Letter to the Editors

Information technology in nutrition and dietetic education

A. Wise

School of Food and Consumer Studies, The Robert Gordon University, Queen's Road, Aberdeen AB15 4PH, UK

The increase in pressures of teaching in tertiary education has led to a need to consider new methods to support the learning experience for students; for example, in a single faculty of a university, a survey has shown that there were 173 different innovations in teaching methods that were being tried and 14% of these involved information technology (Ellington & McIntosh, 1995). Since the development of the computer, it has become a growing influence on the workplace for nutritionists and dietitians, so clearly information technology has been incorporated into the teaching programme as a subject. In addition to these more obvious uses of computers by professionals, computers can also be used to help in the teaching of non-computing-related subjects. While teachers of nutrition may be pleased to allow computing staff to develop separate units for information technology, few may themselves consider the application of information technology in the support of their own teaching. I have developed several different approaches that illustrate the range of possible uses of computers as aids to teaching; I incorporated all of them into the teaching of second year Nutrition and Dietetics students.

A search of the education literature from 1976 to 1997 failed to find any study in which a wide range of information technology was employed at the same time in the support of teaching; there are, however, many reports of individual programs and their evaluation in a wide range of subjects, including nutrition (Kolasa & Miller, 1996). Thus, at the end of the year, before examinations, students were asked to complete a questionnaire about information technology; each question was made in the form of a statement with potential scores 1–7 from one extreme idea to the opposite, for example disagreement to agreement (this type of evaluation is known as the illuminative model; see Knussen *et al.* 1991). Each program was evaluated by students in terms of simplicity of use and the extent to which it helped them. Other questions were asked about whether timetabled hours should increase and about use of the programs outside classes. There were also general questions relating to the use of information technology and the students' attitudes to computers. The scores for all the questions regarding the simplicity of use were summated, as were those asking about how helpful the programs had been. These data were used in Spearman's correlation analysis of the results. There was a high response rate from students (thirty-one completed from thirty-two students). The questions asked and the results obtained are shown in Table 1, and discussed in relation to each program, and then as general conclusions.

Dietary program

'Diet5 for Windows' (Univation Ltd, The Robert Gordon University, Aberdeen, UK) was developed primarily for teaching and it has been enhanced later to provide research functions. Features of special interest to education include the food searching and presentation facilities that help students to explore the food tables simply and learn about the relative nutritional contents of different foods at the same time. There are graphical presentations to illustrate the foods before selection for a diet and to show the relative contributions of foods to the nutrient contents of each meal and recipe. Information about typical portion weights is given and photographs of foods of different weights are available to help students visualize them better.

Students had two practical classes, during which they followed a worksheet with detailed instructions and pictures of the screen. After undertaking a 7 d weighed intake and activity diary, students compiled a report in semester 2 in which they included excerpts from the analysis copied from 'Diet5 for Windows' to Microsoft 'Word 6.0'. They had to show how they could improve the diet and also include analysis of that diet in the report. In semester 2, students were also required to use 'Diet5 for Windows' to calculate nutrient contents of meals and recipes that they cooked in kitchen practical classes. Generally it has received a good score for simplicity and for helping students; this may be because of the use of pull-down menus, a full help system, and a thorough, illustrated worksheet. Despite the inclusion of two 3 h practical classes, most students have suggested an increase in timetabled hours and clearly they have used the program extensively outside class.

Exploration as a learning method

Many educationalists are developing multimedia material similar to that found in current CD ROM encyclopaedias. However, there is a considerable debate concerning the value of incorporation of entertainment into education and a new word has been developed to express the idea: edutainment (Morgan & Sinclair, 1995). Edutainment is thought to give the opportunity for the creative engagement of the student with tools that facilitate the process of

Table 1. Medians and interquartile ranges for scores given for each statement in the student questionnaire to evaluate the use of information technology (IT) in teaching nutrition

