Development of an interactive on-line alternative to a laboratory-based demonstration in the module: Food Microbiology.

Hazel Gibson
Julie Walton
Matt Hammerton
Ros Dyer[1]

School of Applied Sciences (Biosciences & [1]Psychology Division)

Background and rationale

Food Microbiology is a level two module studied by full and part time students on Biological Science Awards. One of the key learning outcomes of this module is that students should be able to discuss the microbiological methods available for the analysis of foods. This is a theory module and practical skills and techniques are developed in other specific stand alone practical classes at level two. The Food Microbiology module includes a series of lectures on the routinely used microbiological techniques, but as a practical subject, the demonstration of the techniques and media used is important in reinforcing the theoretical knowledge and enhancing understanding. In previous years, the demonstration has involved prepared materials e.g. agar plates and biochemical tests or photographs in the laboratory. The aim of this project was to develop an on-line interactive system to replace laboratory-based demonstrations and support lecture material. The system would also support assessments and contribute to the School strategy to increase on-line learning support material. The programme was designed to provide a stimulating learning experience to promote a deep approach to learning and also provides the opportunity for distance and self-paced learning (Hughes, 2000).

The innovation

An interactive on-line new media programme has been produced to replace the laboratory-based demonstrations. The programme, produced with Macromedia Flash MX, combines interactive graphics of microbiological methods with formative assessment exercises providing preparation for the summative assessments within the module. Students were introduced to the system in a tutor-supported session and were then able to use the programme in their own time. Students progress through the programme, which includes a series of fields with microbiological test results such as colonial morphologies on selective agars (Figure 1) and calculations, by answering a series of multiple choice questions based on the theoretical material covered in lectures to interpret the test results shown.

Feedback is provided to explain why the answer selected was incorrect (Figures 2 and 3) and the system tracks the individual question and overall scores for each student with the overall grade provided to the student (Figure 4).

Evaluation

The effectiveness of the programme was evaluated by analysis of the results of a questionnaire. This questionnaire gathered students' perceptions and student performance in formative (multiple choice) and summative assessment (phase test – short answer).

The Outcomes

The results of the questionnaire are shown in Figures 5 to 17 and produced some interesting results, although the sample size was small (n=12). Figures 5 to 9a show that students found the programme easy to use, of sufficient quality, logical and with graphics that made the exercise more interesting. With regard to replacing laboratory-based demonstrations, 75% of the students agreed or strongly agreed that the exercise was a good replacement (Figure 10) and only 33% would have preferred a laboratory practical class (Figure 11).

Figure 12 shows that all of the students strongly agreed or agreed that this type of material should be used to support lecture material, but only 50% felt that this should be used to replace lecture material (Figure 13).

A high proportion of students felt that the exercise and the feedback helped understanding of the subject and showed how to improve (75% and 67%, results not shown). Although, 75% thought that the exercise was beneficial to test revision (Figure 14), 33% thought that the exercise was interesting but did not prepare them for the test (Figure 15). There was no clear indication whether students felt that they could complete the exercise without understanding (Figure 16) or whether the exercise was more effective than course material (Figure 17).

Analysis of the tracking of performance in the programme showed that 83% of the students used the facility at least once (and up to four times) as test revision on the day before and the day of the phase test (Table 1). The microbiological methods section of the phase test made up one third of the test paper, with the remainder covering two other topics not supported by the on line programme. Student performance in the phase test was analysed (Table 2) and there was no significant difference between student performance on the microbiological methods section of the test paper and the two other topics. This would suggest that the formative exercise has not improved the student learning and indicates the need for the assessment to be re-evaluated (Gibbs and Simpson, 2005).

The questionnaire responses were generally positive, but this did not appear to affect phase test performance, although the number of students was small (n=12). The feedback from students seemed to suggest that the programme enhanced their understanding of the material, but further refinement in the types of questions and material is required to provide more effective preparation for the summative assessments.

Benefits

The benefits of the programme to the students and the University are as follows:

- It provides a stimulating learning experience and encourages engagement in learning.
- It contributes to widening access by providing the opportunity for distance learning, particularly important for part-time students.
- The formative assessment provides students with immediate feedback on progress and promotes independence in learning.
- It contributes to the SAS teaching and learning strategy to support up to 25% of course material through WOLF.
- The electronic alternative to a demonstration will allow self-paced study, remove laboratory/ demonstration costs and improve efficiency of staff / student contact time.

