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ABSTRACT

The Computer Science Department at Monash University (Victoria, Australia) recently began presenting lectures using projection of a hypertext system, HyperLecture, running on a notebook computer as the primary medium. This paper presents a statistical analysis of student reactions to this approach, focusing on the effects, as perceived by the students, on retention and comprehension of material, lecturer performance, and overall benefit of computer-mediated presentation (CMP). The student questionnaire asked: (1) Compared to other lecture series you have taken this semester, were the lecture materials presented as clearly using the computer?; (2) Did the code demonstrations help you to understand the examples better?; (3) Did the code demonstrations help you to remember the concepts presented better?; (4) Would you have liked to take an electronic copy of the lecture material home for study and revision?; (5) How do you think the use of the computer affected the lecturer's presentation style?; (6) Do you prefer computer-based presentations or "traditional" presentations?; and (7) Overall, was the use of a computer to present the course of any benefit in helping you to understand the material presented? Results found that: 68% of students reported that the lecture materials were presented more clearly using the computer; 83% reported helpfulness of the code demonstration for understanding examples, and 75% for understanding long-term recall; 91% showed an inclination to take an electronic copy of the lecture home; 87% reported thinking the presentation method benefited lecturer's presentation style; 83% preferred computer-based presentations; and 82% indicated at least some overall benefit of CMP in understanding lecture materials. Student responses were found to be very positive, with strong correlations between scholastic ability (actual or self-perceived) and student approval of CMP. No significant variations in response were found between males and females, nor between native and non-native speakers. Nine figures illustrate data. (MAS)

Student Response to Hypermedia In The Lecture Theatre: A Case Study

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Abstract: The Computer Science Department at Monash University recently began presenting lectures using projection of a hypertext system running on a notebook computer as the primary medium. This paper presents a statistical analysis of student reactions to this approach, focusing on the effects, as perceived by the students, on retention and comprehension of material, lecturer performance and overall benefit of computer-mediated presentation (CMP). Student responses are found to be very positive, with strong correlations between scholastic ability (actual or self-perceived) and student approval of CMP. No significant variations in response are found between male and females, nor between native and non-native English speakers.

A Case Study in Lecture Presentation

Computer-mediated presentation has been discussed for over two decades now (Levien & Mosmann, 1972). Yet, despite the fact that traditional lecture media (that is, blackboards or overhead projectors) impose significant restrictions on the presenter (Penner, 1984; Guskey, 1988; Sharpe & Willshire, 1989), computer-based presentation systems have yet to make significant inroads into the lecture theatre (Dressel & Marcus, 1982).

During the 1993 teaching year the Computer Science Department at Monash University initiated a study to gauge the effectiveness of portable computers as a presentation medium. A hypertextual presentation system, HyperLecture (Conway, 1993a), was developed and used to present an introductory computer programming course at the 1st Year level. Both lecturer and students reacted favourably to the use of the computer as a presentation medium (Conway, 1993b), but no empirical evidence could be gathered until the completion of the course.

During the course review students were asked to complete an additional questionnaire, designed to assess quantitatively their reactions to the use of computer-mediated presentation. The questionnaire asked them to rate the use of the computer in terms of its effect on the lecturer's presentation style, whether it improved information transfer and/or retention, and their overall preference for computer-based or standard presentation techniques

The findings supported the lecturer's opinion that computer mediated presentation had been better received than traditional lecturing techniques. However, some interesting discrepancies in student opinion were noticed when their responses were analysed according to scholastic ability, gender and native language.

The remainder of this section presents a brief overview of the presentation system used. The next section discusses some of the features of the survey and the motivation for particular questions. Sections 3 and 4 present an analysis and interpretation of the results of the study. The final section attempts to draw together the experience of the lecturer and the feedback of the class.

HyperLecture

HyperLecture is an Apple HyperCard stack designed to greatly facilitate the design, creation and presentation of linear and non-linear lecture materials. HyperLecture incorporates many features specifically aimed at minimizing the interference of the presentation medium on the presented message. A full summary of the capacities of HyperLecture is presented in (Conway, 1993a).

Significant features of the HyperLecture stack include:

- A simple gestural command interface, which avoids cluttering the screen with unnecessary controls.
- Optional automatic cross-referencing of materials into a hypertext.
- Multiple navigation modes, supporting linear, hierarchical and free-associative types of presentations.
- The capacity to quickly produce coordinated lecture handouts and summaries, either as electronic documents, reproductions of the actual presentation materials, or as a fully formatted summary document.

