Information Research Strategies (IMT 220) and Fluency with Information Technology (CSE 100) : Two approaches to teaching use of technology

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OVERVIEW

The University of Washington has recently initiated two approaches to teaching technology and information resources via the School of Library and Information Science (SLIS) and Computer Science and Engineering (CSE). The courses developed by the respective departments, IMT 200 [2] and CSE 100, offered specialized instruction, regarding computer use and the availability of information resources. These courses were offered during Winter 1999 and Spring 2000 quarters, allowing for the evaluation of their success over time, and comparison to courses that were unaccompanied by this type of information resource instruction. Questionnaires were administered to students in IMT 220 and CSE 100 both at the beginning and end of the course, and included questions tapping ability, confidence and performance with respect to information resources and technology. Analysis revealed that the incorporation of information resource and technology instruction resulted in significantly improved ratings given by the students concerning their computer skills, as well as increased computer literacy. A detailed account of student responses, as well as conclusions and recommendations for future courses are discussed.

INTRODUCTION

Over the last several years, the University of Washington has taken a number of different approaches to teaching the use of information resources and technology. Recently, two additional approaches have been developed and introduced into the curriculum. First, is the instruction that has traditionally been provided by University librarians in the use of information resources. This instruction has evolved over time in response to the increasing implementation of computerized databases. More recently, a new course was introduced within the department of Computer Science and Engineering based on a model developed by the National Research Council. The report, *Being Fluent with Information Technology (FIT)* defines the level of understanding of information technology sufficient for lifelong self-education. The emphasis within *FITness* is primarily on the technology underlying information resources, whereas that of the Libraries is on the use of those resources.

Instruction by the Libraries

A systematic exploration of instructional methodologies has been undertaken by UW librarians as part of their collaboration in the UWired program. Lessons learned working with GenSt 391 and the IWP program indicated that discipline-specific instruction is most effective and satisfying in teaching information literacy. Providing a departmental home for information literacy instruction and the ability to fulfill distribution requirements for students was another important concern. With the arrival of a new director in 1999, the

School of Library and Information Science (SLIS) began plans to seek campus partnerships and to create a new undergraduate program. The result was a collaborative two-year pilot of IMT 220: *Information Research Strategies* that enabled SLIS to offer their first undergraduate courses in 1999-2000, a year earlier than originally planned.[1] During the pilot period the Libraries has provided instructors and SLIS has provided programmatic support with respect to course advertising, enrollment, room reservations, etc.

The 1999-2000 pilot built on the model developed for IWP but cast use of information resources (rather than writing) as the content area to be linked with courses "across the curriculum." Conversations with several departments identified American History, Geography, and Environmental Sciences as disciplinary partners for IMT 220 during autumn quarter, 1999 (reported here). In winter quarter 2000, disciplinary partners will include International Studies and Geography, and in spring, Technical Communications. In some cases, the IMT section has been or will be linked to multiple courses in the discipline, in others a single course is the content link. In each case, the course is developed by the librarian subject specialists (who serve as the course instructors) in consultation with SLIS. IMT 220 is a three credit course taught as two 1.5 hours class sessions per week, or as three 50-minute sessions. It fulfills the General Education Area of Knowledge requirement for "Individual & Society" (see the course description).

FITness Instruction

In spring quarter, 1999, Computer Science and Engineering offered a new course (CSE 100) developed by Dr. Larry Snyder in accordance with the *FITness* model noted above. This report was the work of a national committee chaired by Dr. Snyder that solicited input from the community at large as well as from national leaders regarding "What everyone should know about information technology." It presents the intellectual foundations of a new concept of computer literacy. Unlike a computer literacy class that typically teaches computing skills of short-lived currency, a Fluency class would teach students what they need to know to continuously adapt to the rapid changes in IT.

Preliminary student response to CSE 100 was gathered when the class was first offered in spring and is reported in OEA Report 99-15 along with a more complete description of the rationale underlying development of the course. The five-credit class includes three 50-minute lectures and two 50-minute lab sessions each week, and is specifically intended for students outside of the science and engineering track.

METHODOLOGY

At the beginning of autumn quarter, 1999, students enrolled in IMT 220 and those enrolled in CSE 100 were asked to complete a questionnaire relating to their previous experience with using computers and information resources. The questionnaire was very similar to that used in the spring quarter assessment of CSE 100, and included modifications based on the findings of this earlier study. Students were asked about their experience with various software applications, their own ability and confidence in working with technology, and their self-assessed liking and comfort with computers. Liking and comfort scales were composed of items drawn from published computer attitude scales as described in OEA Report 99-15. The questionnaire concluded with four open-ended problem-based questions, two of which were intended to assess student use of information resources (primarily the focus of IMT 220) and two of which focused on algorithmic thinking (relating particularly to instruction in CSE 100).