Future Developments

Evaluation of the programme has suggested that it could be improved by varying the questions in terms of sequence, content and enhancing the link with phase test. The programme could expanded to support other topic areas within the module. The tracking information could be more extensively utilised to target support to particular students or topics. The feedback to students on the formative assessment could be enhanced to provide individual print-outs of areas of weakness and resources available for support.

References

Hughes, I.E. (2000) Alternatives to laboratory practicals – do they meet the need? *IELI*, **38**, 3-7.

Gibbs, G. and Simpson, C. (2005) "Does your assessment support your students learning?" *Learning and Teaching in Higher Education, 1*

Table 1 Tracking of student usage (Phase test 14.00 on 8 Nov 2005)

Student No.	Date	Time completed	Duration (min)	Score (/32)
1	4 Nov	12.50	8	26
2	7 Nov	10.39	13	20
3	7 Nov	21.27	51	26
4	8 Nov	10.52	8	20
5	8 Nov	12.49 12.57	25 7	31 30
6	8 Nov	12.54 13.04 13.27 13.40	7 9 22 6	22 21 28 32
7	8 Nov	12.57 13.01	9 4	26 28
8	8 Nov	13.03 13.10 13.16	16 6 5	28 31 32
9	15 Nov	17.22	17	22
10	22 Nov	12.57	5	29

Table 2 Comparison of performance of students in the phase test (n=12) where section 1 was supported by the on-line interactive system

	Mean Percentage (standard deviation)
Section 1 Microbiological Methods	53.4 (18.1)
Section 2 Abiotic factors	43.1 (24.4)
Section 3 Production of foods using micro-organisms	55.5 (21.3)

