Online Assessment of Athletic Training Education Outcomes and Program Satisfaction

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ABSTRACT

This paper describes the development of the Online Assessment of Athletic Training Education system (OAATE), a tool for assessing student achievement in the knowledge domains necessary for certification as an athletic trainer. The system also assesses students' satisfaction with important dimensions of their individual degree programs. By making use of current database and communication technologies, we have developed a system that addresses important, unmet needs in the field of Athletic Training education. The design of the system makes it a dynamic, easily extensible tool that could be applied in a wide variety of education domains beyond its current setting. In addition, because of its Internet-based delivery system, the tool may be widely-used throughout the world, with benefits accruing to students, program instructors and administrators, and researchers in the field of education.

Keywords: Education Assessment, Database, Information/Communication Technologies, Online Assessment.

1. INTRODUCTION

It is a widely-held view that assessment of learning outcomes should be major component of any education program. In higher education, it is common to see this assessment occurring at the degree program level, as well as at the individual course level. To that end, in many disciplines there are multiple assessment tools available, ranging from simple, internally developed instruments to those created by national testing or certification agencies.

In the field of Athletic Training education, as in many other domains, available assessment tools suffer from a variety of shortcomings that reduce their effectiveness or use, among them

- There is no single, universally adopted instrument in use, and the multiple instruments available are not standardized enough to allow comparison across instruments.
  - This makes comparison among programs at the national level difficult or impossible.
- The costs of the tools may be restrictive for smaller programs.
- They may not measure all the dimensions desired by a particular program, and
  - They are usually not easily (if at all) modifiable to include local assessment issues.
- They may not capture attitudinal or other parameters related to the assessed knowledge or performance.
- They may not be adapted in a timely fashion to changes in the external environment or to changes in program content and methodology.
- There may be a significant time delay between testing and assessment, especially for paper-based instruments.
- The statistical analysis provided by assessment services may not include the specific analysis desired by a program.
  - For example, longitudinal assessment of student performance over a multiyear period may need to be performed by ad hoc analysis, using tools external to the assessment service; or
  - The analysis may not provide desired intra- and interprogram comparisons.

To help overcome these limitations, we have designed, and are continuing to develop, an online assessment system for Athletic Training education programs at the university level. The system performs two distinct assessment tasks. The first is assessment of student achievement in the twelve knowledge domains identified by the National Athletic Trainers' Association Education Council (NATA-EC). The second task is the students' assessment of satisfaction and importance of their individual degree programs.

Together, these assessments allow educators and administrators to better evaluate their programs and their students' progress, as well as help them demonstrate the continuous assessment required by accreditation standards.

In addition, the system allows researchers to collect and analyze data as part of a large scale, longitudinal, cross-sectional research program that will provide insight into the field of Athletic Training education.

2. METHODOLOGY

Our assessment system is a browser-based, online system that allows Athletic Training programs to participate from anywhere with Internet access. It has been designed for three major purposes:

- to assess the knowledge of graduating seniors who are preparing for the National Athletic Trainers' Association Board of Certification (NATABOC) certification exam;
- to measure students' satisfaction and assessment of their degree programs, and
- to collect cross-sectional, longitudinal data about Athletic Training education, to allow researchers to better understand the efficacy of such education.

Students complete a twelve part exam that tests twelve major knowledge domains within the field of athletic training, and they also complete a questionnaire that captures students' evaluations of their degree programs. The questionnaire and twelve domain testing subsections are discrete sessions, enabling students to complete the assessments over multiple online sessions. Allowing the assessments to be taken by knowledge area mimics the approach taken by national certification exams in a number of professional areas, and we anticipate it will increase adoption of our system by schools with degree programs in Athletic Training. A larger number of participants increases the usefulness of the system to educators and researchers alike.

The underlying technology used by the system makes it especially extensible and efficient, and allows the system to be modified quickly and easily. This allows easy adaptation in the dynamic environment of Athletic Training education.

The technology being used includes relational database technology (Microsoft SQL Server), Microsoft Internet Information Server (IIS), Java, active server pages, and scripting languages (JavaScript and VBscript). The relational database is used both to capture data for later reporting and analysis and also to generate data for dynamic web pages. These pages deliver differing content, depending on task and/or earlier responses by the user. The web-based and database components are discussed at more length in the following sections. Those components are the keys to developing a system that overcomes the shortcomings of currently available assessment tools described in the Introduction section of this paper.

3. WEB-BASED ASSESSMENT

The first shortcoming described in the previous section was the fact that there is no single, universally adopted instrument in use for assessment of educational outcomes in the field of Athletic Training. The root causes for this are most likely closely associated with several of the other listed shortcomings: the cost of the tools may be restrictive, the tools may not measure all the dimensions desired by a particular program, and they are usually not easily (if at all) modifiable to include local assessment issues.