- A simple plain-text input format. Input text is automatically formatted into a clear, readable, minimalist style, with optional embedded directives giving finer control over presentation format.
- An auxiliary stack which facilitates the presentation and explanation of programming code examples.
- The capacity to annotate materials textually and verbally for later student revision.
- The capacity to design and implement self-driving audio-visual tutorials using the lecture material.
- Audio assistance for visually impaired users.

Typically, a prepared HyperLecture stack is loaded onto a Macintosh PowerBook and is presented (using the screen mirroring facilities of the PowerBook) via an LCD projection panel on a standard overhead projector. Alternatively, the PowerBook may be plugged directly into a large screen display device.

The Questionnaire

A brief questionnaire was issued to 300 students taking the Introduction to Computing subject. Response to this questionnaire was anonymous but compulsory. The seven questions asked were:

1. Compared to other lecture series you have taken this semester, were the lecture materials presented as clearly using the computer?
2. Did the code demonstrations help you to understand the examples better?
3. Did the code demonstrations help you to remember the concepts presented better?
4. Would you have liked to take an electronic copy of the lecture material home for study and revision?
5. How do you think the use of the computer affected the lecturer's presentation style?
6. Do you prefer computer-based presentations or "traditional" presentations (eg: overhead projector and/or blackboard?)
7. Overall, was the use of a computer to present the course of any benefit in helping you to understand the material presented?

For each question students were asked to select a numerical response from 0 to 10, indicating strongly negative response to strongly positive response respectively. They were also asked to furnish information regarding their previous academic achievement and their expectations. This information was requested to test whether (actual or perceived) academic ability was a factor of a students acceptance of computer mediated presentation. Gender differences were also examined.

Many of the students in the class come from countries where English is not the principle language. Such students often experience difficulty in understanding lecture materials, because of language barriers. Hence, native language (specifically, whether the student was a native speaker of English, the presentation language) was investigated as a third possible factor of student acceptance of CMP.

The Student Response

Figure 1 summarizes the overall student responses to the questionnaire whilst Figure 2 shows a breakdown of responses by gender and native language. Figure 3 shows the breakdown of responses to the two summary questions (questions 6 and 7) according to the actual and predicted scholastic achievement of students.

Observations and Commentary

General Observations

It is clear that neither native language nor gender is a significant factor in the response of the students to computer-mediated presentation of lecture materials. There is a small but consistent difference between the mean response of male and female students across all questions, with males responding 0.5 ratings (5%) more positively than females. This may be a genuine difference in perception or may be due to other factors (for example, gender-specific cultural attitudes towards Computer Science or gender-based attitudes to the presentation style of a male lecturer.)

There was no detectable difference (less than 1%) between the overall response between native English speakers and those whose first language is not English. This may be due to the high standard of English literacy amongst international students (a TOEFL score in excess of 575 is an entry requirement for the course.)

To evaluate the statistical variation of student response with scholastic performance, students were classified according to the letter grade of their results: A (100-85, or High Distinction), B (84-75, or Distinction), C (74-65, or Credit), D (64-50, or Pass), E (49-45, or Terminating Pass), F (44 and below, or Fail).

When marks achieved on a midsemester test were considered, there was found to be a strong correlation (81%) between letter grades and the average response of students achieving that grade. For the two summary questions

Response	1. Were lectures presented as clearly using CMP?	2. Code demonstrations assisted understanding of examples	3. Code demonstrations assisted recall of concepts	4. Would you like an electronic copy of lectures?	5. CMP affected lecturer's presentation	6. Prefer CMP or traditional presentations	7. Overall, CMP was of benefit
0 (very negative)	2.00%	0.33%	0.67%	0.67%	0.33%	1.00%	1.00%
1	2.33%	2.00%	1.67%	0.00%	0.67%	1.67%	0.33%
2	3.67%	2.00%	1.33%	0.33%	0.67%	2.00%	2.33%
3	5.33%	2.67%	3.33%	0.33%	1.67%	2.33%	1.67%
4	7.33%	2.33%	3.67%	0.00%	1.33%	2.00%	4.00%
5 (neutral)	11.00%	7.67%	14.33%	7.33%	8.33%	8.33%	8.33%
6	6.67%	12.33%	16.67%	2.67%	7.67%	3.67%	9.00%
7	17.33%	21.67%	24.67%	7.67%	19.00%	12.67%	19.00%
8	19.00%	16.67%	15.67%	16.33%	26.00%	19.00%	27.00%
9	12.00%	17.33%	11.33%	17.33%	15.33%	12.67%	12.67%
10 (very positive)	13.33%	15.00%	6.67%	47.33%	19.00%	34.67%	14.67%

Figure 1. Summary of student responses

(questions 6 and 7) this correlation was 93%. However, as indicated by the high standard deviation of the responses (2.2 ratings, averaged across all questions), the correlation between the letter grade and responses of individuals show negligible correlation (only 18%). This is reflected in Figure 3.