Figure 1

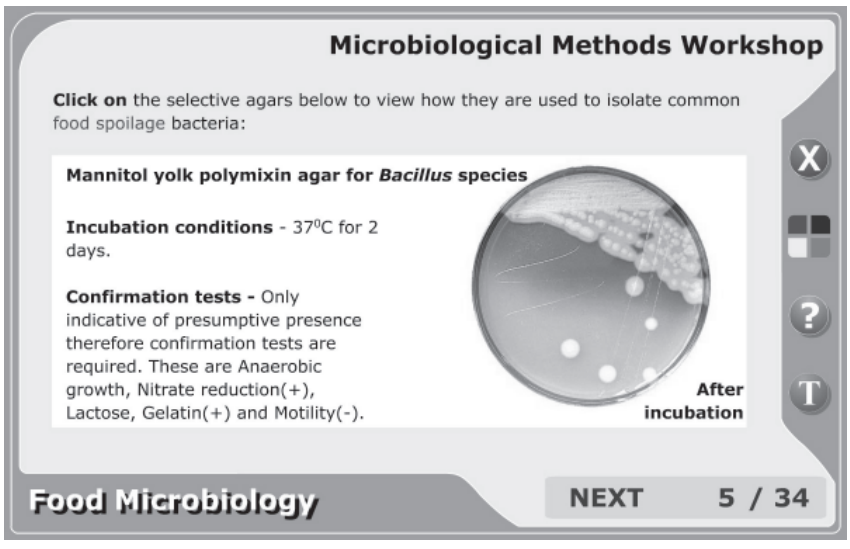


Figure 2

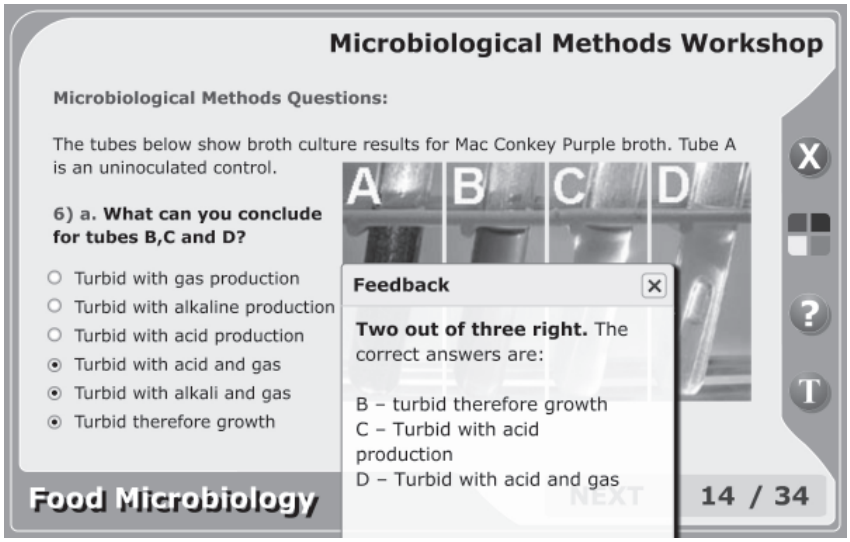


Figure 3

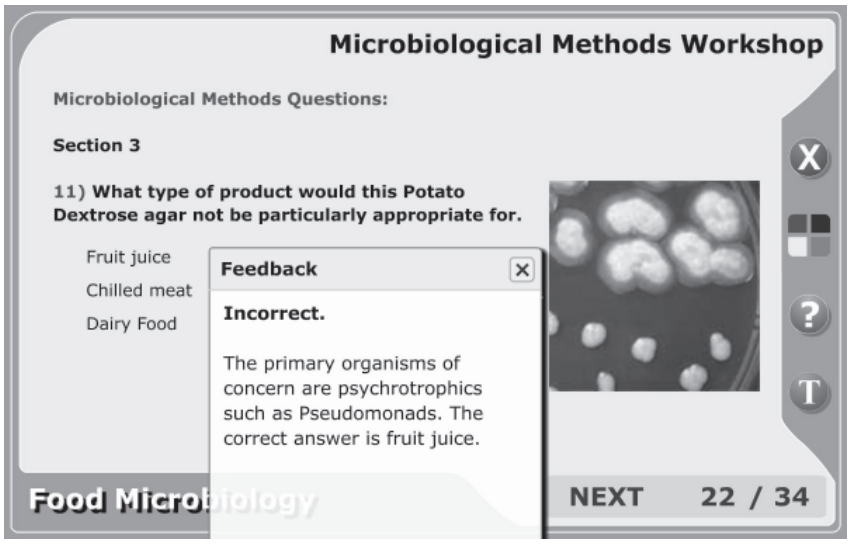
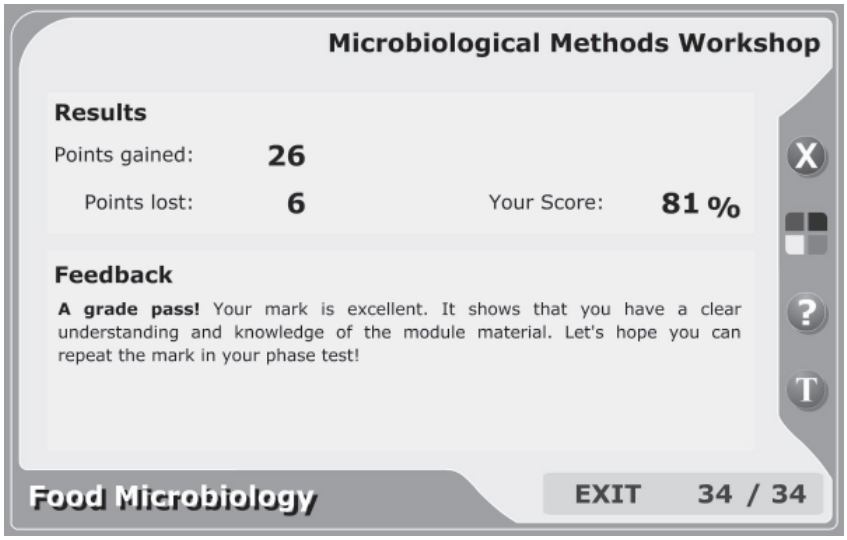


Figure 4



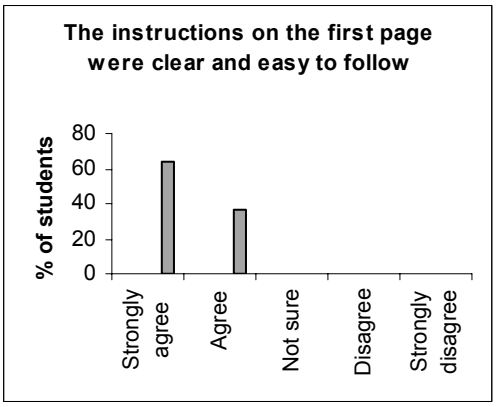
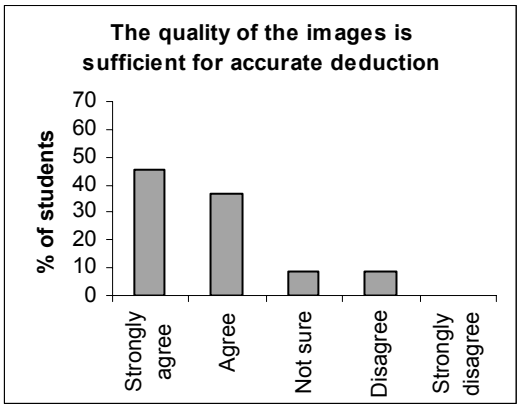