Post-course questionnaires were administered to students in both classes at the end of the quarter, and asked students to rate their ability to describe various course concepts to someone unfamiliar with them. Because they were course-specific, the abilities listed for IMT 220 differed from those listed for CSE 100. Questionnaires also included ability and confidence questions taken from the pre-course questionnaire for the purpose of comparison, as well as the liking, comfort and problem-based questions. Mid-quarter questionnaires composed of liking and comfort scales and student assessment of their progress in the course were administered in CSE 100 but not IMT 220. Students in the IMT linked lecture-courses were administered the same set of questionnaires as were the IMT 220 students.

As shown in Table 1, below, four versions of each questionnaire were created to present computer liking and comfort, and the open-ended problem-based questions in a counter-balanced design. Two versions of each question or scale were created so that students were not presented with the same question on pre- and post-course. Additionally, the order of presentation was counter-balanced for each question, so that half of the students were given the first version on the pre-course questionnaire and the second version on the post-course questionnaire, while the order was reversed for the other half. Response rates for each student group are shown in Table 2.

Table 1. Questionnaires (versions A-D) administered in CSE 100 and IMT 220

Course	Pre	Mid 1	Mid 2	Post
IMT 220	A, B, C, D			A, B, C, D
CSE 100	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D

Table 2. Questionnaire response rates (versions A-D combined)

Course	Enrollment	Pre	Mid 1	Mid 2	Post
IMT 220	26	23 (76.9%)			17 (65.4%)
IMT 220 Link	315	175 (55.6%)			82 (26.0%)
CSE 100	94	87 (92.5%)	74 (78.7%)	58 (61.7%)	43 (45.7%)

Note: Response rates are based on the number of students initially enrolled in the course and are not adjusted for students who withdrew. Enrollment figures for the IMT 220 linked courses are estimates.

ANALYSIS AND FINDINGS

Frequencies of response to the closed questions on all questionnaires are provided in PDF format in Table 3, below, followed by a description of responses to the closed questions.

Table 3. Questionnaire response frequencies and means

IMT 220	Pre		Post
CSE 100	Pre	Mid 1 and 2 combined	Post

IMT 220

Demographics

The largest percentage of students were juniors (52%) (Figure 1), and there were more females than males (60.9% vs. 39.1%) (Figure 2). IMT 220 was comprised of primarily Caucasian students (90.9%) with 4.5% Asian and 4.5% other ethnicity students (Figure 3). The majority of respondents (81.3%) were A&S (Social Sciences) majors (Figure 4). Concerning academic preparedness, in the year prior to course enrollment, students had written an average of 1.3 research intensive papers and all students had completed precalculus (59.1%) or higher level math courses (calculus, 27.3%, beyond calculus, 13.6%), (Figure 5).

Previous Computer Experience

As reported on the precourse questionnaire, the majority of students indicated that they used email, other Internet applications and/or a word processor at least 2-3 times per week (91.3%, 73.9%, and 65.2%, respectively) (Figure 6). Most students had minimal or no experience with spreadsheets (52.2%) or paint/draw applications (69.5%).

Student Ability Level

Student ratings of their own abilities mirrored their level of experience with various applications. Precourse, the majority of students rated themselves as Intermediate or Advanced Intermediate with word processors (91.3%) and browsers (73.9%), but as Beginner with presentation (60.9%), database (69.6%) and bibliographic (91.3%) software.

When asked to provide the same ratings at the end of the quarter, students rated their abilities as significantly higher with respect to spreadsheet, database, bibliographic, browser, wed editor, and search engine applications. Ability self-ratings also improved for all other applications, although these changes were not significant (Figure 7). It should be noted that throughout this analysis, independent comparisons were used due to the lack of identifying information that would have allowed paired comparisons. This may have underestimated the true effect of the IMT 220/CSE 100 instruction.

Student Confidence Level

Most students reported feeling Very or Extremely Confident with the use of word processors (91.3%), browsers (73.9%) and web search engines (47.8%). As expected considering their ability ratings, students reported feeling Not at All or only Somewhat Confident with the use of bibliographic (73.9%), database (69.5%), presentation (65.2%) and web editor (60.8%) software.

At the end of the quarter, students were again asked to rate their confidence across a variety of applications. Compared to precourse confidence levels, students' confidence with various applications was not significantly higher (Figure 8), despite higher self-ratings of ability levels. The lack of significance may be partially due to the small number of IMT 220 students.

Attitude Toward Computers

Students were asked on the pre-course questionnaire to indicate their level of agreement with statements concerning their computer-related anxiety. In general, students indicated high levels of anxiety (mean=4.04, 1=strongly disagree, 5=strongly agree) related to computer use. Students were also asked to indicate their dislike of computers, and it was found that students reported having slightly negative attitudes or indifference toward working with computers (mean=3.45) (Figure 9).

Students' attitude toward computers was assessed again at the end of the quarter and showed a significant ($p<.05$) reduction in self-reported levels of anxiety (mean=2.13). Ratings of "computer dislike" were also slightly improved (mean=3.08), although this finding was not significant.

