Approximately 5 percent of candidates do not pass the Dental Hygiene National Board Examination (DHNBE) exam. While that percentage may not seem exceptionally high, the consequences to those who fail are significant. The DHNBE may be viewed as an examination of high stakes because it is necessary for licensure and for future employment. Consequently, any efforts to assist students in preparing for the DHNBE and to identify and counsel students at risk for failure are worth developing and evaluating.

To assist students in preparation for this high stakes test, the University of Texas Health Science Center at San Antonio (UTHSCSA) developed a Dental Hygiene National Board Review Workshop. The impetus for this workshop, begun in 1998, was a change in the DHNBE’s question format to include case studies. It was anticipated that this testing format would be unfamiliar to students, and the faculty wanted to assist them in preparing for this new testing approach.

The unique aspect of this workshop, which has drawn interest among dental hygiene faculty at other schools, is the use of a Mock Board examination to allow students to engage in a simulation of the DHNBE. The Mock Board is authentic in that it served as the American Dental Association Joint Commission on National Board Examination’s pilot exam when validating the format of the current DHNBE. Compilation of the exam results determined both the validity and reliability of the new board exam.

This pilot exam is now a Mock Board exam available for purchase from the American Dental Association. The use of the Mock Board for predicting performance on DHNBE has been documented in the dental hygiene education literature. The primary purposes of including the Mock Board in the workshop were to a) help students acclimate to the experience of taking a board exam, b) allow students to self-assess their level of preparation for the DHNBE, c) motivate students to study,
and d) help faculty identify students who were at risk for failing the DHNBE.

The UTHSCSA Dental Hygiene department has been using the test as a DHNBE preparation tool for four years. This article presents a critical look at the use of the Mock Board based on results from a formative evaluation. The objective is to assist faculty in other dental hygiene programs to decide whether to adopt the Mock Board in preparing their dental hygiene students for the DHNBE.

**Background**

In 1992, the Joint Commission on National Dental Examinations proposed to revise the structure of the DHNBE to include case studies. The purpose of restructuring the examination was to make the DHNBE more accurately reflect higher levels of knowledge (for example, problem-solving and critical thinking required in dental hygiene practice).4

In light of the new examination format, the UTHSCSA Dental Hygiene faculty designed a Dental Hygiene National Board Review Workshop to assist students in preparing for the new version of the DHNBE. Research indicates that coaching can enhance student performance on standardized exams.5 In a review of the literature on test preparation strategies, Flippo and Caverly concluded that coaching sessions can be effective if they include the following topics: study skills; content review by content experts; and test-taking strategies.6 The workshop included all of these topics, but the unique activity was the Mock Board approach to coaching students in test-taking strategies.

**Use of the Mock Board**

The Mock Board is comprised of 174 items: 100 stand-alone, multiple-choice questions and eight patient cases with 74 corresponding multiple-choice questions. The students are given four hours to complete the exam, half of the amount of time they spend in the DHNBE exam. The DHNBE consists of 350 questions: 200 are stand-alone multiple-choice questions and 150 are multiple-choice questions associated with twelve to fifteen patient cases.

Students take the Mock Board as the first activity in the review course. They then receive their scores before the next event, which is a two-hour workshop on test-taking strategies (such as how to locate clues in multiple-choice questions). Workshop faculty analyzed the Mock Board questions and assigned items to DHNBE subtest areas. Subtest scores were computed and included in the students’ Mock Board results, along with their total scores and a report on correct and incorrect items. Subtest scores allowed students to evaluate their areas of strengths and weaknesses. Students also were referred to a copy of the exam on reserve at the campus library, so they could review missed items.

In the “Test Strategies” session, students are presented with a scatterplot that pictorializes the relationship between UTHSCSA students’ performance on the Mock Board and the DHNBE, using data from all workshop participants since the inception of the workshop. The scatterplot graphically communicates to students the strong, statistically significant correlation (r=.63) that exists between the Mock Board and the DHNBE scores. The presenter highlights the large percentage of students who pass the DHNBE, but also indicates that those who fail the Mock Board are at higher risk of failing the DHNBE. The final message, however, is that many who failed the Mock Board still pass the DHNBE. The objective is to instill hope in all students, but also to alert them to concentrate their studies on areas that the Mock Board identified as weaknesses. The workshop also alerts students with very low Mock Board scores that they may need to increase their board preparation activities and possibly seek guidance from a faculty member.

The UTHSCSA dental hygiene faculty felt the Mock Board seldom indicated surprises about students: students who failed the Mock Board also struggled in their course work. However, faculty reported that students’ performance on the Mock Board helped convince students they were at risk and made them more open to counseling on test preparation.

**Evaluation of the Mock Board Experience**

The faculty collected data over the first four years of the workshop to evaluate the experience and validate the usefulness of the Mock Board as a preparation tool for the DHNBE. The primary purpose of the validation research was to explore the degree to which the Mock Board exam provided a reasonably similar experience to the DHNBE. The test valida-
tion process would allow faculty to know that students were not wasting their time or getting false feedback about their level of preparation for the DHNBE.

