Investigating a Nigerian XXL-Cohort Wiki-Learning Experience: Observation, Feedback and Reflection

Peter Aborisade
Federal University of Technology, Nigeria
baborisade2002@yahoo.com

Abstract: A regular feature of the Nigerian tertiary education context is large numbers of students crammed into small classrooms or lecture theatres. This context had long begged for the creation of innovative learning spaces and adoption of engaging pedagogies. Recourse to technology support and experimenting with the WIKI as a learning tool at the Federal University of Technology, Akure (FUTA), Nigeria gave us an insight into the benefits and challenges of the set-up and use of new knowledge technologies in our technology-poor context. This paper reports an experiment in an extra-large (XXL) class of freshmen (2000+) on a module of second language project writing using the WIKI. The paper emphasises the unique advantages of the WIKI in a large blended learning class and the affordances for socio-cultural and collaborative learning experience. In creating new learning teams and forging collaboration among learners leveraging one another’s abilities, the wiki experience extended the ‘classroom’ beyond the physical space, engaged students in interational communication in the second language, encouraged negotiation of meaning, and challenged learners in finding their ‘solutions’ to real life problems around them, aside from acquisition of hands-on digital literacy. The paper reports on how learners experienced and participated in learning on a technology supported module. Data for the investigation and evaluation of students’ learning experiences were collected using teacher observation of team formation and collaboration on activities offline and tracked students’ logs, footprints and activities on group pages online; students’ feedback on the end-of-course learners’ evaluation forms; and their reflections as gleaned from their comments, encouraged and freely made continually by many from inception through to the end of the course, on the front page of our wiki. The report employs both qualitative and quantitative parameters. Results indicated a large number of students felt satisfied that the learning experience, though difficult, was worth their while; it opened up new vistas to the world; it got them working and learning to collaborate in groups; they developed a level of autonomy they would like to keep, and would like more of their courses supported by technology and thought the medium offered hope for the future, as it opened up new vistas in their learning.

Keywords: large classes, Wiki, e-learning, learning experience, interaction, collaboration, team work

1. Background

Class size is a crucial variable within the sociocultural setting and ethos of African educational system, especially in the Second Language (L2) classroom. A classroom as a social construct where interaction can take place is pivotal to effective language learning in an L2 situation. The Lancaster-Leeds Language Learning Research Project report (Coleman, 1989) remains the reference point in class size research. Surveying teachers from some five developing countries, including Nigeria, the report lists three categories of problems experienced by teachers to include: pedagogical (e.g. difficulties with monitoring and feedback and communicative tasks); management (e.g. discipline, correcting writing work); affective (e.g. creating rapport, learning students’ moods and interests).

Previous research in Second Language Acquisition (SLA) has highlighted the importance of interaction in target language learning (Long, 1996). Krashen’s (1982) Comprehensible Input Hypothesis and Swain’s (1985) Output Hypothesis, both complementary, emphasise the place of learner interaction with the target language in a meaningful way to engender proficiency. More recently acknowledged are Vygotsky’s (1978) Zone of Proximal Development (ZPD) and the place of sociocultural interaction in the development of language proficiency. Donato and McCormick (1994) and Lantolf (2000) further underline the importance of interaction, scaffolded learning and collaboration in constructing effective language classrooms.

What accentuate the large class problem in our context are the triad of escalating enrolments as a result of growing populations and increasing access to higher education, inadequate classroom spaces and facilities to meet the demands, and few numbers of teachers. Solutions to these constraints are beyond the teachers and in most cases the higher institutions. But researchers and practitioners have confirmed the many benefits of the use of learning technologies (computer and the Internet) in language education (Blake, 1987; Lee, 2000; Murray, 2000; Singhall, 1997; Shetzer, 1998). In resource- and technology-poor Nigeria, however, learning technology support for education is virtually non-existent and teachers and students are yet at the early stages of electronic literacies.
Aborisade, 2005). But Kasper (2000), among others, has emphasised the nexus between the new learning technologies and the attendant literacies.