We believe that a tool that overcomes these shortcomings has the potential to become widely adopted, and thus provide the broad baseline of data required to allow students, program directors, and researchers to compare educational outcomes across the entire spectrum of programs. We further believe that OAATE is such a system.

By developing a web-based assessment system, the problems associated with distribution, collection, and cost are greatly reduced. In fact, there is no cost to participating schools for using the system itself, and as virtually all schools have Internet access and browser-equipped computers, the incremental cost to schools should be near zero.

The web site was developed using current XHTML specifications. The adaptability and extensibility of the web site is facilitated by making use of Cascading Style Sheets (CSS) and dynamic web pages that draw much of their content from an underlying database that stores web page content that might change frequently. The dynamic web pages allow content to be produced and displayed on the web page when needed.

There are three main type of dynamic content used by our system:

- The test bank of knowledge domain and satisfaction questions,
- Statistics based on the data collected by those questions, and
- Information based on data submitted by program directors.

The web-based interface for the testing functions uses a multiple-choice question format with which students are universally familiar. This type of test not only mimics the format of the certification tests taken by Athletic Training students, but also lends itself to a point and click interface, using radio buttons for answer selection.

From the program director's perspective, the web-based system allows administration of the assessment tool from any computer with Internet access. Program directors can register their programs, set up student accounts and passwords for their students, select a set of peer schools for outcome comparisons, and review a variety of reports based upon test outcomes.
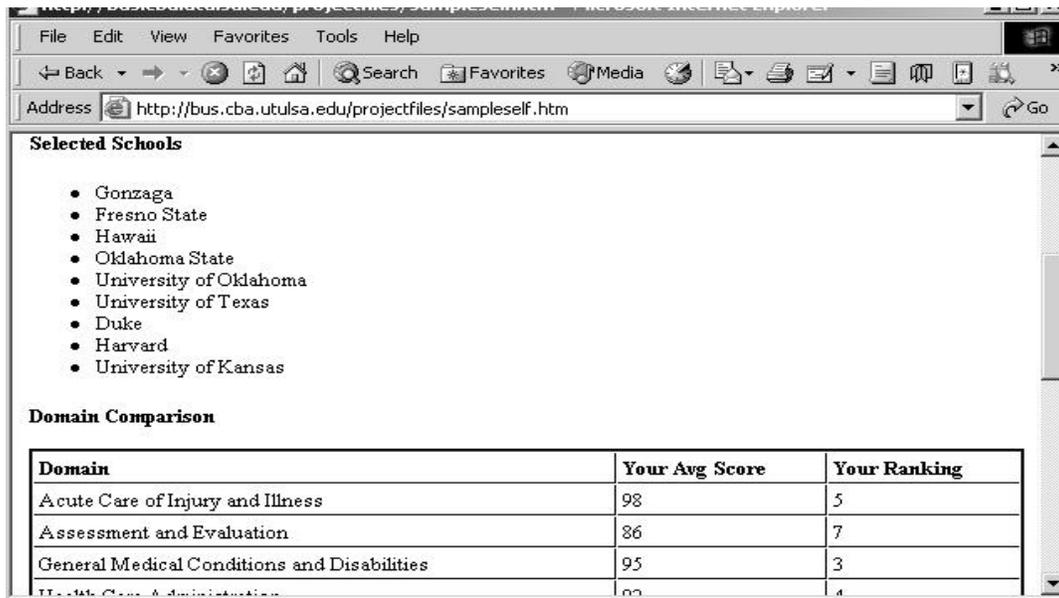
Figure 1: Self-Selection Report

The program director's Self-Selection Report is shown in Figure 1. This report shows the average score of the director's students, and ranks those scores compared to average scores of students at their peer schools. When the program director selects the initial peer school list, it is selected from a system-generated list of all schools currently registered with OAATE. As new schools register, OAATE automatically generates an email to each currently registered program director. The email announces the new registrant school, to allow program directors to add the school to their peer school lists, if desired. So in addition to giving program directors the most up to date list of scores, OAATE allows them to keep a current list of peer schools.

In addition to the knowledge assessment questions, students are asked to rate their degree program on a number of dimensions. Those dimensions are

- Use of Technology
- Career Placement Service
- Administration
- Course Instruction
- Advising
- Clinical Experience
- Instructor Availability

For each dimension, students provide two ratings. The first rating indicates the student's satisfaction with that dimension of their program. The second rating indicates the student's assessment of the importance of that dimension to them.