A database was developed comprised of Mock Board and DHNBE scores of all workshop participants from 1998 to 2001. Ninety-eight percent of the UTHSCSA graduating dental hygiene students from that time period participated in the workshops. This participation rate yielded a database of a Mock Board and DHNBE scores for 119 students. Their mean score on the Mock Board was 58.21 (standard deviation=7.71) and on the DHNBE, 82.13 (standard deviation=4.92).

The first step in establishing any test’s validity is to determine its reliability. Internal reliability estimates (KR-20) were generated for the Mock Board at each administration. The coefficients for the 1998, 1999, 2000, and 2001 classes were .79, .81, .93, and .74 respectively.

Two types of evidence support the content validity of the Mock Board. First, the fact that it was developed as a pilot for validating the current DHNBE supports its representativeness of the actual DHNBE content and item formats. Second, two workshop faculty members, also UTHSCSA dental hygiene instructors, reviewed the DHNBE on two separate occasions. They verified that the Mock Board content and item types are representative of the DHNBE.

The first assessment of the construct validity of the Mock Board was through a correlational analysis between the Mock Board and DHNBE scores. A statistically significant Pearson correlation of .63 was found. By Cohen’s7 standards, this constitutes a strong correlation, with 40 percent of students’ DHNBE scores predictable from their Mock Board scores.

A second assessment of construct validity was a sensitivity/specificity analysis to determine the Mock Board’s ability to predict students’ failure on the DHNBE. Because a number of factors affect students’ performance on boards, the Mock Board understandably would not have a perfect track record in predicting board performance. The researchers would have needed more predictors (such as cumulative GPA) to build a rigorous prediction model incorporating the Mock Board. However, it was necessary to explore, at some level, the Mock Board’s level of accuracy in predicting success to determine if it provided a valid DHNBE-preparation experience. To conduct a sensitivity/specificity analysis, workshop faculty developed a method to categorize students’ Mock Board exams into “pass-fail” categories. In 1998, they established a tentative cut score by examining the frequency distribution of the first workshop group’s scores. Faculty members predicted that students who missed 50 percent of the Mock Board questions might have difficulty passing the DHNBE. They then tested the prediction after the first group completed both the Mock Board and the DHNBE. Faculty then re-evaluated the 1998-2001 data using frequency data and Mock Board indices of measurement error and discovered a higher cut-score would capture more at-risk students. Therefore, a new cut score of 56 percent was established.

To conduct the sensitivity/specificity analysis, students’ Mock Board exams were classified as passing or failing using a cut score of 56 percent. Students’ DHNBE scores were classified into “pass” or “fail” categories using the DHNBE’s cut score of 75. The screening test was the Mock Board, and the condition screened was the “inability to pass the DHNBE.” Figure 1 shows the true and false positives and negatives of the test.

A valid screening test will be accurate in categorizing students as having or not having a particular condition or problem—in this case, those at high risk of failing the DHNBE. More importantly, it should identify most examinees with a specific problem, in this case, those at high risk of failing the DHNBE (high sensitivity), exclude examinees who do not have the problem (high specificity), and usually indicate when a problem exists (high positive predicted value).8 For this situation, a negative predicted value was also of particular interest, indicating the likelihood that those passing the Mock Board will also pass the DHNBE. The negative predicted value would allow workshop facilitators to show students their probability of passing the DHNBE given their passing of the Mock Board. The results of the analysis are summarized below.

Accuracy. The accuracy index indicates the proportion of students for whom the Mock Board accurately predicted success or failure on the DHNBE. The Mock Board correctly classified 75 percent of participants.

Sensitivity. Sensitivity refers to a screening test’s ability to identify an existing disease or condition. In this case, sensitivity was the proportion of students who failed the DHNBE and who were identified as being at risk by the Mock Board. The exam’s sensitivity was 100 percent, meaning no student who passed the Mock Board failed the DHNBE.
Specificity. Specificity refers to a test’s ability to correctly identify students who are not at risk for failing the DHNBE. The Mock Board’s specificity was the proportion of students who passed the Mock Board and also passed the DHNBE. The Mock Board’s specificity was 73 percent.

Positive predictive value. This index indicates the likelihood that students who failed the Mock Board would also fail the DHNBE. The Mock Board positive predictive value was 21 percent, meaning the majority of students who failed the Mock Board were still likely to pass the DHNBE.

Negative predictive value. This index shows the probability that a person who passes the Mock Board will pass the DHNBE. The negative predicted value was 100 percent.

The findings show that the Mock Board can correctly identify students’ risk status for almost 3/4 of the participants. However, the exam’s main weakness, as used in this setting, was its false positive rate. The Mock Board was much more useful in identifying students who were not at risk than identifying those at risk. This supports the analysis that taking the Mock Board allows students to better understand how their performance on the Mock Board relates to their likelihood of success on the DHNBE. These findings also emphasize to students that failure on the Mock Board does not guarantee failure on the DHNBE.

