Student Assessment of Web-Assisted Instruction

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Introduction

There is much interest in the use of Internet based technologies to deliver or to enhance the
delivery of engineering course material. Papers describing the use of various web-based
technologies in engineering and technology courses are reported in previous ASEE Conference
proceedings. The use of the Internet to deliver (on-line) or enhance the delivery (web-assisted)
of engineering courses is accelerating rapidly, and it is now possible to receive an MS degree
using on-line technology.

Although there is much interest in and an explosion of the use of Internet-based technologies in
engineering education, there are important questions being asked concerning the effectiveness of
the methods being proposed. “The rapid expansion of multimedia technology including CD-
ROM, World Wide Web, and video technologies is providing engineering educators with
unprecedented opportunities to break away from the traditional black-board based paradigm.
However, this rapid introduction of technology into the classroom is not being accomplished by
an equivalent level of concern for the impact of these technologies on the educational experience
of the students.” Therefore, there is a need to not only develop and implement, but to also
assess of the effectiveness of the learning experience of students taking courses that use Internet
technologies.

There are many issues associated with trying to assess the effectiveness of teaching methods in
general and Internet-based methods in particular. Do students learn the material presented using
Internet-based technologies just as well, better, or worse than if a traditional blackboard based
lecture is used? Is there a need to break away from the traditional blackboard paradigm? Many
engineers have been successfully educated using the traditional blackboard paradigm, and for
every instructor advocating the use of Internet technologies, there are just as many or more who
are advocating caution. The rapid rise and equally rapid collapse of many dot.com companies
which were going to change the retail shopping paradigm via the Internet should be enough to
make people look at other Internet motivated paradigm shifts with caution.

Furthermore, not all of the issues associated with the use of Internet based technologies are
driven by education quality or effectiveness issues. There is certainly interest among
administrators seeking new ways to expand the market for their product, and legislators who are looking for ways to reduce funds needed to educate a populace increasingly less willing or able to relocate to a traditional college campus. Enabling students to pursue an education in a much less structured environment certainly has a market-based element.

The use of Internet-based technologies is relatively new, and there are few assessments reported in the literature. In one assessment that was found, it was reported that a statistical comparison of grades obtained by students taking a particular course prior to and after the use of web-page software showed no significant differences. The purpose of this paper is to present the results of a student assessment of a specific web-assisted teaching methodology that has been used to teach twelve engineering courses.

The Method

This particular method grew out of the one of the author’s familiarity with the use of PowerPoint briefing charts in a business environment. In business, engineers, project managers, and organization managers routinely communicate information to employees, customers, and peers in a briefing format. The ability to pull together technical briefings on very short notice is an important practical skill. It is becoming standard practice in industry for briefing charts, calculations, drawings, and computer models to be stored in intranet-based databases that can be accessed by project personnel using standard web browsers.

This particular instructional method combines lectures with web-based access to lecture notes, worked homework problems, test answers, course schedules, syllabi, and announcements. It is a mix between a traditional blackboard supported lecture and a totally on-line course. The lecture notes are prepared and presented using PowerPoint in a briefing chart format. A computer projector is used during lectures to present the charts, and students often follow along with the lecture while connected to the course website. The use of PowerPoint briefing charts in the classroom is not unique and making them available on a website is mentioned by other authors.

Briefing style lecture charts were first used because of the instructor’s desire to include more graphic intensive information in lectures than can be done in the traditional blackboard environment. Once the charts started to be used, students immediately began requesting copies. Paper copies were initially handed out, but this quickly changed to making the lecture material available on a course website. Homework solutions were initially performed by hand and added to the website as a scanned image. Currently, some homework solutions are now worked using electronic tools and added to the website in a briefing chart format in addition to the hand worked solutions. Numerous example problems are presented during lectures using the briefing chart format. Typically the only time that a chalkboard is used during class is to respond to a question.

The website has been developed and is maintained using Microsoft FrontPage software. Only minor HTML editing is done to achieve a common look with other web pages on the server. All material is displayed using Adobe Acrobat’s pdf format. The most time consuming part of this method is associated with preparation of the briefing charts required for each lecture. On the average, it takes three to five hours to prepare the material for a single lecture. The time required
to post the material to the website is usually less than a minute. Practical issues associated with the development and maintenance of the website are reported in Reference 6.