Analysis of the correlation between students' responses to CMP and their predictions of their final marks show very similar patterns Letter grade and average student response within that grade were correlated at 83% overall and at 89% for the summary questions. Correlation between grade and individual response was, once again, effectively uncorrelated (at 18%).

An interesting exception to the general pattern of high correlation between predicted letter grade and average reaction to CMP is in the response of students predicting an F grade. Averaged across all questions, students who believed they were going to fail exhibited an average response 7% (approximately three-quarters of a rating) higher than students who believed they would achieve a non-continuing pass. This pattern is reflected in the vee-shaped "tails" in the "Predicted final result" graphs of Figure 3.

Three possible explanations for this anomaly present themselves. This exception to the correlation between grade and response may be indicative of wishful thinking on the part of weaker students. Alternatively it may suggest that students predicting failure are an enthusiastic but pessimistic group within the population. Finally it may be that students who expect only a terminating pass have lost interest in the course or confidence in themselves and therefore their reactions to CMP expressing a negative attitude to their studies as a whole, rather than specific hostility to computer-based lecturing.

Nevertheless, it may be concluded that both students who perform better and students who are more confident are generally more positively disposed to CMP, but with large individual variations. Initially it was hypothesised that, given the similarity of statistical and individual response patterns, these two factors – performance and confidence – might be highly correlated. However, analysis reveals a correlation of only 36% within this population, suggesting instead that either ability or confidence suffices as a predictor of enthusiasm for CMP.

Student Response to Specific Questions

68% of students reported that the lecture materials were presented more clearly using the computer; 21% indicated that other lecture presentation methods were more clear. The average rating for presentation clarity was 6.6 out of 10. Males responded 9% more positively than females, with an average rating of 6.8.

Students who predicted a non-continuing pass (E grade) for the subject were the least positive group (the only group with a negative average.) Students predicting an A grade reported greatest positive response – a difference of nearly 4 ratings higher than the students predicting an E. This difference was largest margin between any two groups in any question. Students who expected a failing grade (F) were, on average, 1.5 ratings (16%) more positive than students expecting a non-continuing pass.

