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ABSTRACT

A Collaborative Learning Environment (CLE) for second year Physiology students, involving timetabled tutorials, a student-friendly learning space, and a variety of computer-based and traditional resources has been previously shown to impact positively on student learning. In the sessions described in this paper, students used a semester-long group project to explore a topical question in physiology, exercising skills in scientific writing, analytical thinking, communication, and collaboration. Limited flexibility of the course management system used in the first iteration of this activity prompted its redevelopment in 2000, this time using a more flexible database system. The redevelopment involved an action research collaboration between faculty teachers and Multimedia Education Unit staff, who put together weekly online activities based on the previous week's experience. Outcomes of the development included a suite of practical pedagogical structures, increased personal understanding of the operation of computer-facilitated CLEs, and refinements to the database system grounded in the coal face implementation experience. (Author)

Developing a Collaborative Learning Environment in Physiology – Using an Online Architecture to Link Faculty and Institution Needs

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Abstract: A Collaborative Learning Environment (CLE) for second year Physiology students, involving timetabled tutorials, a student-friendly learning space and variety of computer-based and traditional resources, has been previously shown to impact positively on student learning. In these sessions, students used a semester-long group project to explore a topical question in physiology, exercising skills in scientific writing, analytical thinking, communication and collaboration. Limited flexibility of the course management system used in the first iteration of this activity prompted its redevelopment in 2000, this time using a more flexible database system. The redevelopment involved an action research collaboration between faculty teachers and Multimedia Education Unit staff, who put together weekly online activities based on the previous week's experience. Outcomes of the development included a suite of practical pedagogical structures, increased personal understanding of the operation of computer-facilitated CLEs, and refinements to the database system grounded in the coal face implementation experience.

Background

The development of a model for student-centred learning within a Collaborative Learning Environment (CLE) was a response of the Physiology Department to an increased level of lecture-dominated teaching. The CLE was first set up in 1998 to encourage student interactions between peers and tutors in a friendly study environment in which the tutor acted as a 'facilitutor', to guide and assist. The two-hour time tabled tutorials employed a variety of software and teaching approaches, with the students encouraged to work in groups. Results so far suggest that this general approach has had a significant positive effect on student learning outcomes (Kemm, Kavnoudias et al. 2000 p10).

The philosophy behind the redevelopment of the CLE is in line with calls by Reeves for instructional technology research to be driven by 'use-inspired goals' (Reeves 2000). These goals focus on developing creative approaches to particular learning requirements, while at the same time establishing generalised design models to guide future development practice. In our case, the Multimedia Education Unit (MEU) is interested in generalised online pedagogical architectures for application across the University.

The Physiology Group Project

Part of the weekly Physiology CLE tutorial in Semester 1 1999 was devoted to a semester long project to help students develop higher level scientific communication and writing skills. Each week, student groups were given a task through which they could engage in analytical thinking, reflection and discussion with peers and tutors. The original Group Project utilised the TopClass learning management system which however proved insufficiently flexible for the kind of environment we required. It was necessary to produce detailed instructions on the use of discussion lists, email & course navigation controls, and tutors found it inconvenient to review the discussion process and provide useful feedback to the groups. Students also found the peer review process too complicated and were inclined not to take it seriously. The Physiology team decided to redevelop the Group Project, with the same educational philosophy, but using MEU's OCCA framework which had greater potential to adapt to our intended learning and teaching model, without the limitations of predefined courseware functions.

Online Courseware Component Architecture

The Online Courseware Component Architecture (OCCA) is a low level component framework for implementing pedagogical structures that can support discursive interactions and reflection on learning (Fritze, Welch et al. 2000). It has been developed as an institutional approach for online learning, supported by a central server run by MEU and used in a variety of projects across the faculties. Key features include a generic database for managing learning records and server functions for accessing and embedding these data within Web pages. Using simple HTML pages, departmental staff can create their own learning activities and summaries of student work. Additional Shockwave components or Javascript functions can be used to support more specialised educational functions or discipline interfaces.

