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WebCT and First Year Computer Science: Student Reaction to and Use of a Web-Based Resource in First Year Computer Science

Murray W. Goldberg
Department of Computer Science, University of British Columbia
2366 Main Mall, Vancouver British Columbia, Canada, V6T 1Z4
(604) 822-3153
(604) 822-5485 goldberg@cs.ubc.ca

ABSTRACT

Our previous experiments with the World Wide Web (WWW) as an educational resource focused on a third year Computer Science course. The results were very positive showing a high degree of student satisfaction and improved academic performance. Our intuition, however, made us question whether the same would be true for a first year course given that the students are new to the university environment and often less willing to participate in class. Thus we performed an experiment comparing the difference between third and first year students in their reaction to and use of educational technologies. Overall we have found the use and acceptance of these resources to be higher for our third year students than for our first.

1.0 Introduction and History

Over the last two years we in the Department of Computer Science at the University of British Columbia have been conducting experiments to evaluate the student acceptance and academic effectiveness of various modes of course delivery, both with and without the use of educational technologies. Our experiments were primarily focused on a group of third year students in an introductory Operating Systems course. A sophisticated web-based educational environment was constructed and used in the course[1]. The students were divided into three groups. The first group took the course in the traditional, lecture-based format. The second group took the course entirely on-line. The third group had access both to lectures and the on-line environment. Academic performance of the groups was compared and student acceptance was evaluated [2]. The result, though anecdotal, showed that the group with access both to lectures and the on-line environment faired best academically, while the performance of the other two

groups was roughly equal. The students taking the course on-line claimed a high degree of satisfaction with the delivery model.

In order to facilitate the construction of similarly sophisticated web-based course environments and thus further experimentation, we then went on to develop WebCT (World Wide Web Course Tool) [3][4][5][6]. WebCT is an authoring environment for the construction of Web-based courses, and requires no technical expertise on behalf of the course designer. It provides an interface that facilitates course construction (content organization, course look and feel, etc) as well as a set of educational and administrative tools. These tools include student management and access control, grade storage and distribution, a conferencing system, a chat area, electronic mail, group presentation areas, student self-evaluation, on-line quizzes, searchable glossary, student progress tracking, course content searching and more.

With WebCT available the cost, time, and level of technical expertise required to place a course on the web was reduced to the point where during its first four months of use over 60 courses had been placed on-line at the University of British Columbia. These courses cover a wide spectrum both in terms of subject matter and in terms of their degree of reliance on the WWW. Some courses are offered entirely on-line, and others use the WWW only as a supplement to existing lectures.

One of the new WebCT-based courses is a first-year course that introduces Computer Science and uses C++ as the language of experimentation. This is a lecture-based course and has an enrollment of approximately 650 students. The on-line environment for the course contains a complete set of course notes, tutorials and assignments, an extensive glossary, and uses many of WebCT's features including the conferencing system and the chat area. Students in first year at the University of British Columbia are, in many ways, quite different than their more mature third year counterparts. Our experience has shown that they tend to be less likely to participate in class and take advantage of the resources available to them. The reason for this could be a combination of the fact that they are new to the university environment, and that the class sizes tend to be much larger in first year than in third. Regardless of the reasons, we wanted to know:

1. whether the availability of a web-based resource would affect their experience in the same way that it did for the third year students we studied, and
2. whether the students would make as much use of the web-based resource as did the third year students.

The remainder of this paper addresses these questions. First we begin by outlining exactly what we've done in order to address these questions. Then we discuss some of the answers we've found.

2.0 Methodology

This study differs from that of the third year Operating Systems course study in that for the previous study we examined not only student reaction to the on-line resource, but also the difference in academic performance between the three delivery models. This study examines only the student use of, acceptance of, and reaction to the on-line resource. It does not address academic performance. To do so would have meant dividing the class into three groups as in the previous experiment. While we may do so in the future, we wanted first to gain some experience with the newly constructed on-line resource before having new university students depend on it as the single source of learning for one of their courses. We

felt that first year students would be less able to address and seek resolution to any "teething" problems encountered in the resource.

In order to obtain information regarding the level of use that students made of the resource we relied on WebCT's student progress tracking facilities [6]. These provide information for each student including the number of accesses, a breakdown of where the accesses have been to, the number of postings to the conferencing tool, etc.

