- Kuder, G. F., & Richardson, M. W. (1937). The theory of the estimation of test reliability. *Psychometrika, 2*, 151–160.