As with the knowledge domain scores, program directors can see their students' satisfaction/importance scores and rankings compared to their peer school group. The bottom portion of the Self-Selection Report is shown in Figure 2.

Figure 2: Satisfaction/Importance Scores and Ratings
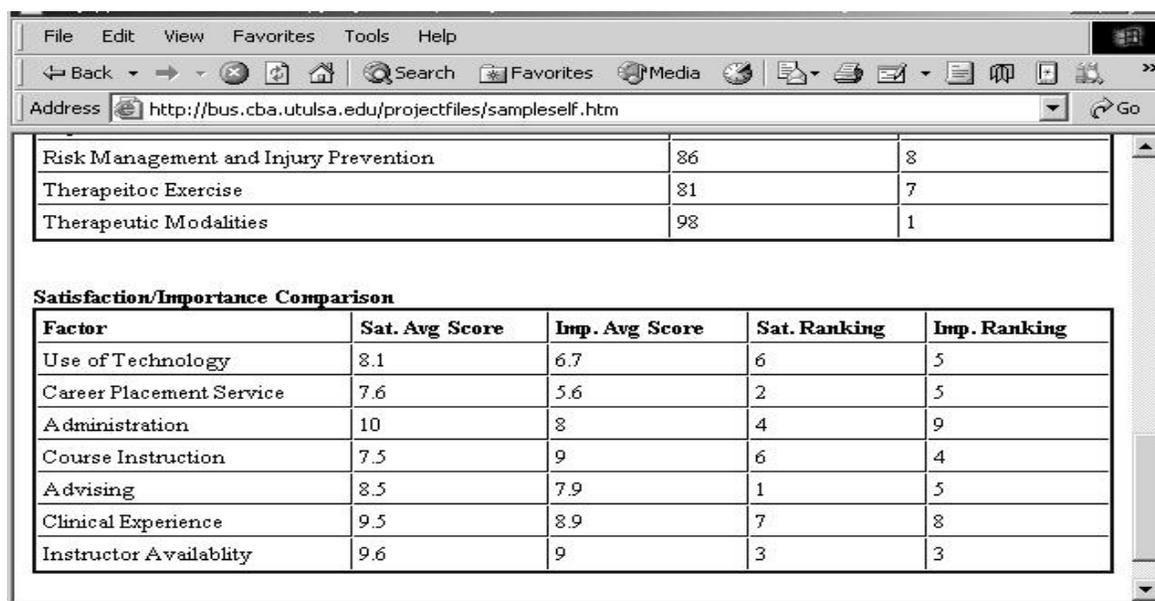
The Self-Selection report shown above relates a program's scores to the self-selected set of peer schools. OAATE also provides a number of reports that report a school's scores and compare them to the average scores of all participating schools. Figure 3 shows a portion of this type of report. You'll notice that the report also shows the multiyear trend in the school's scores for each Satisfaction/Importance dimension.

The reports described here are just a sample of the wide variety of reports that have or are being created for OAATE. Summary statistics such as means, medians, maximums, and minimums will be available for virtually any level of evaluation from individual assessment question, to student, program, and national levels.

Students receive immediate feedback in the form of a diagnostic evaluation of their performance within each educational domain, and for questions where a student gave an incorrect answer, a reference is given, to point the student to a specific book chapter or article where the question's concepts are explained. Thus, OAATE goes beyond most assessment tools by helping students find the resources to improve knowledge areas where they may be deficient.

4. THE DATABASE COMPONENT

The engine that really drives OAATE's capabilities is the relational database that underlies it. Figure 4: shows a simple Entity-Relationship-Diagram (ERD) for the database. Missing from the figure is a recursive relationship of *Institutions* upon itself. That relationship links a school to its peer schools in the same table.

By decoupling question content from the web pages, we gain several important advantages. First, a test's domain questions may be drawn randomly from a larger pool of domain questions, helping to minimize cheating when giving the test in a group setting. Second, test questions
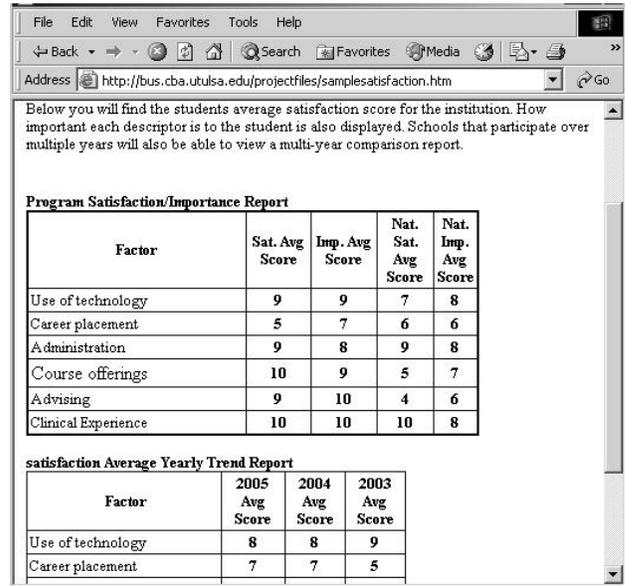
Figure 3: Satisfaction/Importance Summary Report