A questionnaire was administered to obtain information regarding student acceptance of, and reaction to, the resource. This questionnaire was based on one constructed by the Center for Applied Studies and Evaluation at the University of British Columbia. The original questionnaire was used in the previous study of third year students. We also administered the same, new, questionnaire to the current class of third year Operating Systems students in order to provide a current basis of comparison and to confirm the results of our previous study.

Finally, it should be well noted that the nature of the results being presented here are purely anecdotal in nature. Given the differences in the first and third year courses, the number of students in these courses, and the difference in topic and instructors, it would be very difficult to construct an experiment designed to produce results of statistical significance. Thus the results presented here are anecdotal in nature and should be read as such. Still, we hope the are of interest to those considering the adoption of educational technologies in first and third year courses.

3.0 Results

As previously indicated there were approximately 650 students in the first year course (CPSC 122). The third year course (CPSC 315) had 80 enrolled. Roughly half of the CPSC 122 students, and 80% of the CPSC 315 students completed the questionnaire. In both of these courses use of the web-based resource was optional except for the requirement that all students must read all articles posted to the conferencing system.

The resources in CPSC 122 and 315 were as similar as they could be given the difference in course content. Both had complete course content on-line and both made use of the same set of WebCT tools (conferencing system, chat area, course glossary, student self-evaluation, etc.). Likewise, the incentives to use the resources and the reminders given to the students about the availability of the resources were the same.

Here we first look at the actual usage that students made of the on-line resource for each course. Then we summarize the results of the questionnaire that deals with student impressions regarding the effectiveness of the on-line resource.

3.1 Student Use

First we wanted to know how much use the students made of the resource. This is an important question as our previous study showed that the availability and use of such a resource had a beneficial impact on the grades of the students. As previously mentioned, except for asking students to read the conferencing system articles, there was no requirement for them to use the on-line material or communication tools. The question of use can be answered in several ways.

3.1.1 Course Accesses

On average the third year students made more use of the on-line resource than did the first year students. For example, the total number of sign-ons was roughly 22,000 for CPSC 122 (roughly 34 per student) versus 7000 for CPSC 315 (roughly 88 per student). Nearly every student in both courses signed on at least once. These sign-ons were counted over the three month term. These numbers were consistent with the total number of accesses to the course material (an access is counted as one viewing of a page of course content). For CPSC 122, there were on average 144 accesses per student. This compared to 258 accesses per student for CPSC 315.

3.1.2 Conferencing Tool Usage

First, how much did the students access the conferencing system? The average number of postings for CPSC 122 was just under 1.7 per student, and only 18% of the students made ever made a posting (82% did not even make one posting). Compared to the third year course where the incentives to use the resource were the same, the use in 122 was very low. In CPSC 315 the average number of postings per student was 10, and almost 70% of the students made at least one posting.

Roughly half of the 315 students read at least 50% of the articles and every student read at least some of the articles. For 122, only 5% of the students read at least half of the articles and one third of the class never read any articles.

How can this difference be explained? Part of the difference in postings per student can be explained by the difference in the number of students in each course. It has been our experience that the number of posting does not vary linearly with the number of students in the class. This is a logical result given that the bulk of the postings are questions about the course material and administration, and there are only so many questions of this nature to ask. Thus even though the number of postings per student was smaller in CPSC 122, the total number of postings was larger for 122 (roughly 1100 compared to 800 for CPSC 315). Still, the difference in postings and readings is very large and cannot be fully accounted for in this way. We are anxious to explore this issue further.

3.1.3 Access Patterns

One often-mentioned advantage of on-line educational resources is their availability at any time of the day or night, and from any location. Both groups of students had access to university labs open 24 hours per day. The on-line resource was also available off campus to anyone with a network-connected computer. This was borne out in practice for both courses. Approximately 30% of the accesses came from outside our university labs. The busiest time of day for our server was 2:00PM. During the hour between 2:00PM and 3:00PM we experienced 10% of our daily traffic. The evenings were still busy with the hour between 7:00PM and 8:00PM experiencing 4% of the daily traffic. The hour from midnight to 1:00am accounted for 2% and from 2:00am to 3:00am accounted for 1%. The only fairly quiet hours for the server were from 3:00am to 6:00am.

3.2 Student Reaction

This section examines the student's impressions of the utility of the on-line resource.