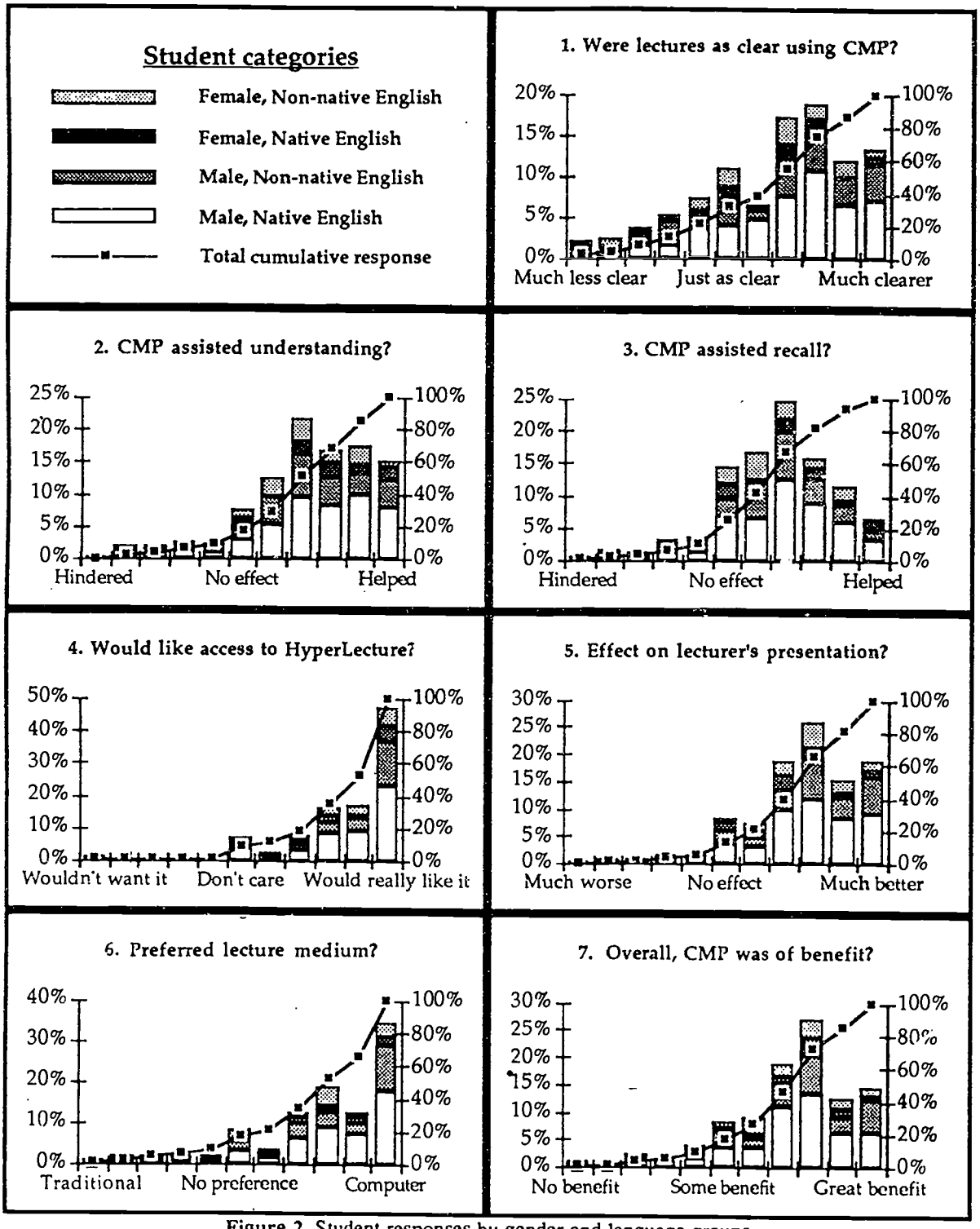

Figure 2. Student responses by gender and language groups

Approximately 83% of students reported that the code demonstration software integrated into HyperLecture system helped them to understand the programming examples to some extent. 9% of students indicated that the software had some negative effect. Average response to this question was a rating of 7.23 out of 10.

As with question 1, students who expected to achieves grades of A or B reported significantly more positive perceptions (approximately 3 ratings) than students expecting a non-continuing pass. Again, students expecting to fail were noticeably more positive about the effects of CMP than those expecting an E.