Information Resourses

Included on both the pre- and postcourse questionnaires were open-ended questions asking students to explain how they would go about completing various tasks, requiring knowledge of various applications and information resourses covered in the IMT 220 course. The quality of the responses were scored on a scale of 0 - 5, with 5 being the best answer possible. Points were summed over two questions, with a highest possible score of 10. Although not statistically significant, IMT 220 students showed improvement in answering such questions and exhibited a better understanding of information resourses at postcourse than precourse (2.45 and 3.29, respectively) (Figure 10).

IMT Versus Linked Courses

The existence of linked courses, which did not include a computer component, offered a good opportunity to examine the true effects of IMT 220 and additional computer instruction. Concerning demographic variables, linked courses were comparatively more diverse, most likely resulting from the substantially larger sample size. Similarily, few differences between IMT and the linked courses were found concerning previous computer experience, and will not be reported due to their erratic nature. There were no significant differences between IMT and linked courses in ability or confidence concerning computer use at the time of pre-course assessment. Also, there were no significant differences in computer anxiety levels or self reported computer dislike at precourse.

There were, however, some notable changes between IMT 220 and linked courses at postcourse assessment. IMT students reported significantly higher skill than linked course students in using online databases, web editors and search engines than did linked course respondents (Figure 11). The majority of IMT 220 respondents considered themselves Advanced Intermediate or Expert with online databases (58.9%), while significantly fewer students from the linked courses felt as skilled (27.2%). Over half of the IMT students (52.9%) rated themselves as Intermediate, Advanced or Expert with web editors, while the majority of linked course students (64.2%) rated themselves as Beginner or Intermediate Beginner with that particular application. Concerning search engines, nearly half of IMT students (47.1%) rated themselves as experts, while a very small portion of linked students (9.8%) rated themselves as highly skilled. Findings did not reveal differences in confidence with the various applications between the courses. However, IMT students did report feeling significantly less anxious toward computer use than did students in the linked courses (2.05 and 2.43, respectively) (Figure 12). No differences were found between the courses concerning dislike of computers, which was not surprising considering the relatively neutral feelings reported at precourse assessment.

As expected, results indicated that individuals in the IMT 220 course had a significantly greater degree of knowledge (Figure 13) than did respondents in the linked courses concerning computer/software problem solving both pre- (2.45 and 2.07, respectively) and post course (3.29 and 1.90, respectively). It appears that the additional instruction of IMT 220 did, in fact, improve the computer skills of enrolled students.

CSE 100

Demographics

There were near equal proportions of freshmen, sophomores, juniors and seniors (Figure 14), and the class had comparable numbers of male (54.7%) and female (45.3%) students (Figure 15). CSE 100 was equally comprised of Caucasians (42.2%) and Asians (41.0%) with low enrollment rates for other ethnicities (Figure 16). Most CSE students were either A&S (Social Sciences) (37.9%), Business Administration (24.2%), or Engineering (19.7%) students (Figure 17). Academically speaking, most students were well prepared, as the majority (88.2%) had completed precalculus or higher level math course (Figure 18), and the average number of research intensive papers written in the last year was 5.72.

Previous Computer Experience

The majority of CSE 100 students indicated that they used word processors, email and other internet functions daily or several times per week (55.8%, 80.3% and 75.8%, respectively) (Figure 19). Most respondents reported having little or no experience with spreadsheets (51.7%) or paint/draw applications (66.3%).

Student Ability Level

Precourse questionnaires indicated that students' ability levels were closely linked to their rates of usage for the various applications. A large proportion of students rated their skill as Advanced Intermediate or Expert with word processing (50.6%), browsers (52.3%) and web search engines (43.6%), but Beginner

with spreadsheet (33.3%), database (64.7%), presentation (55.3%), graphic (52.9%), and web editor (65.5%) software.

Following the completion of the course, students were again asked to rate their abilities with the applications covered. Ratings were improved across nearly all applications, and significantly so for word processing, spreadsheet, database, bibliographic, and wed editor applications. Interestingly, ability ratings significantly decreased for browser applications (Figure 20).

Student Confidence Level

As indicated on precourse questionnaires, the majority of students indicated feeling Very or Extremely Confident with the use of word processors (77.9%), browsers (66.6%), and search engines (50.6%). Similar to ability ratings, most respondents rated themselves as Beginner with database (37.9%), presentation (34.5%), graphic (41.4%), bibliographic (51.7%) and web editor (43.7%) software.

At the end of the quarter, CSE 100 students again provided confidence ratings, which indicated a significant increase in confidence for using word processors, spreadsheet, database, bibliographic, and web editor applications. As in ability ratings, a decrease in confidence level was evident with the use of browsers following the completion of the course (Figure 21).

Attitude Toward Computers

In responding to precourse questionnaires regarding anxiety and dislike surrounding the use of computers, students indicated high levels of anxiety associated with computer use (4.0 of a high of 5.0), and a moderately high dislike of computers (3.7 of a high of 5.0).