Figure 5



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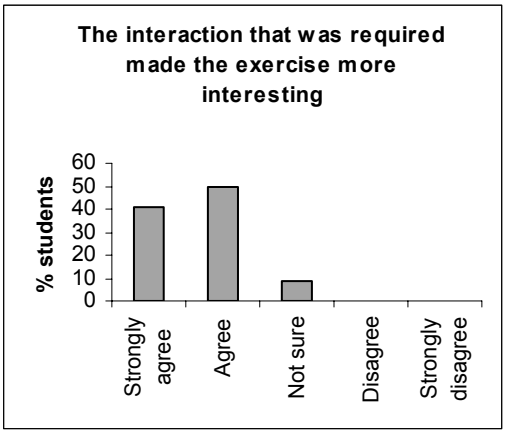

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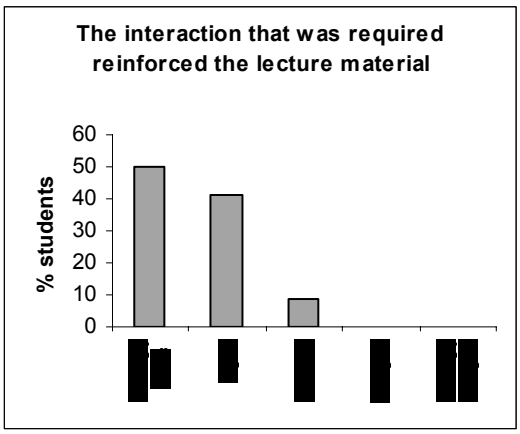

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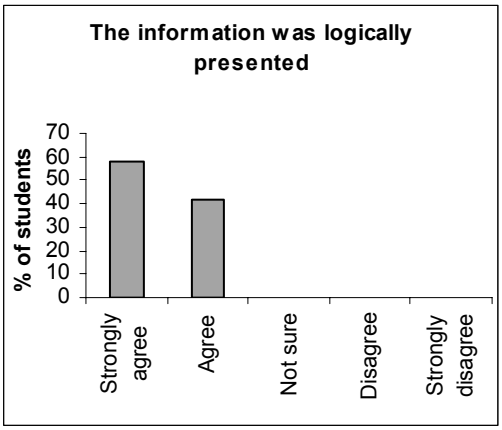

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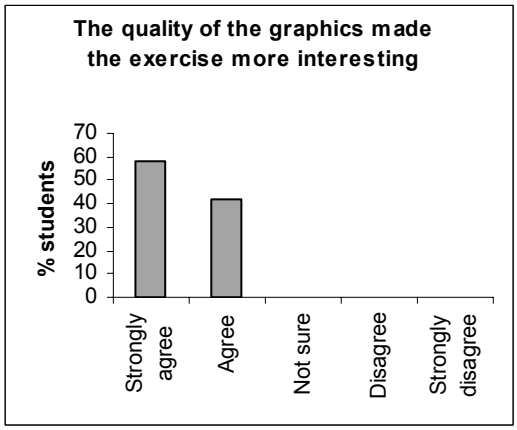


Figure 9a

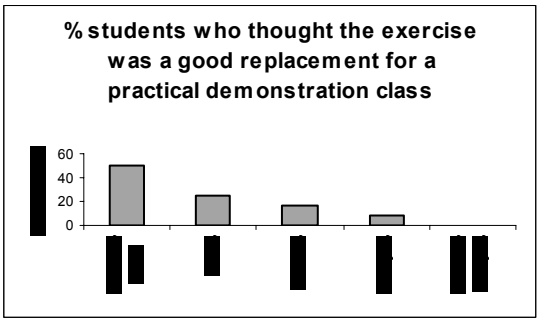
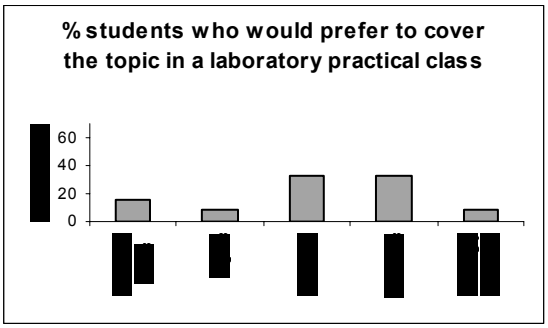


