

DELIVERING WEB-BASED QUIZZES IN PRECALCULUS WITH WEBCT

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WebCT is a commercial software package for web-based course development. Information on its various features can be found at WebCT's web site [2]. This article concentrates on the quiz module and its use in the author's precalculus sections. Additional materials pertaining to this application can be found at [1].

The author uses a dozen web-based quizzes in his precalculus sections. Students are allowed to repeat each quiz up to five times, with only the highest score recorded. Each quiz is available for a thirty-six hour period, so students' work is self-paced, but only to a limited degree. Additional on paper assignments, quizzes and exams are collected and used with the online quizzes in determining grades.

The students access the quizzes by logging in to a personal course account and selecting the current quiz from a list. A sequence of five questions is presented. These questions can be in several formats, including multiple choice, numerical answer, and matching. Examples of a matching question and a numerical question appear as figures 1 and 2 respectively. The questions use standard web scripts to collect responses, so students find the interface very familiar. This distracts minimally from the mathematical content. Upon completion, each quiz is automatically graded, and students can immediately review their errors. When students retake quizzes, the questions are slightly modified.

Here is a graph of $f(x)$.



For each graph, select the appropriate function. Each function is used exactly once. Thinking about how the original graph could be continued to the left and the right will help with matching its horizontal shifts.

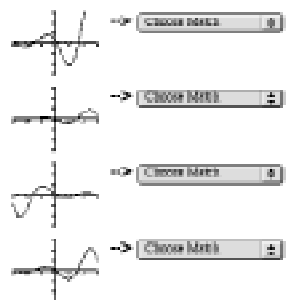


Figure 1: A matching question

Here is a graph of $y = 3\tan(x) - 2$ for x between -5 and 5 .



Find the right root. Give your answer in decimal form and include at least three digits after the decimal point.

Answer:

Figure 2: A numerical question

This delivery system is superior to paper in several respects. First, it allows instantaneous feedback and encourages repetition to gain proficiency. The process is scalable: students who have already mastered the material can score a perfect on the first try, while students who need more drill are motivated to practice. Machine generated statistics on class performance can be used to steer classroom discussions and address common errors. Finally, students like these quizzes. For them, answering a question using a radio button is somehow more rewarding.

The WebCT courseware enables the instructor to construct quizzes with a minimal understanding of html. Figure 3 shows the interface used to build a matching question, and figure 4 shows the page used to assemble a quiz. The multiple versions of each problem in figure 4 enable the software to generate multiple versions of the quiz.

The quiz building process can be somewhat time intensive. It takes the author about three hours to generate a complete, thoroughly proofread quiz with multiple versions of five questions. Since the quizzes are essentially html documents, all the flexibility and limitations of html as a method of delivering mathematical material apply here.

The most appealing aspect of these web-based quizzes is that they appear to significantly improve student performance. The author was able to compare two of his sections taught with online quizzes ($n = 61$) to two sections taught without ($n = 59$). In the sections without online quizzes, 59.3% of the students earned a C+ or better final grade, compared to 86.9% of the students who received online quizzes. Comparisons in performance on paper based quizzes show similar improvement for students who received the web-based quizzes. (See [1].) While this experiment was not as rigidly controlled as one might wish, it convinced the author that his efforts were worthwhile.

Save Save As New Move Answers Cancel

Category: quad

Title: Problem 1: Shifting and Reflection

Question:

```

<font size=2>
Here is a graph of  $f(x)$ .
</font>


```

Format: HTML Text

Image: Browse...

Settings:

Marking Scheme: Equally Weighted All or Nothing Right Less Wrong

Preview Columns: Yes No

Matching Pairs:

Short Answer: Refresh: Short Answer:

| | | |
|----------------------|---------|----------------------|
| <input type="text"/> | matches | <input type="text"/> |
| <input type="text"/> | matches | <input type="text"/> |
| <input type="text"/> | matches | <input type="text"/> |
| <input type="text"/> | matches | <input type="text"/> |

Figure 3: Building the matching question

| No. | Points | Select: | Questions |
|--------------------------|--------|----------------------|--|
| <input type="checkbox"/> | 1 | <input type="text"/> | <input type="checkbox"/> <input type="button"/> Problem 1: Shifting and Reflection |
| | | | <input type="checkbox"/> <input type="button"/> Problem 1: Shifting and Reflection |
| <input type="checkbox"/> | 2 | <input type="text"/> | <input type="checkbox"/> <input type="button"/> Problem 2: Calculate the value of composed functions |
| | | | <input type="checkbox"/> <input type="button"/> Problem 2: Calculate the value of composed functions |
| | | | <input type="checkbox"/> <input type="button"/> Problem 2: Calculate the value of composed functions |
| | | | <input type="checkbox"/> <input type="button"/> Problem 2: Calculate the value of composed functions |
| <input type="checkbox"/> | 3 | <input type="text"/> | <input type="checkbox"/> <input type="button"/> Problem 3(A): Use trig identities |
| | | | <input type="checkbox"/> <input type="button"/> Problem 3(B): Use trig identities |
| | | | <input type="checkbox"/> <input type="button"/> Problem 3(C): Use trig identities |
| <input type="checkbox"/> | 4 | <input type="text"/> | <input type="checkbox"/> <input type="button"/> Problem 4(a): Find the root |
| | | | <input type="checkbox"/> <input type="button"/> Problem 4(b): Find the root |

Figure 4: Building the quiz

REFERENCES

[1] Hirst, Jeffrey L., *Web-based Quizzes for Precalculus*, www.mathsci.appstate.edu/~jlh/ICTCM0/ICTCM0.html.

[2] WebCT, *Homepage*, www.webct.com.