Postcourse questionnaires indicated a significant improvement in attitudes toward computers following the completion of the CSE 100 course. Students reported moderately low levels of anxiety (2.3) and dislike (2.8) (Figure 22).

Two midquarter questionnaires were administered to CSE 100 students one-third and two-thirds through the quarter. The responses indicated that computer dislike decreased from precourse (3.7) to postcourse (2.8), but was stable across the midquarter questionnaires (3.0). Computer anxiety also decreased from pre- (4.0) to postcourse (2.3) but was actually elevated at the time of the second midquarter questionnaire (2.5) relative to the first midquarter assessment. This finding corresponded with the fact that the majority of students reported that the material covered had been getting progressively more difficult, and that they did not understand as much of the course content towards the end of the term as they had earlier in the quarter.

Information Resourses

As with the IMT 220 course, students in CSE 100 were given a series of open-ended questions, requiring knowledge of various applications and information resources covered throughout the quarter. The quality of the responses were scored on a scale of 0 - 5, with 5 being the best answer possible. Points were summed over two questions, with a highest possible score of 10. Interestingly, the results suggested that

students exhibited less understanding of information resources following the course. This is most likely a function of the lack of reponses (n = 22, verus 68 at precourse), and unwillingness to spend time answering the questions in sufficient detail (Figure 23). This finding was not significant, suggesting that the direction of differences was due to chance. The performance of CSE 100 students was, as expected, lower than that of IMT 220 students on the aforementioned questions as they were based on IMT course content.

CONCLUSIONS / RECOMMENDATIONS

IMT 220

From the findings based on the completed IMT 200 questionnaires, a number of conclusions and recommendations can be made to improve the course in future quarters. The demographics of the students suggest that juniors and other upper level students are more aware of the IMT opportunity and are more likely to enroll in such a course. Because the content courses are often at the 200-300 level, it was expected that more freshmen and sophomores would have enrolled. There is a possibility that younger students have not yet identified the need to develop such skills, while upper level students are more aware of skill deficit. Although gender was equally balanced within the linked courses, there were more females involved in the IMT 220 course, perhaps due to a gender-specific preference for instruction rather than self-teaching. Minority students were highly underrepresented in the IMT 220 course, although this trend was also evident in the linked courses, which consisted of primarily Caucasians. Clearly, outreach efforts must be increased to include more underrepresented minorities, both in linked courses and IMT 220 participation. Individuals enrolled were primarily students in Social Sciences, as was expected considering the disciplines of the linked courses.

According to the findings concerning previous computer experience, ability and confidence ratings, students are comfortable with word processing and basic email and internet functions, and therefore instruction need not focus heavily on these areas. However, it can be concluded that IMT 220 instruction was globally effective, as ability and confidence ratings improved with all applications. The largest improvements were made to bibliographic and web editor skills, two areas that were particularly weak at the beginning of the term.

The majority of students liked computers, or were indifferent towards their use, at the beginning of the course, and this feeling remained relatively stable throughout. There were, however, significant reductions in anxiety associated with computer use throughout the quarter, stemming at least partially from the hands on experience with common applications. Students were exposed to a variety of previously unfamiliar applications and functions, perhaps diminishing the "fear of the unknown".

There are several general recommendations that can be made to improve enrollment. Perhaps IMT instruction should be linked to departments or disciplines rather than specific courses. This will enlarge the pool of students that may benefit from the course, and increase awareness of its availability. Student interest might also be improved if the course was held over three 50 minute sessions per/week rather than two 90 minute sessions as is currently the case.

Clearly, IMT 220 is an effective method of improving student computer skills and reducing the anxiety surrounding unfamiliar applications. Additional disciplines should be explored, and librarian involvement should continue to be encouraged.

CSE 100

This course consisted of relatively equal proportions of freshmen, sophomore, juniors and seniors indicating that it is reaching a variety of students and is well suited to individuals at various points in their academic careers. The class also appeared to offer instruction equally appealing to both males and females, and reached a variety of disciplines. Asian participation was high, as was Caucasian, however there were few students of other ethnicities enrolled. This may be a function of the University population in general. The majority of the students enrolled appeared to be involved in higher than average research intensive course work, perhaps indicating that their motivation for gaining computer skill was greater than most students.

CSE 100 students, and perhaps students in general, are comfortable with word processors, email and basic internet functions, but their skill does not extend much beyond those familiar applications. CSE 100 instruction greatly improved those areas in which the students were weakest, particularly bibliographic and web editor applications, demonstrating the effectiveness of the course and/or the instructor. However, an area where most students felt very confident precourse, browser applications, was actually weakened following the completion of the course. Because students indicated the progressive difficulty of the course and their anxiety and lack of full understanding late midquarter, it is possible that the information provided on what they thought was a simple application, actually confused them more than it helped. It appears that more course time needs to be directed toward browser applications and perhaps structional clarity on the topic is necessary.