Redevelopment of the Group Project as a MEU/Faculty collaboration

The redevelopment of the Group Project provided the opportunity to address three key goals:

- to produce and evaluate the Group Project as a computer-facilitated collaborative learning activity using OCCA,
- to increase our collective understanding of pedagogical and delivery processes associated with CLEs, and
- to further develop OCCA through its application to a real teaching context.

We felt these aims could be best achieved through close collaboration between teaching staff and the MEU framework developer during the implementation. This would enable the developer to acquire a better understanding coalface teaching issues, and insights into how a technical architecture impacts on the real teaching world. The educational aim of the Group Project was for students to develop their understanding of, and ability to discuss, key Physiological concepts. They were to be introduced to the rigorous process of scientific writing and to engage in written debate on the topics. The students were to collaboratively develop a 500-word analysis of a topical physiological question over the semester which would be reviewed by their peers.

Development method

Our approach was to develop the online activities immediately prior to their implementation each week. In this way the content team could refine them in the light student observations, tutor feedback and evaluation questions of the previous week. We considered this a reasonable undertaking, given that there were only two or three tasks each week, the content design was already in place, and we had the safety net of a human tutor during each session. An end-of-semester evaluation and reflection completed the process.

We undertook the development as a form of participatory action research - a self-reflective research enquiry undertaken by us as joint participants in the process (Kemmis and McTaggart 1997 p5). Most of the day to day 'action' took place between Kavnoudias and Fritze, who kept reflective journals of the experience. Teaching and

curriculum guidance was provided by Physiology lecturers Kemm and Williams, with other important communications occurring with tutors, students and teaching staff from other faculties using OCCA in different curriculum projects.

Structure of the Group Project

The structure of the project is illustrated on the group's overview Web page (Fig. 1). Each week involved several activities such as building a key concept list, a writing task, reflecting on previous work or reviewing the work of their peer group. The column headings displayed the group's work for one activity. For example, the 'Writing' link summarised the group's writing tasks from brainstorming to the final submission on the one page. The 'Peer interactions' page tabled the draft sent to peers, the peer review and the group's response to that. Each row heading linked to a summary of the group's work for that week.

Week	Key concepts	Writing	Discussion & reflection	Peer interactions	Tutor interactions
2	Individual research				
3	Brainstorm ✓ Identify keywords ✓	Draft 1 ✓			💬
4	Review ✓	Draft 2 ✓	Guided discussion ✓		💬 💬
5		Draft 3 ✓	Reflection ✓	Send draft 3 to peers ✓	
7				Review peer paper	
8		Final submission	Evaluation	Reply to peer review	
					Editorial board assessment

Key: ✓ = submitted, 💬 = comments to tutor, 💬 = tutor feedback

Figure 1: Group Project overview page indicating weekly tasks, progress made and tutor messages.

Outcomes of the developmental research

Evolved pedagogical elements

Particular teaching elements were crafted on top of the OCCA framework, becoming our 'toolkit' of teaching resources. These were structures we found useful for the Physiology CLE, although we believe they would be generally applicable in other areas. Some of these ideas originated from previous projects (Fritze, Johnston et al. 1998; Fritze, Welch et al. 2000), while others emerged within this project.

Other pedagogical elements beyond the scope of this paper include an 'administrator view', 'tutor view', 'rubber stamp', confidence indicators, key word prioritisation task and facilitated group discussions. Various pedagogical features are indicated in the template page that was used by the tutors to review and annotate the work of each group prior to the next class (Fig. 2).

