CONSTRUCTING WEBCT QUIZZES FOR USE IN COLLEGE ALGEBRA

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Abstract

Online quizzes are used within WEBCT to enhance both on campus and remote site college algebra courses offered by the Institute for Math Learning at West Virginia University. The final course evaluations for the 2002-2003 academic year for the remote site course show that 82% of respondents indicated that the online quizzes helped them learn the course material with half of them reporting that is it was the component that helped them learn most. The correlation between the online quiz average and the score on the final exam was .83 for the on campus sections during the spring 2003 semester. This paper will discuss the four methods used for generating WEBCT questions for the online quizzes and tests: developing questions using WEBCT, scripting questions in a word processor, importing questions from a test generating packages, and developing questions using the management tool *Respondus*.

In the 2001-2002 academic year, online quizzes were implemented for the first time as a component of the WvEB Algebra project which is a college algebra course offered to high school students for dual credit through West Virginia University, WVU. On the final course evaluation, over half of the student participants indicated that the online quizzes helped them learn the course material and approximately 25% of the student participants completing the evaluation reported that it was the component that most helped them learn the material of the course. (Pyzdrowski & Pyzdrowski, 2003) Even more noteworthy is that student evaluations from the WvEB Algebra project during the 2002-2003 academic year show that 82% of the 62 respondents from WVU indicated that the online quizzes helped them learn the course material with half of them reporting that is it is the component that most helped them learn the material. It is interesting that the correlation between the online quiz average and the grade on the final exam showed only a moderate correlation ($r = .54$) for that course. However, in the spring 2003 semester, the same online quizzes were used for the on campus college algebra sections with a final enrollment of 300 students. A higher correlation coefficient of .83 was found to exist when comparing the online quiz average and the students' performance on the same comprehensive final exam. In addition, the on campus spring semester 2002 drop/fail/withdraw rate was 51.3 percent and the on campus spring semester 2003 drop/fail/withdraw rate of 37 percent. The only major course component change was the use of online homework quizzes. However, caution is warranted when making the

comparison, because other factors such as instructor, administrative support for change, and student differences most likely influenced some of the change as well.

These results are similar to those found by Hirsch and Weibel (2003) who studied the effect of *WebWork* homework assignments on student performance on the common final exam in a general calculus course of 1175 students. They found that students in the web-based sections showed a statistically significant improvement on the final exam and that those who attempted every *WebWork* problem had higher grades on the final by at least two letters.

Online quizzing has been shown to affect positively student performance in college level mathematics courses; but, more in depth studies should be conducted in order to fully understand the resulting increased performance on final examinations. One can conjecture that while collecting and grading weekly homework assignments for hundreds of students at large universities is not feasible, online quizzing gives a way to implement a homework component into the course while not placing a grading burden on the instructors. Since the online work can be graded immediately and allows for multiple attempts, students can get immediate feedback and can be encouraged to become active with the content continuously throughout the semester, rather than only on the evenings before an exam. Although the use of online quizzing can ease the grading requirement for the instructors, the "up front" work of constructing the question bank, quizzes, and tests is an ongoing necessity requiring a lot of time. Each semester, "bad" questions must be eliminated or fixed and new questions should be added. As new questions are added, they should go through a review process to make sure that they are relevant to the course content and are clear and meaningful. Test packages that accompany text books are often a good source for a number of the classic questions that are used on tests. Usually the test package will have a random generator that creates multiple versions of a question. However, often it is desired to develop homemade questions that are more meaningful to the course at a given site. In that case, developing questions in WEBCT, scripting questions in a word processor, or using a management tool such as *Respondus* is necessary. Each of the mentioned methods of developing questions for the test bank in WEBCT has certain pros and cons. These methods will be discussed in the remainder of this paper.

One major advantage of creating the questions from WEBCT or from a text file is that the questions can be reused for multiple quizzes. Also, the images used in the questions can be organized in folders so they can be easily identified and maintained. These images can also be reused by multiple questions. Reusing images and questions reduces the amount of disk space used on the server and reduces the size of your backup files. A management package such as *Respondus* does simplify the question and quiz creation process, but it is wasteful with resource usage. When a question is reused in multiple quizzes in *Respondus*, the images for the question are saved for each quiz for which it is used. When changes are made to a question or quiz, all of the information is saved again, leaving the previous version.

Even though *Respondus* simplifies the posting of the questions and creates the quiz on WEBCT,

it still needs the graphical images to be imported from another package. There is very little difference in using the equation editor in *Respondus*, WEBCT, or a word processor and have it generate the image or MathML. One major drawback of *Respondus* is that the calculated question is not available. This is a very powerful question type to use. Another feature that is not available in *Respondus* that is available from the WEBCT question editor or from scripting the question from a text editor, is the use of regular expressions in the short answer question. These Perl regular expressions allow the parsing of a short answer for a more complex variation of answer matching.