Responses concerning computer attitudes indicated that while students liked computers, there was a great deal of anxiety surrounding their use. Although anxiety was significantly reduced by postcourse assessment, individuals' anxiety increased at late midquarter, probably as a function of the difficulty of the material covered at that time.

Certainly, it appears that CSE 100 is an effective method of computer instruction, particularly for non-computer science majors and individuals of various class standing. Efforts need to be continued to increase student enrollment and involve a wider variety of disciplines and ethnicities.

FIGURES AND TABLES

Figure 1. Class distribution of IMT 220 students

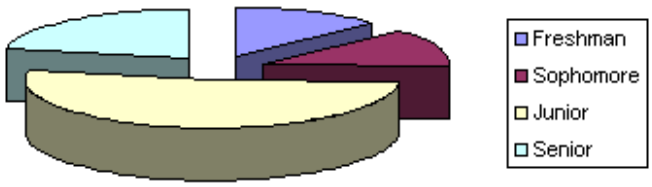

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Figure 2. Gender distribution of IMT 220 students

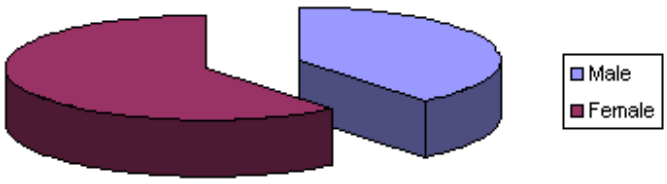

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Figure 3. Ethnic distribution of IMT 220 students

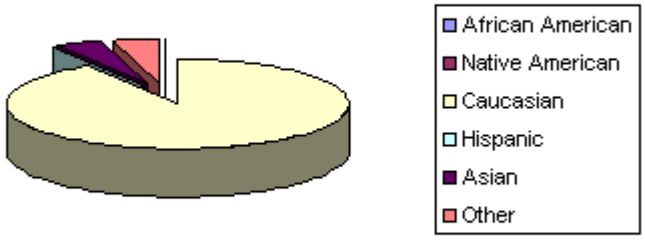

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Figure 4. Academic major of IMT 220 students

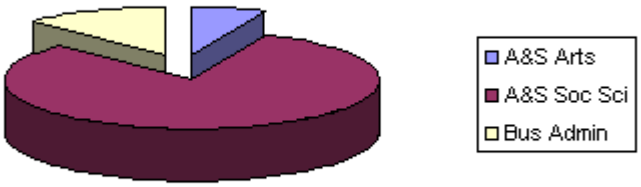

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Figure 5. Highest level of math taken by IMT 220 students

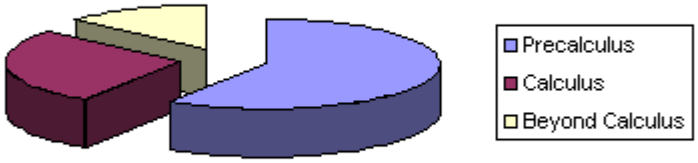

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Figure 6. Frequency of computer use for IMT 220 students

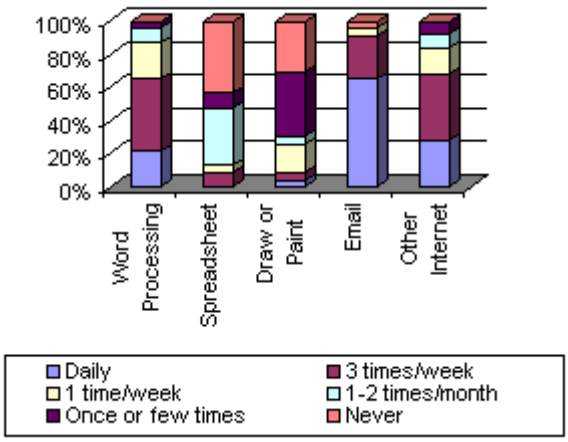

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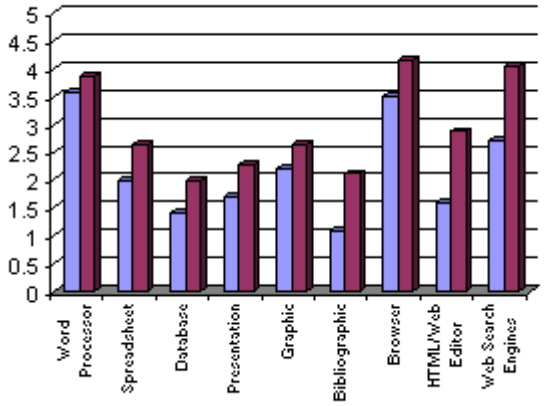
Figure 7. Self-rated ability for IMT 220 students Figure 8.