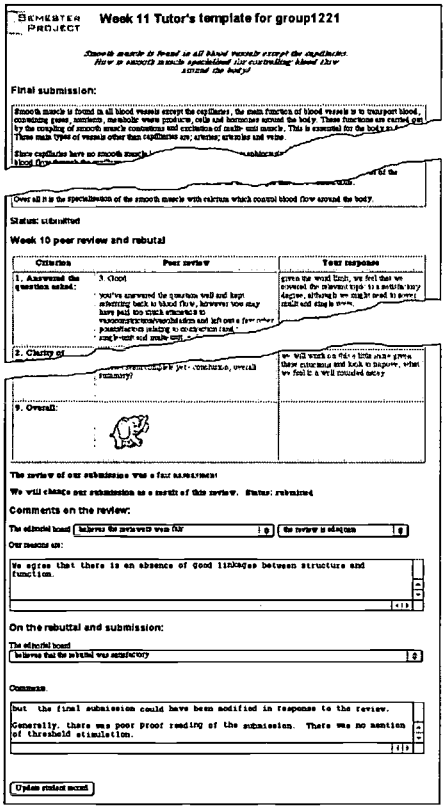
Changes in understanding arising from collaborative re-development

More subjective changes in our understanding are evidenced by reviews of journal entries, post-semester discussions, and reflection on student work. These observations do not form a generalised 'theory' of practice, but are important in developing our own personal conceptual models. We hope that they may also provide useful

insights and promote discussion by others. Some of the emotional aspects and unpredictability of the real work environment are reflected in the observations in Tab. 2.

'Summary page'	A single Web page containing a collation of student work eg. for one week.
'Learning portfolio'	This started as an organised collection of weekly summary pages but was refined to include summaries of the drafting sequence, students' confident levels across the weeks and side-by-side comparisons of written work and key concepts. The instruction 'Submit to your Portfolio' emphasised that work remained accessible.
Student self-assessment of open-ended questions	We developed a self-assessment sequence commencing with an open-ended question, a self-assessment of this against certain criteria followed by an opportunity to redraft. A summary of the whole process was then provided.
Reflection on previous work	We used the online learning portfolio or embedded references to prior work to set the context for questions designed to promote reflection on the learning process.
'Importing' prior work	We provided a special button to allow students to 'import' a specific prior response, or collection of responses, into a text box on a later page for re-drafting.
'Posting work to peers'	With a simple button, groups could 'post' a piece of work to an anonymous peer group assigned by the tutors. The peers subsequently 'posted' their review back.
Tutor annotation template (the 'editorial board')	Tutors used an 'annotation template' page showing the final essay, peer review and response made by a selected group. They could scan through each group's work prior to a class, entering feedback via popup menus and comment boxes (Fig. 2).

Table 1: Some pedagogical elements emerging from the development



Case topic question assigned to the Group

Final version of 500 word essay that was 'posted' to Peers

Table summarising points made by the Peer Review Group presented side by side with original Group's response. The review was made against 9 criteria points.

Student Peer reviewers award a 'rubber stamp'

The Group thinks review was 'fair' and 'will redraft their essay'

The Editorial Board (ie. tutors) have selected certain preset and entered comments in their assessment of the review.

Preset responses and comments used by the Editorial Board in reference to the rebuttal and submission

The Editorial Board uses this button to save the annotation record that will be viewed by the Group the following week.

Figure 2: Web template used by 'editorial board' to assess the group essay and peer review process.

Thinking about teaching, not tools	In shaping each activity, we found ourselves trying to think in terms of face to face interactions eg. how we might write on pieces of paper and later arrange them on a table.
Serendipity	Delays in programming database reports prompted the development of the administrative page that delighted us with its usefulness. 'Naïve' users also sometimes provided ideas. A request to "paste in a picture" into the page made us think. After consideration, it was not included for pedagogical rather than technical reasons.
Value of effective teaching tools	The Physiology staff were excited by the effectiveness of the tutor annotation Web page for reviewing and responding to students.
Portfolios	Even though portfolios had been planned, all of us were delighted at their effectiveness in summarising a group's work. To the developer, the simple web frame structure meant that the teaching staff could easily extend the summary pages themselves. We realised this could be given to the student at the end of the course as a personal record of their learning.
Changed perspectives via new views	Despite the time spent in the CLE helping students, Physiology staff were interested in how the summary pages of students work increased their understanding.
Value of seeing tools in real use	The framework developer noted the additional insights gained from seeing the software in actual use in the CLE.
Time pressures	Completing the activities each week often placed pressure on us due to illness and other factors. We needed time reflect and were sometimes frustrated when we had no time to implement often quite small changes.
Change of direction	We originally planned to use immediate feedback in some tasks, but decided the reflective self-assessment tasks were of greater use to the student (and far easier to implement).