Assessing the Method

The instrument used to perform the student assessment contained 28 questions, and was given to sixty-six students. The questions were asked in a both a positive and negative sense. The questions were of two basic types: 1) those in which students could select one or more responses, and 2) those in which a numbered response ranging from one to five were selected. The key for the numbered response was: 1) Strongly Disagree, 2) Slightly Disagree, 3) No Opinion, 4) Slightly Agree, and 5) Strongly Agree.

The questions included in the survey can be grouped into the following categories: 1) learning effectiveness, 2) lecture material content, 3) presentation effectiveness, 4) student preference, 5) access location, 6) access purpose, and 7) access problems. Questions of a related nature were randomly ordered within the questionnaire.

Table One lists the questions, average response, and coefficient of variation for questions requiring a numerical response. Questions that were asked in a negative sense have been reworded to a positive sense and reverse scored to facilitate comparison of the data. An average response greater than 3.0 indicates that more students agreed with a question than disagreed. In all cases, the average response to a question was greater than 3.0. Questions with an average response in the high three to low four range were interpreted as the students generally agreeing with a question, while a numerical response in the high four’s was interpreted as very strong agreement by the students.

An examination of the questions in Table One dealing with Learning Effectiveness, shows that students were in general agreement that this instructional method made learning the material easier and facilitated learning. However, there was a more mixed response concerning whether they learned the material better. For example, the question dealing with whether they were able to learn better when lecture notes were made available on the web than when notes were taken during the lecture received only a slight positive agreement (3.17 with a COV of 0.38). This indicates that close to half of the students feel that they learn the material equally well in a course in which they are required to take notes during the lecture as when the notes are available on a website.

Responses to questions dealing with Lecture Material Content indicate general agreement that pictures and graphics are important to understanding the material, and that the amount of information being presented in class was not overwhelming to the student. This latter point is important in that more material can be covered in a lecture when the briefing charts are prepared in advance and there is no need to write material on the board. There was less agreement as to how much the students relied on the textbook as compared to the web-based lecture notes. This was interpreted as meaning that many of the students feel that the textbook is important to their learning experience. This is an important result since the instructor using this methodology thought that students were not using the texts that were required for the courses.
Questions on Presentation Effectiveness revealed general to strong agreement that it was easier to follow lecture material when the PowerPoint slides are used, that they are able to concentrate more on the lecture material, and asking questions was easier. The students were in general agreement that it is important to attend class and listen to the lecture by the instructor. The coefficient of variation of the responses to this question was very low indicating an almost unanimous response of “slightly agree”. This is an important response that should be considered when totally on-line classes with no in-class or video lecture are being considered. Students were not in as much agreement concerning whether it was easier to stay awake in computer projected lectures as compared to traditional lectures. This was a concern to the instructor since taking notes requires a certain degree of active participation that is missing when notes are provided on a website.

The questions on Student Preference showed the strongest overall agreement. Students definitely prefer web-assisted courses offered using this method more than traditional lecture based courses. The highest average response with the smallest coefficient of variation was obtained on the question dealing with whether they liked having class notes, test dates, homework answers, etc., on the web. There was an almost unanimous “strongly agree” response to this question.

Table Two lists the questions and percent of students indicating a particular response. These questions permitted multiple responses and dealt with access related issues.

Students were allowed to make additional comments concerning this instructional method. Representative comments are presented below.

- Keeping up was easier and keeping track of notes was a lot better. Overall I prefer this methodology.
- Access to the web site gives the students a more flexible approach for the class.
- I would like to see examples worked out live. On the computer it is harder to follow the examples.
- For notes, I believe this method is very helpful. But for working example problems, using the blackboard would help more.
- The methodology is beneficial in most courses, not all.
- Great idea to have class notes, test dates, homework answers on the web.
- Notes, etc. on the web is one of the best things I’ve seen in education. I depend on it.
- The computer notes and web access are great supplements to the learning experience. Those, coupled with standard lectures, are a great way to promote academic success.
Table One
Summary of Questions Requiring a Single Numerical Response