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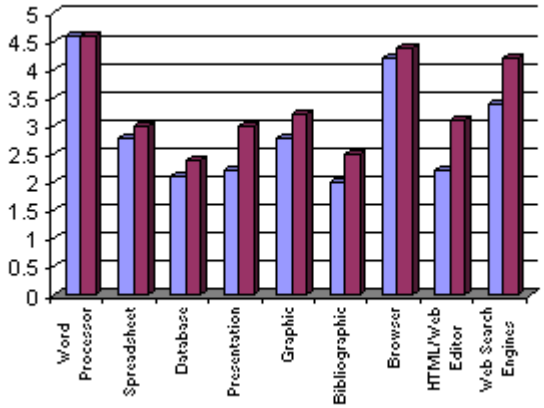
Self-rated confidence for IMT 220 students Figure 9.



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Attitude toward computers for IMT 220 students

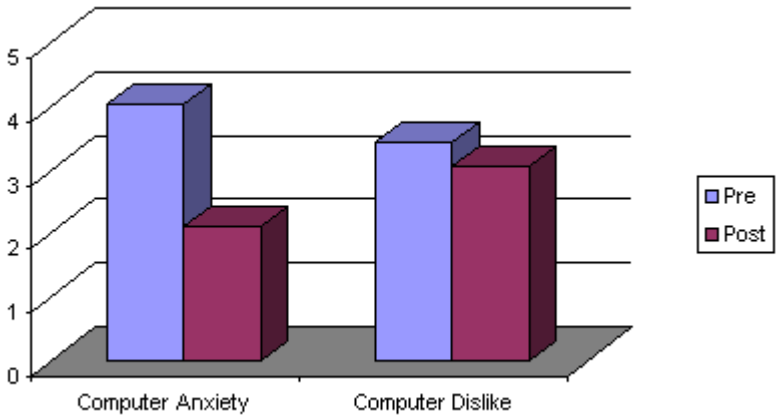

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Figure 10. Open-ended question performance by IMT 220 students

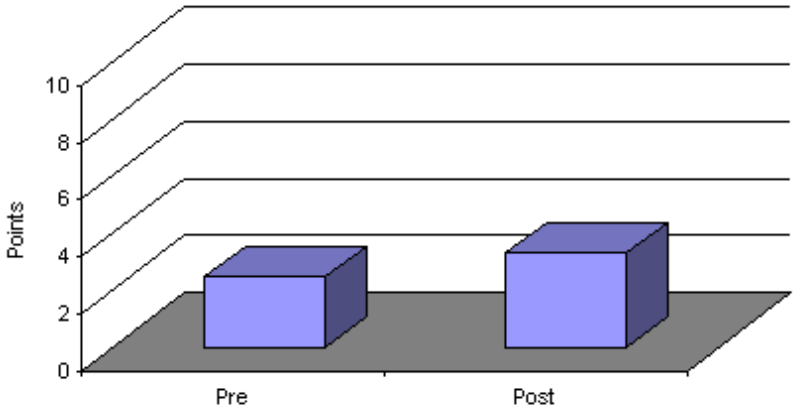

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Figure 11. Comparison of postcourse ability ratings for IMT 220 and linked course students

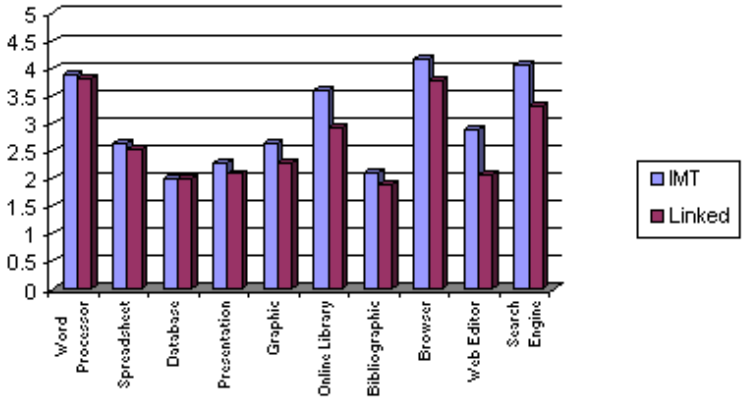

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Figure 12. Comparison of postcourse anxiety ratings for IMT 220 and linked course students

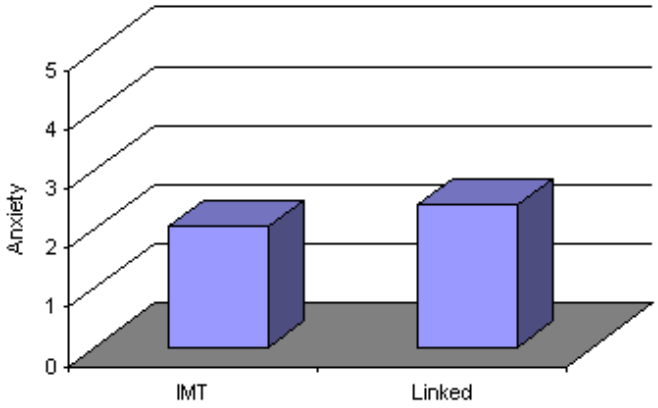

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Figure 13. Comparison of postcourse open-ended responses for IMT 220 and linked course students