'Diet5 for Windows'*			
Simple to use	Disagree	1 2 3 **4 5 6** 7	Agree
Helped me learn about nutritional value of foods	Disagree	1 2 3 **4** 5 **6** 7	Agree
Timetabled hours for program should be	Decreased	1 2 3 **4 5 6** 7	Increased
I used the program outside classes	Rarely	1 2 3 4 5 **6** 7	Frequently
'Crossword puzzle'			
Simple to use	Disagree	1 2 3 4 5 **6** 7	Agree
Helped me revise	Disagree	1 2 3 4 **5** 6 7	Agree
Timetabled hours for program should be	Decreased	1 2 3 **4 5** 6 7	Increased
I used the program outside classes	Rarely	1 **2 3 4 5 6** 7	Frequently
The number of puzzles I did was	None of them	1 2 3 4 **5 6** 7	All of them
'Interpret Minitab'			
Simple to use	Disagree	1 2 **3 4 5** 6 7	Agree
Helped me learn about Minitab output	Disagree	1 2 **3** 4 **5** 6 7	Agree
Helped me learn about research	Disagree	1 2 **3 4 5** 6 7	Agree
I used the program outside classes	Rarely	**1 2 3** 4 5 6 7	Frequently
'Sentence construction'			
Simple to use	Disagree	1 2 3 4 5 **6 7**	Agree
Helped me learn about research	Disagree	1 2 3 **4 5** 6 7	Agree
I used the program outside classes	Rarely	1 **2 3 4 5 6 7**	Frequently
Practical time for Minitab and research should be	Decreased	1 2 3 **4 5** 6 7	Increased
'Metabolic pathways'			
Simple to use	Disagree	1 2 3 4 **5 6** 7	Agree
Helped me learn about biochemistry	Disagree	1 2 3 **4 5 6** 7	Agree
Timetabled hours for program should be	Decreased	1 2 3 4 **5 6** 7	Increased
I used the program outside classes	Rarely	**1 2** 3 4 5 6 7	Frequently
'Word for nutritionists'			
Simple to use	Disagree	1 2 3 4 **5 6 7**	Agree
Helped me learn about references	Disagree	1 2 3 4 **5 6** 7	Agree
Helped me learn about citations	Disagree	1 2 3 **4 5 6** 7	Agree
Helped me improve my English	Disagree	1 2 **3 4 5 6** 7	Agree
Timetabled hours for program should be	Decreased	1 2 3 4 5 6 7	Increased
I used the program outside classes	Rarely	1 2 **3 4 5 6 7**	Frequently
Will be more useful in future than this year	Disagree	1 2 3 **4 5 6 7**	Agree
'Lecture notes'			
Simple to use	Disagree	1 2 3 4 5 **6 7**	Agree
Helped me to revise	Disagree	1 2 3 4 **5 6 7**	Agree
I used the program outside classes	Rarely	1 2 3 **4 5 6 7**	Frequently
General			
There is too much IT on this course	Disagree	**1 2 3 4 5** 6 7	Agree
Lecturers should use IT in teaching	Disagree	1 **2 3 4 5 6** 7	Agree
Before starting the course computers were	Disliked	1 2 **3 4 5 6** 7	Liked
My liking of computers has	Decreased	1 2 3 **4 5 6** 7	Increased
With regard to computers I am now	Diffident	1 2 3 **4 5 6** 7	Confident

■, Medians; ▩, interquartile ranges.
* Univation Ltd, The Robert Gordon University, Aberdeen, UK.

association and exploration, features critical to meaningful learning and the maintenance of attention. It has been noted that hypermedia facilitates exploration, but that poor links may mean that students have difficulty in finding information, and ineffective navigation strategies may disorientate students.

'Metabolic pathways' was written to help students explore biochemistry interactively. The main pathways in intermediary metabolism have been divided into over 100 screens, most of which contain a single step, although some of them contain several steps. All chemical structures are illustrated on screen, and further information about enzymes and cofactors can be found as 'popups' by clicking 'hot spots' on the screen. There is a simple map of metabolism, which has hot spots to allow students to start at any place in metabolism. There is also a search facility to enable students to find where different substances, including vitamins, are found in metabolism. The program was explained in two tutorials, but it was not given a high profile in the course because it was mainly left to the

students' own initiative. Nevertheless, it received a high rating for simplicity and relatively good score for helpfulness. Students thought that they should have more timetabled hours and relatively few were prepared to use it without tutorial support. Perhaps lecturers could use programs like 'Metabolic pathways' during lectures to illustrate material more profitably than using overheads. For example, Beerman (1996) replaced all her overheads by computer-generated presentations and increased the grades obtained by her students.