or answers may be modified (changed, added, deleted) without requiring modification to the web pages or underlying code. Older questions can be cycled out of the exam rotation, and newer questions can be cycled in. If important new domain knowledge is discovered that would change a question or require a new question, that knowledge can be incorporated into the test as soon as it is known. This has obvious benefits from the timeliness perspective, and it has great cost savings over traditional paper-based tests that might require discarding potentially large numbers of outdated tests.

Likewise, the satisfaction/importance questionnaire may be easily modified to meet the changing needs of program directors. While we can require that certain questions be answered by all schools, other questions may be designated as optional, with the program directors selecting the questions to be answered by their students.

Figure 4: Database ERD
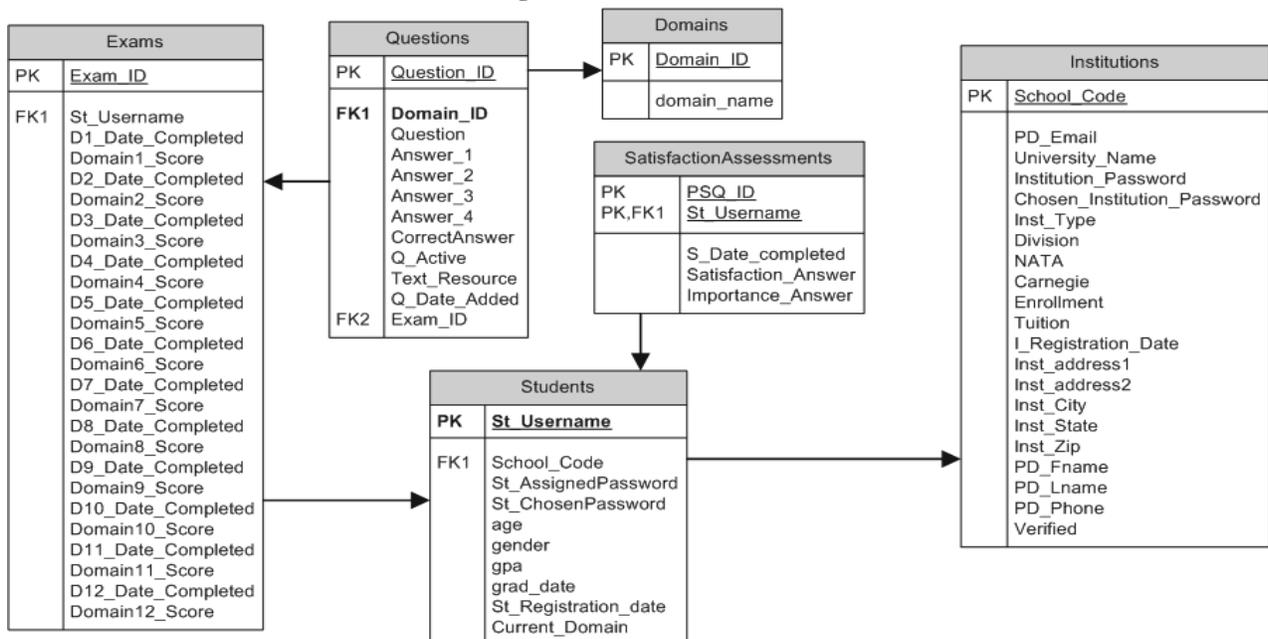
A future enhancement to OAATE will be the ability for program directors to add their own satisfaction questions to the optional survey question set. Thus, a larger, shared body of questions might be developed from participating schools, adding the possibility for schools to learn from the best practices of other schools. This capability has already been designed and built, and it is currently undergoing testing, prior to its release into the production environment.

Beyond the advantages listed above, system extensibility and maintainability is perhaps the greatest benefit of using relational database technology for storing the large quantity of test, participant, and web page data required by OAATE.