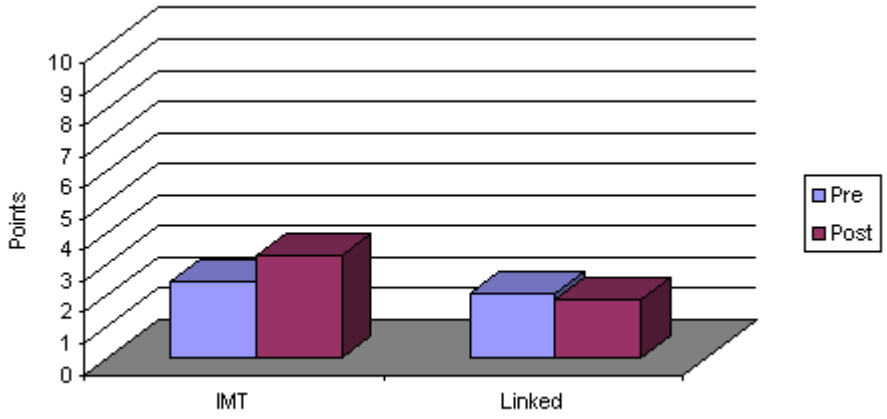

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Figure 14. Class distribution of CSE 100 students

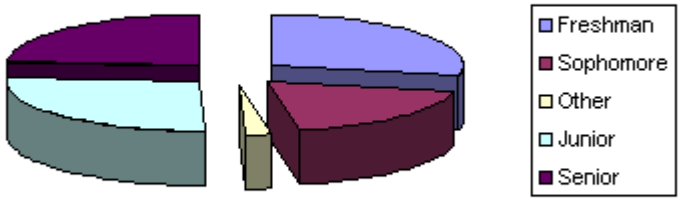

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Figure 15. Gender distribution of CSE 100 students

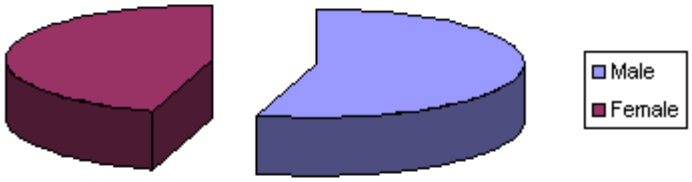

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Figure 16. Ethnic distribution of CSE 100 students

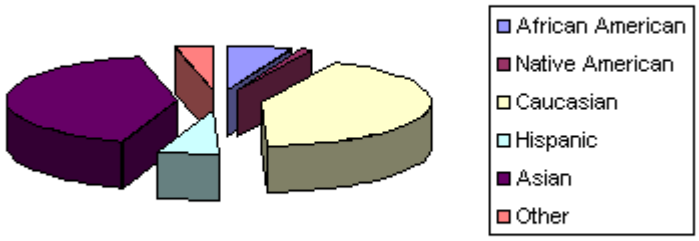

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Figure 17. Academic major of CSE 100 students

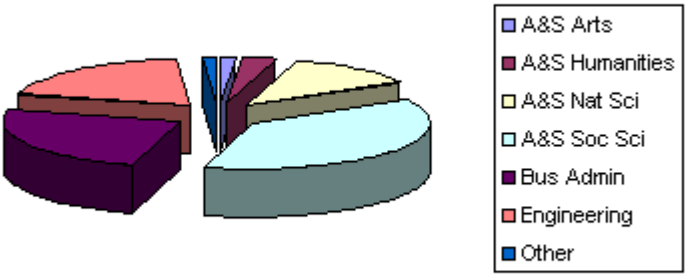

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Figure 18. Highest level of math taken by CSE 100 students

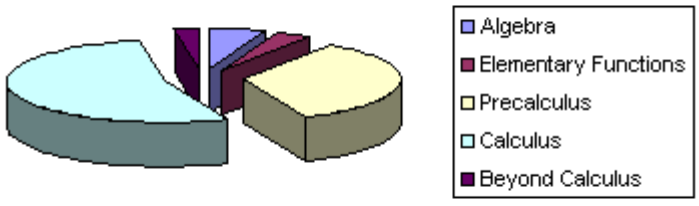

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Figure 19. Frequency of computer use for CSE 100 students