Figure 10



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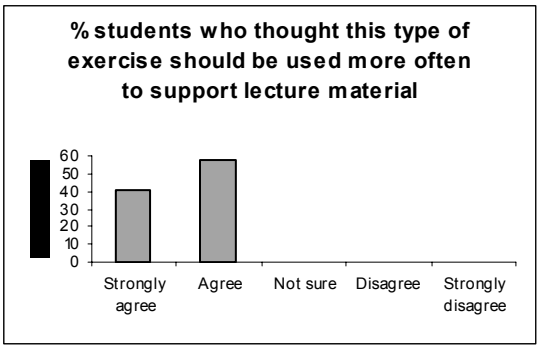

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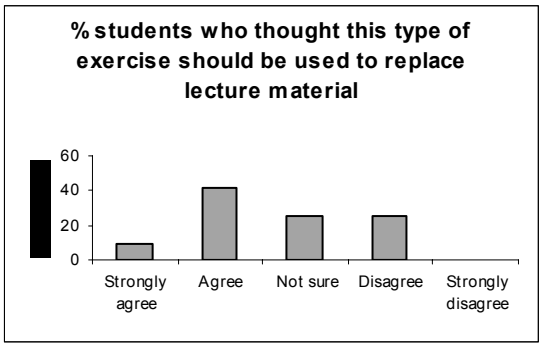

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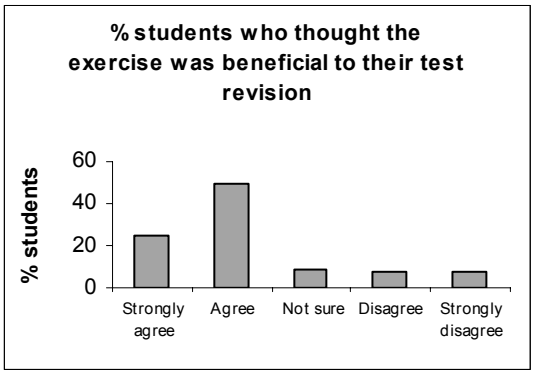

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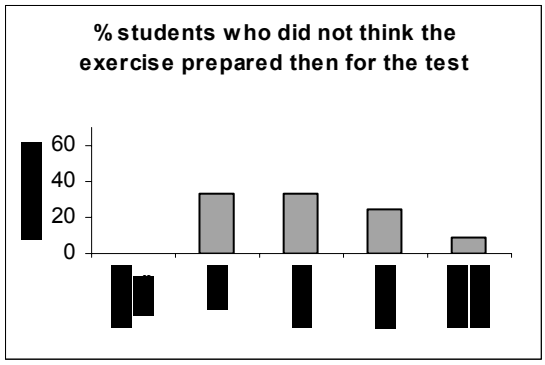

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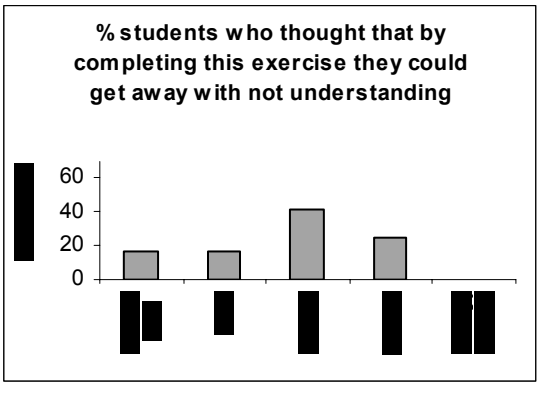

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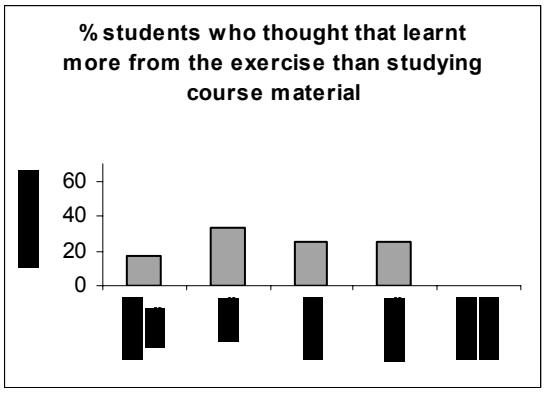

Figure 17