Program to enhance understanding

Some lecturers use interactive handouts, in which students fill in blank spaces in the handout during the lecture; this is thought to promote understanding, getting students more involved with the content of the material and stimulating their critical thinking (Tam *et al.* 1993). The 'Sentence construction' program was designed to perform a similar function interactively. Sentences were constructed, based on nutritional research themes, in which one or more words were omitted. Ten sentences and their missing parts are randomly presented on the screen and students try to complete them interactively by the 'drag and drop' technique. When all sentences have been finished, more puzzles can be generated. This program was highly rated for simplicity and the majority of students claimed it helped them learn about research.

Interactive tutoring

The interpretation of data is a subject that deserves greater attention in teaching (Simon, 1980), but it is not easy to write computer programs to achieve this. In previous years, students had found the output from 'Minitab', a statistical program, very hard to interpret. This is because it is really designed for statisticians, and presents data in excess of requirements for beginners, and also the language and way in which it is set out are not designed with education as a priority. Since there may be many students in the class, it can be difficult for a lecturer to find enough time to explain each screen to individual students. Scotney & McClean (1995) developed a computer program that presented examples of output from 'Minitab' with explanations on the same screen, but this did not explain the results of an actual test currently performed by a student. Thus, 'Interpret Minitab' was developed to run alongside 'Minitab' and explain statistical tests actually performed by a student. It reads the 'Minitab' screen and, using expected relative locations on the screen, depending on each test performed, finds the most relevant values that need to be interpreted. It then constructs a paragraph incorporating these values and explaining their meaning. It was the least-highly-rated program, which is a pity because it was intended to help them understand another program that is certainly not simple, i.e. 'Minitab'. 'Interpret Minitab' was one of the most experimental programs and was improved several times during the course of the practical classes; it is not clear from the question asked whether the poorer rating for simplicity was due to the problems that had to be solved during the time the program was in use.

Enhancement of scientific writing skills

Problems persuading students to adopt correct writing style have sometimes led educators to make special efforts to improve students' skills in this area. For example, special written material and workshops have been tried by Lynch & McGrath (1993), but there is no known method involving a computer. 'Word for nutritionists' was introduced halfway through the year, partly in response to the poor quality of citation and referencing shown by students in a nutrition essay in the first semester. It is not a separate program; it is Microsoft 'Word 6.0' that has been enhanced by the addition of a new menu item giving access to specially-written macros ('Word' programs). There is a menu of different situations for which references must be written; the course standardized all references on the *British Journal of Nutrition*, so there are examples of references written in that style for twenty-six different situations; a few situations students face, like referencing the Internet, have been added. When the student chooses one, the example is placed in the document and can be edited; even the title is already in italics and the volume number in bold. Another menu item leads to a help file containing examples of how to cite references in the text, and another gives 'nutritional' examples of poor English and how it can be corrected. It appears that most students considered 'Word for nutritionists' to be a simple program to use, although they thought that more timetabled hours would have helped them. They were clearest about its helpfulness with regard to reference style. It was clear that students, who perhaps had not had enough time to use the program to its full advantage, did appreciate that it would be of greater use to them in future.

Revision

Making lecture notes available on computer is becoming more common (Barker, 1995). The facility to review the material actually provided by the lecturer is important for some students; it has been found that students given handouts scored better on recall than those who only took their own notes (Maqsud, 1980). It has also been shown that students make errors when copying from overheads during lectures (Mahalski, 1995), so the availability on the computer of all the overheads used by the lecturer is also important. All my lecture notes and overheads could be viewed on screen by students and they could get permission to print them if they missed classes due to illness or to support their dyslexia. This was evidently appreciated by the students.