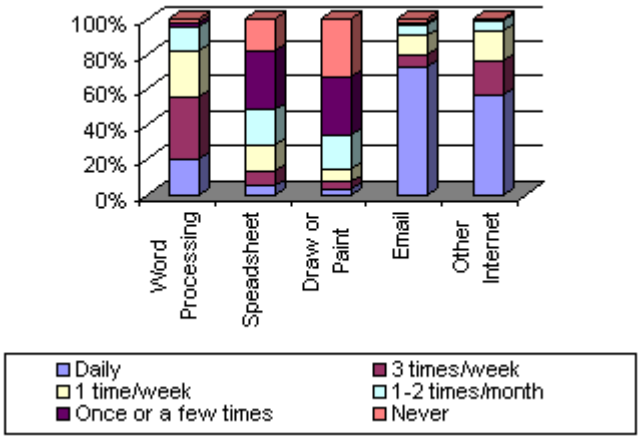

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Figure 20. Self-rated ability for CSE 100 students

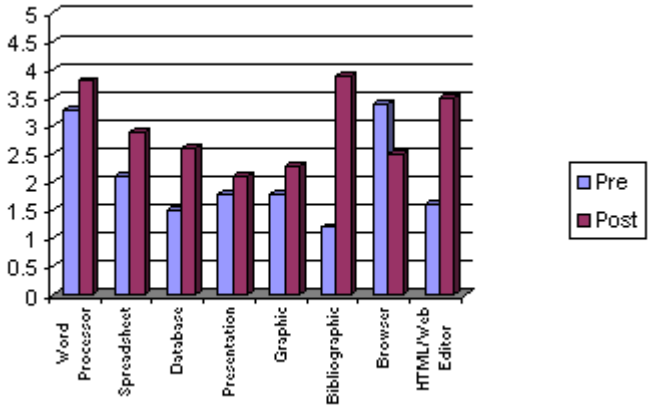

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Figure 21. Self-rated confidence for CSE 100 students

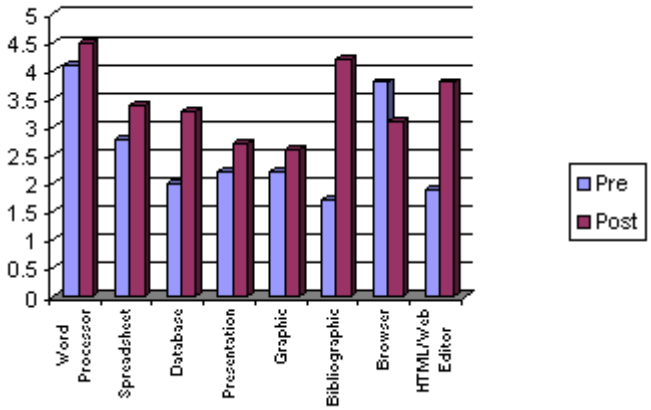

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Figure 22. Attitude toward computers for CSE 100 students

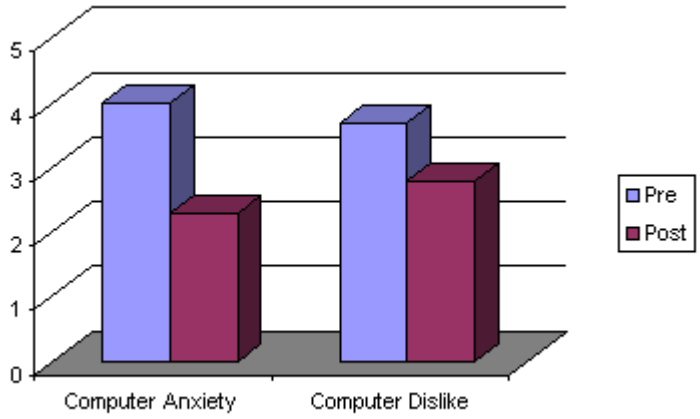

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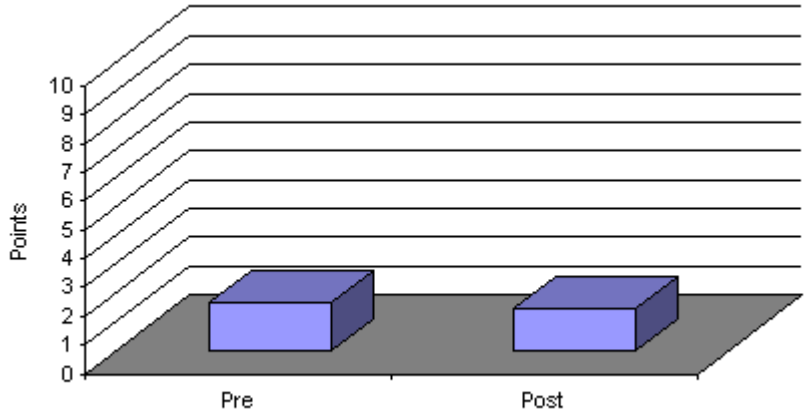
Figure 23. Open-ended question performance by CSE 100 students



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[1] We would like to extend our special thanks to Dr. Larry Snyder for the inclusion of CSE 100 students in the present study.

[2] The *IMT* (Information Management & Technology) course designation for the SLIS undergraduate program was changed to *INFO* as of the 2000-2001 academic year.

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