Many educators hope that on-line conferencing tools help to create a closer community of students through enhanced communication. Without such a resource it would be difficult for students to reach one another on such a uniform basis. When asked whether or not a stronger feeling of community has been formed as a result of the use of the communication tools, 85% of CPSC 315 students said it had. For CPSC 122 students, only 62% agreed.

A related question asked whether the conferencing tool made the large course more or less personal (i.e. made the students feel more or less like a "number"). For CPSC 315 over half of the students felt the experience was more personal and 42% said the experience was unchanged in that regard. A small number of students (4% in CPSC 315 and 12% in CPSC 122) said it made the experience less personal. For CPSC 122 students the numbers were roughly the same. This is of particular interest to us as it is often said by students that our large class sizes tend to make the experience somewhat impersonal. Anything we can do to personalize out student's education is of value.

When asked how useful and beneficial the students found the on-line conferencing tool and course notes, 99% of CPSC 315 students found having the the course notes on line useful (90% of those saying it was very useful) and 94% of CPSC 122 students said they were useful (though only 67% said they were very useful). For the conferencing tool, the results were less consistent between the years. For CPSC 315, 100% of the students found the conferencing system useful (77% of those found it very useful) while 78% of the CPSC 122 students found it useful (and only 26% found it very useful). Even having 78% of CPSC 122 students find the conferencing tool useful was unusual given that our access records showed that one third of the CPSC 122 students never used the conferencing tool at all. 91% of the CPSC 315 students felt that the on-line resource improved their understanding of the course material (32% saying it significantly improved their understanding). 81% of CPSC 122 students said it improved their understanding (27% saying it significantly improved their understanding).

Given the choice between the online environment and an extra office hour each week, 64% of the CPSC 315 students and 66% of the CPSC 122 students would prefer the on-line resource. Given the choice between the on-line resource and an extra lecture hour each week, 70% of CPSC 315 students, and 54% of CPSC 122 students would prefer the on-line resource. Given the choice between the on-line resource and full, printed notes handed out the first day of classes, only 60% of CPSC 315 students preferred the on-line environment, and a still smaller 41% of CPSC 122 students preferred the on-line resource. This last result was a surprise to us given that WebCT has a tool designed to make printing any (or all) of the on-line notes simple, and also given the apparent appreciation of the conferencing tool. One factor in this result could be the fact that our printing facilities were experiencing some technical problems in the first half of the term. Coupled to the fact that students have to pay for their printing but not normally for their handouts, the choice expressed by the students may not be purely pedagogical. Still, we plan to investigate this further.

One of the most important expectations we have of on-line conferencing systems is that of encouraging participation among students that would normally never participate in an in-class discussion. I have heard from several students that would never be bold enough to participate in a discussion in class, but are happy, after careful writing and the opportunity for rework, to make a contribution to an on-line discussion. This was borne out in our survey. In CPSC 122, 55% of the students claimed to be comfortable participating (asking questions and contributing to a discussion) in class, and 75% claimed to be comfortable participating in the conferencing system. Over 34% of the students were comfortable participating in the conferencing tool, but not in class. Making it possible for an additional 34% of the class to participate in discussions goes a long way toward complete inclusivity in a course. The numbers

for CPSC 315 were roughly the same, except the comfort level in both the lecture and conferencing system was somewhat higher.

The students were also asked if having access to this kind of resource reduced the need to have lectures. Roughly half the students in both courses said it did not. Of those that said it did, the average response was that an appropriate number of in-class hours per week was 1.5 (compared to the usual 3 hour per week schedule).

Finally, when asked whether the on-line environment generally improved the student's experience in the course, 94% of CPSC 315 students said it did (37% saying it greatly improved it) and 80% of CPSC 122 students said it did (29% saying it greatly improved it).

4.0 Conclusion and Future Work

This was our first survey of a large first year class regarding their reaction to educational technologies.

The most notable difference between students in our first and third tear classes was their difference in use of the on-line environment and most notably the reduced use of the conferencing tool in first year. Given that those students that did use it found it to be of benefit, we now know that we need to give our first year students more encouragement in that regard.

This work has raised many points that we are anxious to explore further. We have answered "what" and now hope to explore "why". For example, why is it that the first year students make less use of the available resources and find them, in general, less useful that the third year students? Now that we know this to be true, we plan to further investigate this and other questions to find out why they are true. Thus this work provides a focus for us in the design and administration of further surveys, and to some extent in the design and rework of our educational technologies.

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