'Crossword puzzle' was developed to make revision more enjoyable and provoke students to revise throughout the course, rather than just at the end. Although crosswords have been used in teaching before, nothing similar to the present program was found in the literature. It is interactive, in that when the mouse is placed over the start of a word, a clue appears on the screen. Some clues are somewhat cryptic to enhance the enjoyability of the puzzle, but all test

Table 2. Spearman's correlations for responses of students to a questionnaire to evaluate the use of information technology (IT) in teaching nutrition

	There is too much IT on this course	Lecturers should use IT in teaching	My liking of computers has increased	With regard to computers I am now confident	Simple to use
Lecturers should use IT in teaching	−0·348				
My liking of computers has increased	−0·295	0·341			
With regard to computers I am now confident	−0·168	0·414*	0·703***		
Simple to use	−0·132	0·337	0·361*	0·365*	
Helped me	−0·313	0·599***	0·456**	0·332	0·604***

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

the knowledge of lecture material. Each puzzle was produced to cover about six lectures. During the year, four tutorials were held in the computer laboratory to enable students to do crosswords. It appears that the objectives of this program were achieved.

General conclusions

The correlation matrix (see Table 2) simply illustrates that students varied in their interest in information technology; the strong relationship between those whose liking of computers increased during the course and their current feeling of confidence suggests that information technology has been of benefit to some students. The fact that some students remained less confident suggests that information technology should be offered as an aid to those who find it useful, but that a course would fail to support some students if it relied too much on computers for teaching material. The main question must be how confidence and liking for computers can be increased for every student. Presumably the perceived simplicity of the programs is important to students and may enhance their liking for computing; it seems to enhance their educational experience because they perceived that they had been helped if they found the programs simple to use. Other research has shown that students may have different levels of conception related to the working of computers; some may have better understanding of technical aspects, and others an abstract mental picture of the processes involved (Twining, 1995). Some competencies may be related to a more comprehensive mental model; further research in this area by education researchers may help us to promote the use of information technology more widely among the student body.

Although clearly, in the early steps of development, the students themselves are good judges of whether they feel that programs are beneficial to them, in future each separate program should be evaluated by more rigorous methods. I would like to invite comments from others, and collaborative exploration of some of the issues raised by this work.

References

Barker P (1995) Designing interactive learning support environments. In *Computer Assisted and Open Access Education*, pp. 46–51 [F Percival, R Land and D Edgar-Nevill, editors]. London: Kogan Page Ltd.

Beerman KA (1996) Computer-based multimedia: new directions in teaching and learning. *Journal of Nutrition Education* **28**, 15–18.

Ellington H & McIntosh B (1995) Innovative teaching at a Scottish university. In *Computer Assisted and Open Access Education*, pp. 7–10 [F Percival, R Land and D Edgar-Nevill, editors]. London: Kogan Page Ltd.

Knussen C, Tanner GR & Kibby MR (1991) An approach to the evaluation of hypermedia. *Computers and Education* **17**, 13–24.

Kolasa KM & Miller MG (1996) New developments in nutrition education using computer technology. *Journal of Nutrition Education* **28**, 7–14.

Lynch T & McGrath I (1993) Teaching bibliographic documentation skills. *English for Specific Purposes* **12**, 219–238.

Mahalski PA (1995) What happens when students copy notes with different content and layout from an overhead screen? How often do they glance up and how accurate are they? *British Journal of Educational Technology* **26**, 5–15.

Maqsud M (1980) Effects of personal lecture notes and teacher-notes on recall of university students. *British Journal of Educational Psychology* **50**, 289–294.

Morgan L & Sinclair J (1995) Let me edutain you! In *Computer Assisted and Open Access Education*, pp. 58–63 [F Percival, R Land and D Edgar-Nevill, editors]. London: Kogan Page Ltd.

Scotney B & McClean S (1995) The design and use of computer-based tutorials for teaching learning and assessment of quantitative research methods. In *Computer Assisted and Open Access Education*, pp. 80–86 [F Percival, R Land and D Edgar-Nevill, editors]. London: Kogan Page Ltd.

Simon EW (1980) Learning to interpret data. *Journal of Biological Education* **14**, 132–136.

Tam M, Leung RW & Koo A (1993) Improving lectures by using interactive handouts. *British Journal of Educational Technology* **24**, 139–145.

Twining P (1995) Towards an understanding of the links between conceptual understanding of computer systems and information technology competence. *Journal of Information Technology for Teacher Education* **4**, 377–391.