Questions can be used from test generating programs such as *TestGen-EQ* by Prentice Hall. Once the test is created, export it as an HTML file. When it is converted to an HTML file, the graphs and equations are converted into gif images. Typically the text is also converted into gif images, but they are not very clear. Text can be retyped when you create the question set. This method is primarily used for generating the graphs and equation images. Most programs will place the images in a question folder. Usually there is a format to the file name used for the images. The images related to a question may contain that question number followed by a number representing the specific image in the question. The worst case is where all images are simply numbered sequentially. In order to access the images, identify and open the folder containing them and select view as thumbnails. Identify the naming format used by the program. Select the graphs and equations that you want to use in your questions. Save these images in a folder that you will access from the question sets that you will script.

Word processors, like *WordPerfect* by Corel or *Word* by Microsoft, offer a publish to, or save as HTML feature under their file menu. The word processors will convert the drawings and equations to image gif's and reference them from an HTML file that they create. As with the test generating programs, generating the images is the goal. Find the images and save them in a folder where you will access them from the question sets that you will script.

Mathematical software packages, like *Derive* or *TI Interactive* both available through Texas Instruments, can export or save the graphs as images. These images can then be used in the question sets that you will script. You will also need these images for use in *Respondus*.

Another advantage of creating questions from a text file is that programs can be written in C, Java, BASIC, or any programing language that will generate numerous questions and answers and write these questions and answers to a file following the rules for scripting questions. These files can be imported into WEBCT and hundreds of questions can be generated in a short amount of time.

General procedures for scripting questions in a text editor include:

- Do not introduce extra spaces.
- The field names are case sensitive.
- Lines beginning with a colon (:) identify a field name
- Each question must begin with the type declaration line.

- A :QUESTION: must be specified.
- Comment lines begin with a #.
- Save the file as an ASCII text file.

The tags used in the files begin and end with a colon, :, and the colon, :, is also used as a field separator. The tags have different parameters based on the type of question. These tags are:

- :TYPE:question_type where question_type is MC:{1|N}:{0|1}:{C|A}, S, P, M:{short|long}:{short|long}:{E|A|RW}:{0|1}, or C.
- :TITLE:title_text (Optional)
- :QUESTION:{H|T}
- :IMAGE:filename (Optional)
- :LAYOUT:{horizontal|vertical}(Optional)
- :ANSWERS:n
- :ANSWERi:parameters where parameters is % value:{H|T} or answer_text:value %:{0|1|..|n}:width:{0|1|2}.
- :ANSWER:{H|T} (Optional)
- :REASON1:{H|T}(Optional)
- :CASE:{0|1} (Optional)
- :TEMPLATE: (Optional)
- :Li
- :Ri
- :FORMULA:formula text
- :var-MIN:number
- :var-MAX:number
- :VALUES:number
- :var-VAL1:number
- :ANS-DEC:number
- :TOL:number (Optional)
- :TOLTYPE:{percent|units} (Optional)
- :UNITS:units text (Optional)
- :UNITREQ:{0|1} (Optional)
- :UNITSPACE:{0|1} (Optional)
- :UNITCASE:{0|1} (Optional)
- :UNITVAL:value %
- :ANSTYPE:{dec|sig}
- :FEEDBACK (Optional)
- :CAT:text

An example of a multiple choice question with multiple answers for the correct answer and penalty for selecting wrong answers is:

Start of question 2.5 V 1 Even Power Functions

:TITLE:2.5 V 1 Even Power Functions
:FEEDBACK
:QUESTION:H
Choose the five true statements for even power functions y = x^{even}
:IMAGE:
:LAYOUT:vertical
:ANSWER1:20.0:H
<img src="Test1/Quiz_2/Q2Q5/q1g1.jpg">
<align="absmiddle">
:ANSWER2:-16.7:H
<img src="Test1/Quiz_2/Q2Q5/q1g2.jpg">
<align="absmiddle">
:ANSWER3:20.0:H
<img src="Test1/Quiz_2/Q2Q5/q1g3.jpg">
<align="absmiddle">
:ANSWER4:-16.7:H
<img src="Test1/Quiz_2/Q2Q5/q1g4.jpg">
<align="absmiddle">
:ANSWER5:-16.7:H
the graphs have symmetry with respect to the origin
:ANSWER6:20.0:H
the graphs have symmetry with respect to the y-axis
:ANSWER7:-16.7:H
the graphs have symmetry with respect to the x-axis
:ANSWER8:20.0:H
the graphs are shaped like parabolas
:ANSWER9:-16.7:H
the graphs are not shaped like parabolas
:ANSWER10:20.0:H
as the powers increase, the graphs seem steeper at the "ends" and flatter around the origin
:ANSWER11:-16.7:H
as the powers increase, the graphs seem flatter at the "ends" and steeper around the origin
:CAT:Quiz_2
End of question 2.5 V 1 Even Power Functions

The process of creating questions and the components of the questions created in WEBCT or scripted in a text editor is too large to fit in this paper and can be found at http://www.pyzdrowski.ws/conference.

Hirsch, L. and Weibel, C.(2003, February). Statistical Evidence that Web-Based Homework

Helps. FOCUS: The Newsletter of the Mathematics Association of America, 23(2), 14.

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