Student Evaluation of the Mock Board Experience

Student feedback about the experience of taking the Mock Board was collected through a short survey with the graduating class of 2001. Ninety-four percent of the graduating students (N=30) completed the survey in April, after they had taken the DHNBE but before they received their results. The fact that students did not know how well they did on the DHNBE may have skewed their responses. However, students usually do not receive national board scores until after they graduate and workshop faculty were concerned they would have difficulty contacting students after graduation. Therefore, students completed the survey prior to knowing their status on the DHNBE.

Table 1 presents the questions asked and the results. The majority agreed or strongly agreed that the Mock Board motivated them to study harder (77 percent) and prepared them well for the experience of taking the DHNBE (67 percent). In that sense, the Mock Board served its purpose of raising the students’ awareness of the board experience they were about to face.

The third question inquired whether the Mock Board made students overly anxious about taking the DHNBE. This question was particularly important
because of the high false-positive rate of the exam. The Mock Board experience could have a detrimental consequence of raising students’ anxiety levels to a dysfunctional level. The majority (53 percent) said the Mock Board did not make them overly anxious, and 40 percent gave the questions a neutral rating. Only 7 percent agreed that the Mock Board did make them overly anxious. Due to the anonymity of the survey, it is not known if those who reported being overly anxious also failed the Mock Board. Even though only a small percentage of students reported anxiety from the Mock Board, faculty should address test anxiety with anyone who fails the Mock Board and/or anyone with a history of severe text anxiety.

**Conclusion**

The Mock Board served its educational purpose well. Students reported that the exam motivated them to prepare for the national board and gave them exposure to a test format that prepared them for the DHNBE experience. It also demonstrated correctly to students that many of them were likely to pass the actual DHNBE. In fact, students learned that no one who scored above 56 percent on the Mock Board failed the DHNBE.

We are not suggesting that the Mock Board was the sole source of students’ success. In fact, it is likely that the combination of Mock Board, a test-taking strategies workshop, and review of subject matter and case-based questions contributed to the students’ overall preparedness for the DHNBE. However, our intent was to determine the effectiveness of adding the Mock Board exercise to the DHNBE preparation activities. The evidence suggests that the Mock Board is a useful coaching tool in the overall process of DHNBE preparation.

The use of the Mock Board as a screening tool for students who are at risk is more problematic. One problem in accurately evaluating the Mock Board’s predictive validity is the intervention (the workshop) between administrations of the Mock Board and the DHNBE. Students who were at risk before the workshop may have moved out (in fact, hopefully had moved out) of the “at-risk” category because of the workshop training and/or faculty counseling. A good assessment of the Mock Board would require some form of control group, where some students received the training and some did not. However, this provides an ethical dilemma that plagues many researchers trying to conduct applied educational research: how can evaluators deny a random sample of students an experience that could help them?

Also, the predictive value of the Mock Board could be enhanced if it were used in conjunction with other factors (such as cumulative GPA) in a multiple regression model. Failure of the DHNBE certainly is caused by a number of factors, and a more complicated prediction model is necessary to truly predict students’ DHNBE scores. However, the more simplistic predictive analysis conducted here provided satisfactory evidence that the Mock Board does provide an experience comparable enough to the DHNBE to give students a useful educational experience.

The workshop faculty members intend to continue administering the Mock Board, based on the evaluation results presented here. To date, the sensitivity/specificity findings have not yet been presented to students during their Mock Board debriefing session. However, the next workshop will incorporate information about students’ “odds” of passing the DHNBE given their passage or failure on the Mock Board.

The Mock Board results can be communicated effectively to students to help them understand how well prepared they are for the DHNBE. It also serves as a communication tool for faculty attempting to counsel students who may be at risk of failing the DHNBE. Faculty who worked with students in preparing for the Mock Board often found the students’ performance corroborated their grade history. Once students were faced with both their performance in the program and their Mock Board results, they were more motivated to listen to their instructors’ counsel regarding DHNBE preparation.

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**Table 1. Student evaluation of the Mock Board experience**

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Taking the Mock Board motivated me to study harder for the National Board.</td>
<td>0</td>
<td>10</td>
<td>13</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td>2. Taking the Mock Board prepared me for the experience of taking the National Board.</td>
<td>13</td>
<td>7</td>
<td>13</td>
<td>50</td>
<td>17</td>
</tr>
<tr>
<td>3. The Mock Board made me overly anxious about taking the National Board.</td>
<td>3</td>
<td>50</td>
<td>40</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree; SA=Strongly Agree
In conclusion, the authors recommend using the Mock Board as an educational tool to acclimate students to the DHNBE experience. While the students did not experience the intensity of the DHNBE, the Mock Board provided an opportunity to assess their level of preparation and practice item formats that might be unfamiliar to them. Moreover, Mock Board results can guide faculty in providing or suggesting specific strategies to individual students regarding DHNBE preparation, such as tutoring, test-anxiety counseling, departmental topic review sessions, and private board review courses. The Mock Board experience, therefore, can be an excellent coaching tool for helping students pass the DHNBE.

REFERENCES
8. Greenhalgh T. How to read a paper: papers that report diagnostic or screening tests. bmj.com 1997;315:540-3. At: www.bmj.com/cgi/content/full/315/7107/540.