<table>
<thead>
<tr>
<th>Learning Effectiveness</th>
<th>Ave</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 I learn better when I have access to lecture material on the web than when I take notes during the lecture.</td>
<td>3.17</td>
<td>0.38</td>
</tr>
<tr>
<td>2 Having the web notes made learning the material for class easier.</td>
<td>4.29</td>
<td>0.21</td>
</tr>
<tr>
<td>3 The use of this instructional methodology facilitates learning.</td>
<td>4.13</td>
<td>0.23</td>
</tr>
<tr>
<td>4 I have been able to learn course material better when this instructional method has been used.</td>
<td>3.60</td>
<td>0.25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lecture Material Content</th>
<th>Ave</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The inclusion of pictures, sketches, and graphics in the computer projected PowerPoint slides is important to my comprehending the material being presented.</td>
<td>4.10</td>
<td>0.27</td>
</tr>
<tr>
<td>2 The right amount of information was presented in class.</td>
<td>3.84</td>
<td>0.27</td>
</tr>
<tr>
<td>3 I rely on the lecture notes and very seldom use the textbook for learning this material.</td>
<td>3.13</td>
<td>0.40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Presentation Effectiveness</th>
<th>Ave</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 I am better able to follow material being presented in a lecture when PowerPoint slides are used.</td>
<td>3.76</td>
<td>0.30</td>
</tr>
<tr>
<td>2 I was able to concentrate more on the material during the lectures because I didn’t need to take notes.</td>
<td>3.78</td>
<td>0.32</td>
</tr>
<tr>
<td>3 The PowerPoint presentations by the instructor made it easier to ask questions in class.</td>
<td>3.68</td>
<td>0.25</td>
</tr>
<tr>
<td>4 I am able to stay awake easier in a computer-projected lecture than in a traditional lecture.</td>
<td>3.24</td>
<td>0.36</td>
</tr>
<tr>
<td>5 It is important that I come to class and listen to lectures in addition to having access to the material on the website.</td>
<td>3.87</td>
<td>0.09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student Preference</th>
<th>Ave</th>
<th>COV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 I prefer lectures using computer projected PowerPoint slides more than traditional chalkboard lectures.</td>
<td>3.95</td>
<td>0.24</td>
</tr>
<tr>
<td>2 Compared to other classes I have taken, the class material was presented in a more student friendly manner using this instructional method.</td>
<td>3.90</td>
<td>0.22</td>
</tr>
<tr>
<td>3 I like having class notes, test dates, homework answers, etc., on the web.</td>
<td>4.84</td>
<td>0.08</td>
</tr>
<tr>
<td>4 I like courses offered in this method.</td>
<td>4.24</td>
<td>0.21</td>
</tr>
</tbody>
</table>
Conclusion

Hopefully this paper has shed some light on the effectiveness of this particular web-assisted instruction method. Several conclusions from this one survey can be drawn.

The survey indicated that students were in strong agreement concerning their preference for having access to course material on the web and their preference for this method of instruction over traditional methods. The students also indicated strong agreement that this instructional method makes learning easier, and that pictures, sketches, and graphics are important for comprehending the material.

It also indicated that students agreed that this instructional method facilitates learning and that coming to class and listening to lectures is important. This second point is worthy of consideration when proposing the use of totally on-line courses. Students also agreed that they were able to learn better when this instructional method is used and that the right amount of material is being presented in class.

There seems to be no conclusive evidence on whether or not taking notes during lectures enables them to learn better, and as to the importance of a textbook when the method is used.

\begin{table}[h]
\centering
\begin{tabular}{|l|c|}
\hline
\textbf{Access Locations} & \textbf{Percent Responding} \\
\hline
Engineering computer lab & 97\% \\
Off campus using internet dial-up service & 54 \\
Dorm room & 24 \\
Other campus computer lab & 14 \\
\hline
\textbf{Access Purpose} & \\
Print a copy of class notes & 81\% \\
Check homework/test answers & 65 \\
Obtain homework assignments & 65 \\
Check project/homework due dates & 54 \\
Check test dates & 48 \\
Obtain syllabus information & 46 \\
Check class meeting calendar of topics & 30 \\
Other & 3 \\
\hline
\textbf{Access Problems} & \\
Never encountered problems & 43\% \\
Slow download speed & 29 \\
Slow access speed & 25 \\
Web notes page down & 19 \\
UTM server down & 17 \\
Department of Engineering Server Down & 2 \\
\hline
\end{tabular}
\caption{Summary of Questions Permitting Multiple Responses}
\end{table}
Even though the sample size was relatively small, the results should still be of interest to those considering the use of web-assisted methods of instruction. From this survey a general conclusion of student acceptance and approval of this method can be drawn.

Bibliography

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