Table 2: Some changes in understanding emerging from reflection on the development process.

Revised functions and extensions of OCCA

The third class of outcome from the regular weekly development cycle involved changes to the OCCA system, necessary to implement emerging requirements of this project. These were either simple page components or more fundamental changes to the framework which are indicated in Tab. 3.

Administrator & tutor access	Ability for administrators to log on as any student in order to review their work.
Post record function	Ability for a user to 'post' a record to another user which could then be displayed in the second user's pages, eg. for the purpose of reviewing.
Group login	As we required students to sit together around the computer and create group responses, they needed to log in as a group, rather than individuals.
Resources for different assigned cases	Each group required a case question to be assigned by the administrator. The system then dynamically enabled certain pages according to the assigned case.
Specification of peer group	Each group required a peer review group to be assigned by the administrator.

Table 3: Fundamental changes to the OCCA system arising from the redevelopment project

Evaluation of the student experience

At the conclusion of the Group Project run in semester 1 and again in semester 2, we undertook a reflective examination of the whole process, as well as conducting a more traditional evaluation. Briefly, the 44-question questionnaire filled in by the students at the end of semester indicated that:

Seventy-two percent of students found the project enjoyable and eighty percent found that their ability to discuss physiology with others was enhanced. Ninety percent of the students found the program easy to use, instructions were easy to follow, navigation was easy and most importantly, that the instructions, questions and guidance helped to generate discussion amongst the students. The biggest revelation to us, which was not commented on in the

previous implementation (TopClass framework), was that students appreciated the opportunity to hear and read different interpretations of a problem. A comment given referred to 'supporting and extending each others knowledge'. Other frequent positive comments related to the opportunity to peer review, that they enjoyed researching a topic in depth, it was good exam practice, or that they made new friends.

Negative comments concerning the group size led to us reducing this to 3 in Semester 2. Students indicated they needed more help in dealing with conflicting opinions and that not everyone pulled their weight.

Discussion

The re-development of the campus-based Group Project was a genuine collaboration between the Physiology teaching staff and MEU developers of OCCA. In the resulting process of negotiation and exchange of ideas, enhanced versions of the CLE model and generic online architecture emerged. We have shown how a low-level architecture can be used in a participant research study to create a flexible student environment involving open-ended tasks, reflective activities, and feedback between student and teacher.

Thinking about how a student will engage with a given activity should involve more than just consideration of what tool to apply. We found that even the simplest learning activity can be used as the basis of a rich variety of learning situations. For example, submitting a short piece of writing might have value added by associating it with self-assessment activities, feedback comments to tutors, indications of confidence, later reflection on the task, peer or tutor assessment and guiding comments, later re-drafting, incorporation of other existing work and placement within a portfolio of work for the whole subject. Applying these possibilities to a practical learning activity requires careful thought and reflection on the context of use, far more comprehensive than the initial simple task would suggest.

We have reported the outcomes of a development process carried out in a single setting, but more detailed comparisons of online frameworks should be undertaken. These should consider educational principles and the organisational context in a holistic way, rather than focusing on functions and features. We suggest that where learning systems are adopted on an institutional basis, the impact on teaching and learning should be carefully considered and monitored. Collaborative developmental research of the type we have conducted is one important technique that can help inform the implementation or development of such systems.

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