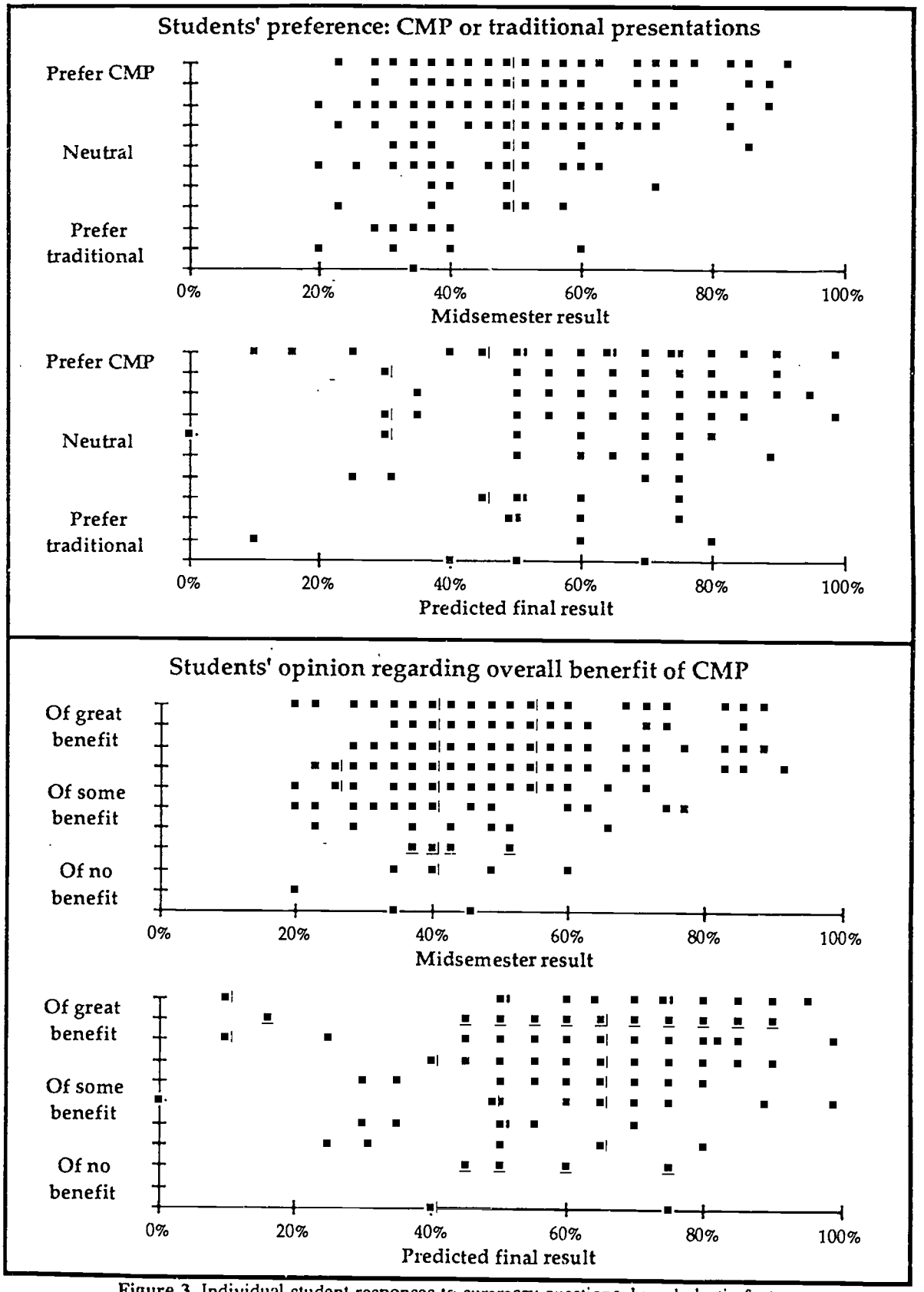

Figure 3. Individual student responses to summary questions, by scholastic factors

Students were less convinced that the use of the code demonstration software aided their long-term recall of programming concepts, with 75% of students reporting some benefit. 11% of students suggested that the software had some negative effect on their recall. The average rating for this question was 6.65 out of 10. Despite the large number of neutral responses to this question, there was still solid correlation (86%) between predicted grade and average degree to which students predicting that grade believed that CMP had assisted their recall of material. However, at 42%, correlation between students' actual grades and their individual response was very poor.

Students exhibited an overwhelmingly positive response when asked if they would have liked to take an electronic copy of the lecture material home for study and revision. 91% of students showed at least some inclination to do so and only 1% showed any disinclination. The average response to this question was 8.70 out of 10, the most positive rating for any question. No doubt this reflects the average student's perennial enthusiasm for any educational resource.

Asked how they thought the use of a computer had affected the lecturer's presentation style, 87% indicated some beneficial effect, with 5% indicating a detrimental effect. The average response was 7.65 out of 10. Both predicted and actual grades were clearly correlated as factors in student response (93% and 83% respectively.)

In response to question 6, 83% of students reported that they preferred computer-based presentations, whilst 9% indicated a preference for "traditional" presentations (for example, overhead projector and/or blackboard.) The average response was 7.82 out of 10. A greater percentage of males indicated preference for CMP, with average male responses being approximately 1 rating level (9%) higher than that of female students. In contrast, there was absolutely no variation by native language group (less than 0.2%).

The final question, which asked if the students believed that the use of CMP was of any benefit in helping them to understand lecture materials, was procedurally flawed in that it failed to allow students to indicate any detrimental effects. Nevertheless 82% of students indicated there at least some benefit, with an average response of 7.30 out of 10. Once again, student response was strongly correlated with both predicted and actual grades.

Conclusion

It is clear that, generally speaking, the students responded very positively to the use of computer-based hypermedia in the lecture theatre. Most particularly, students were extremely keen to interact directly with lecture materials and code examples, by taking copies of them home for their own use. There was a slightly more positive response by male, English-speaking students, but this is probably more a reflection of the gender of the lecturer and cultural attitudes to the lecture subject than suggestive of varying reactions to the technology.

Actual scholastic achievement was well correlated with statistical response to CMP, but showed negligible correlation on the individual level. There was also strong correlation between expected grade and average response for that grade, but again there was wide variation in individual responses.

Students generally reported that the computer-based lecture materials were presented more clearly than materials in standard lectures. It appears that CMP assisted their initial understanding of material more than subsequent recall, although a majority of students reported benefits in both areas. It is possible that this partial failure may have been overcome had students been able to gain direct access to the hypertext materials for revision purposes.

CMP was clearly more popular than standard lecture presentation techniques, although this may partially be indicative of the relative novelty of hypermedia in the lecture theatre. However a clear majority of students also indicated that they believed the use of CMP to have been of benefit to them.

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