Learning Outcomes Assessment Review
School of Optometry
University of Alabama at Birmingham

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Summary
The School of Optometry has a strong record of achievement on the National Board of Examiners in Optometry (NBEO) examination. This document examines student learning compared to national results for part I and II.

Background
The NBEO examination is one of two principal tools for the assessment of learning outcomes at The UAB School of Optometry. The other tool is a variety of Objective Standardized Clinical Examinations (OSCEs).

The NBEO examination consists of three parts that examine the entire curricular range of the School (Part I: Basic Science, Part II: Clinical Science and Part III, Patient Care). The typical student takes the NBEO examinations during the spring of the second year (Part I), summer of the third year (Part II) and winter of the fourth year (Part III).

The NBEO exam is developed by teams of content experts from all institutions of optometry across the country. Scoring is criterion referenced and is psychometrically sound. The NBEO exam is nationally recognized as the best, most careful and exhaustive assessment of student learning in optometry.

Methods
z-scores
This assessment uses z-scores as the principal assessment tool. A z-score is a reflection of the number of standard deviations that the UAB mean differs from the national mean and may be interpreted as noted in Table 1.

Table 1. Interpretation of z-scores.

<table>
<thead>
<tr>
<th>Z-SCORE</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>UAB mean greater than 97.7% of national scores</td>
</tr>
<tr>
<td>1</td>
<td>UAB mean greater than 84.1% of national scores</td>
</tr>
<tr>
<td>0.5</td>
<td>UAB mean greater than 69.2% of national scores</td>
</tr>
<tr>
<td>scores</td>
<td>0</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>-0.5</td>
<td>UAB mean less than 30.8% of national scores</td>
</tr>
<tr>
<td>-1</td>
<td>UAB mean less than 15.9% of national scores</td>
</tr>
</tbody>
</table>

The NBEO exam data may not be normally distributed. In this case, the use of z-scores is still likely to be a valid index of student performance. However, in any case where the data are not normally distributed, the z-score may not accurately reflect the proportion of national candidates above or below the score. Provided that the distributions vary in relatively consistent ways, z-scores are likely to be valid indices for comparing performance from one part to the other. Distributions are likely to be similar among different portions of a given topic part.

Z-scores are probably better indices of relative student performance on different parts of the NBEO exam in that they take into account the variability of the data. For example, if the UAB mean was 10 points above two different parts on an exam and the standard deviation was 5 in one case and 30 in the other case, the performance reflected by the mean difference is different. In case one, the UAB mean is two standard deviations above the national mean and indicates exceptional performance of the overall class. In the second case, the UAB score is only slightly above the overall national performance (1/6 standard deviation) and indicates very little difference from the national candidates.

**NBEO Exams Used in Analysis**

This analysis uses data from the April 1998-2002 NBEO exams for Part I. Data used in examining Part II comes from the December 1998-2002 NBEO exams. Some data is not available for all analysis as a result of changes in the exam content outline.

**Results**

**Part I**

**UAB performance on Part I.** Figure 1 demonstrates that UAB consistently scores above the national mean. Overall mean performance is 0.53 above the national mean (range 0.28 to 0.83).

Figure 1. UAB performance on NBEO Part I.
UAB performance on varying parts of the exam. Figure 2 indicates the School’s relative performance on the four different parts of the exam. The mean z-scores are 0.76, 0.37, 0.17 and 0.17 for Human Biology, Ocular/Visual Biology, Theoretical, Ophthalmic & PO and Psychology, respectively.

Figure 2. UAB performance vs. nation on different parts of exam I.

Performance on Human Biology, NBEO Part I. Figure 3 displays the relative performance of UAB vs. nation on the seven parts of the exam. For the period of 1998 to 2002, the z-scores range from 0.87 (General Pathology) to 0.29 (General Biochemistry).

Figure 3. UAB performance vs. nation, Human Biology portion.
Performance on Ocular/Visual Biology, NBEO Part I. Figure 4 displays the relative performance of UAB vs. nation on the four parts of the exam. For the period of 1998 to 2002, the z-scores range from 0.72 (Ocular Pharmacology) to -0.12 (Ocular/Visual Pathway).

Figure 4. UAB performance vs. nation, Ocular/Visual Biology portion.

Performance on Theoretical/Ophthalmic & PO, NBEO Part I. Figure 5 displays the relative performance of UAB vs. nation on the six parts of the exam. For the period of 1998 to 2002, the z-scores range from 0.29 (Ocular Motility) to 0.12 (Physical Optics).

Figure 5. UAB performance vs. nation, Theoretical/Ophthalmic & PO portion
Performance on Psychology, NBEO Part I. Figure 6 displays the relative performance of UAB vs. nation on the two parts of the Psychology exam. For the period of 1998 to 2002, the z-scores range from 0.21 (Psychophysical Methodology) to 0.08 (Human Development).

Figure 6. UAB performance vs. nation, Theoretical/ Ophthalmic & PO portion

**Part II**

UAB performance on Part II. Figure 7 demonstrates that UAB consistently scores above the national mean. Overall mean performance is 0.53 above the national mean (range 0.28 to 0.83).

Figure 7. UAB performance on NBEO Part II.
UAB performance on varying parts of the exam. Figure 8 indicates the School’s relative performance on the four different parts of the exam. The mean z-scores are 0.76, 0.37, 0.17 and 0.17 for Human Biology, Ocular/Visual Biology, Theoretical, Ophthalmic & PO and Psychology, respectively.

Figure 8. UAB performance vs. nation on different parts of exam II.

Analysis
Part I
Overall the School has consistently demonstrated strong performance on Part I with the mean z-score not being less than 0.28 in the past five years. Performance in different parts of the exam varies considerably. Human Biology scores are outstanding overall (median z-score 0.72). Even the weakest portion (General Biochemistry) of this section has a z-score of 0.29. Ocular/Visual Biology (median z-score 0.26) provides evidence of strong learning on Ocular Pharmacology (median z-score 0.72) and Ocular Physiology/Neurophysiology (median z-score 0.35). The scores for Anatomy of the Eye (median z-score 0.08) is less strong. The mean z-score for Ocular/Visual Pathway is -0.12. This is the only negative median score among the twenty-one parts to this exam. The median z-scores for Theoretical/Ophthalmic & PO as well as Psychology parts are less strong and are 0.26, 0.21, respectively. In the optics section, the median z-scores for Visual Optics and Physical Optics are lowest (0.13, 0.12, respectively). Human Development part demonstrated a median z-score of 0.08.

Figure X displays those areas that most differ from the overall UAB median over the period of 1998-2002.

Figure X. NBEO parts with greatest negative difference from UAB median z-score, 1998-2002.
Mean Difference from UAB Median z-score, 1998-2002

- Ophthalmic Optics
- Visual Optics
- Human Development
- Anatomy of the Eye et al.
- Ocular/Visual Pathway