A look at Figure 4 shows the variety of data currently collected about students and participating institutions. If researchers or participants wish to collect data about new attributes not included in the original design, adding them is a relatively trivial task. For example, if future research finds a new factor related to student test performance, it can easily be added as a field in the database, and the web page for collecting student data can be modified with a relatively few lines of code. The time delay between identifying a new attribute and adding it to OAATE can be a matter of hours, if not minutes

It's difficult to overemphasize the power added to OAATE by using this database-driven, dynamic web page combination. Over the course of system development, we encountered numerous situations in which we were "saved by the design."

For example, during development of questions for the various knowledge domains, we became aware that there are at least two different decompositions available for our domain knowledge: the twelve domain framework specified by the National Athletic Trainers' Association Education Council and a second, commonly-used decomposition that divides athletic trainer knowledge into only six categories. Because of the design of the database, by adding a single field to the questions table, we can identify questions by their second category. Tests could be constructed, and information reported, using the alternate framework, should we so desire.

Another benefit of relational database technology is the relative ease with which data may be extracted by a variety of software applications. In our web pages, we use SQL code to generate the data for the various reports, but we could easily access the data from within spreadsheet or statistics programs, for more advanced analysis. Using the Internet as our communication medium, we could generate XML-based reports for sharing data sets among researchers at different institutions.

5. CURRENT PARTICIPANT DEMOGRAPHICS

OAATE is currently in use at a number of private and public universities. Table 1 shows selected demographics, to provide insight into the current scope of our research.

Table 1: Selected Demographics

Total number of athletic training education programs:	352
Number of programs registered in OAATE:	96
Number of registered programs that have registered students	50
Number of students registered	439
Number of students tested	156

Before students may use the OAATE system, their program director must register their school with OAATE researchers. Once registered, program directors can enroll the students they want to participate without further involvement of the researchers. There is typically a time lag between the date a program director registers students and the date students begin using the system, so the number of registered students typically exceeds the number who have participated in testing. In addition, the totals above include schools that registered at the beginning of the current academic year, and students will most likely take the assessments late in the semester, after the Table 1 numbers were generated.

6. FUTURE DIRECTIONS

Because of the ease with which the system may be maintained and modified, there are a number of potential future enhancements to OAATE that may be envisioned.

Given the nature of the data collected and the primary purpose of the system, some of the more obvious improvements involve reporting. We envision providing a much wider variety of statistics for program directors, including standard deviations, medians, minimums, maximums, and more. Multiyear reports of peer school and national averages would be an informative addition to the single school data shown in Figure 3.

Beyond the information being provided by OAATE, information format is another area of potential improvement. Recently, a great deal of attention and development effort has been directed toward producing "digital dashboards" to present information to information users. The term "digital dashboard" refers to a user interface where data is displayed in a graphical format, often resembling the array of gauges and dials in the dashboard of an automobile. The term is in such wide use now that the term has moved beyond the automobile metaphor and is being used to refer to an interface that integrates information from multiple sources into a single, unified display, often incorporating text, tables, and pictures. Most often, the underlying information for the dashboard is stored in databases. There are a number of third-party vendors of such tools, and it would be relatively easy to incorporate them into OAATE. The multiyear assessment score averages might be presented as line or bar charts, or even as a gauge reminiscent of a gasoline gauge, with program director-specified warning levels that indicate when scores are moving into dangerously low levels. There could be red light-green light metaphors—we're limited only by imagination, it seems.

Once we have implemented our desired enhancements to OAATE, we intend to extend its use into other knowledge domains. The nature of the tests and reports we have developed are applicable to many other degree programs. The design structure of the system is such that neither the database nor web site require extensive modification to be used in such a manner. It could be accomplished in a few short stages:

- Clone the data base and web site.
- Modify pages to reflect the new knowledge domain.
- Change the test questions and the satisfaction/importance questions in the test database.
- Modify a few systems resource files that keep track of important web site information.

If a set of questions were already developed, it could be a matter of as little as a week or less to have an OAATE-like system up and running in a different knowledge domain.

7. CONCLUSIONS

In this paper, we discussed some of the aspects of OAATE, a system for assessing educational outcomes for students in Athletic Training degree programs at the university level. We explained the advantages derived by using a web-based system and underlying relational database instead of more traditional assessment methods. Those advantages include the ability to quickly and easily adapt the system to changes in domain knowledge and education content; reduced cost to users of the assessment tool when compared to alternative tools; and the ability to customize the system for a particular institutions needs.

In our Future Directions section, we described a number of enhancements and extensions to OAATE and explained how it might be modified to utilize it in different knowledge and education domains.

Through the use of Information/Communication Technologies, OAATE improves upon previous methods of assessing educational outcomes in the Athletic Training field and offers us other advantages as well. We believe that through OAATE we will also be able to collect a large set of cross-sectional, longitudinal data that can be used by education researchers to improve Athletic Training education.