2. The context

Till date most Nigerian classrooms follow the traditional teaching-learning methodology of rote. Large numbers of students crammed into small classrooms, teachers dictating notes or lecturing (ostensibly ‘transferring knowledge’) with students taking notes (‘acquiring knowledge’) completes the dominant ethos that results, at best, in little learning taking place. At the Federal University of Technology, Akure (FUTA), all fresh students take ‘Use of English’ (EAP) courses, one in each semester of the first year; the courses are credit bearing. The second semester course is integrated Reading-Writing. Students who are mostly Nigerians usually come from a wide range of language backgrounds and they use English as second or third language; they range in competence from upper intermediate to advanced levels. Students come to the course from various disciplines - biological and physical sciences, and engineering; students are grouped along disciplinary streams. Class size ranges from 100 or 150 (where this can be arranged) and 700 in many cases, each stream taught by one of four regular teachers; some 2000+ students complete the course each year. Students demonstrate a palpable lack of motivation and interest in the courses.

3. The challenge

In our context, the driver of change was the large class situation and our inability to interact with the students on a one-on-one basis and get students to use the target language in their interaction. The physical classroom had become an albatross, at all times in short supply and attempts to vary its design are resisted by authority. We experimented with getting students to do some project work outside classroom walls in groups, including gathering information from online sources. This was found to be useful but insufficient. However, the lesson from group work collaboration on the writing project pointed the direction for change: the need to offer further technology support in a way that shifts emphasis away from the well-known physical classroom yet extends the work of the classroom, promoting interaction and the use of the target language.

The stimulus for the change came through the e-learning symposium organized by the UK Subject Centre for Languages, Linguistics and Area Studies, University of Southampton in January 2008, where Steve Wheeler’s (2008) presentation on using the Wiki showed one way to create new learning environments.

4. The project

The project reported here is the transformation of English for Academic Purposes (EAP) writing course, from an essentially face-to-face offering into one supported by a Web 2.0 tool in a blended learning environment. The purpose of the project was to solve a nagging practical problem of teachers’ helplessness in motivating and engaging the large numbers of students in real learning; the experimentation with technology was not intended as a research project, though we attempted, right from the beginning, to monitor the processes with the aim of informing practice. It is within this context that our conception of integrating the e-learning technology is framed and our perception of its effect measured and situated. This paper reports the experiment in an extra-large (XXL) class of freshmen (2000+) on a module of second language project writing using the WIKI. The paper emphasises the unique advantages of the Wiki in a large blended learning class and the affordances for socio-cultural and collaborative learning experience. What follows are the four stages of implementing the project.

4.1 Planning and teacher orientation

Following the teaching team’s agreement to explore the possibilities offered by the Wiki, we sought to find out how the integration could be done. It was soon agreed that a blended learning approach offered the best option. Much of the work would have to be carried on off-line, in and out of class, since both teachers and students needed to come to grips with e-skills and e-pedagogy. The steps are sketched out below:

- Several teacher-orientation meetings were held to re-orientate the course design and agree methods;
- Students’ teams/groups were agreed on departmental basis in class; students elect team leaders and assigned a role for each member;
The new course content, components and group lists were uploaded to the Wiki site by teachers.

4.2 Learner, environment and activity

Once the Wiki was set up (http://futagns.pbwiki.com), students were taken through it in an orientation class. Explanations were provided on how to log in, edit their profiles and collaborate on group pages. What takes place in the three learning environments: teacher-fronted classroom, out of class group meetings and wiki site, are explained. Components of this process are as follows:

- Learning activity is central to the exploitation of learner characteristics (preferences, needs, abilities, approaches etc) and learning environments (tools, resources and affordances of the physical and virtual environments, etc);
- Learning activities with some clear outcomes are set; activities are aimed to get students to appreciate and understand their own processes of composing, and to build their strategies for the writing project;
- Rules of engagement are agreed for teacher-student, student-site (netiquette) and student-student interactions.

4.3 Monitoring, facilitation and evaluation

The main product outcome for the course is a term paper (academic writing) that begins the induction of freshmen apprentices into the academic culture. Along the route to this final product are a few milestones for the learners to cover. En route, however, teachers, experts, resources and learner interactions and collaborations assist in the development of proficiency. Feedback is provided at various levels and on various activities, in class and on the group pages, both by teachers and peers. Teachers are learning to step back, cede some control to students who gradually begin to assume some level of autonomy in the learning process and learn to take control of their learning. Built into the wiki are facilities for some level of qualitative evaluation which can be taken advantage of in addition to traditional formative and progressive evaluation methods.

5. The study

A Wiki is a collaborative authoring tool providing learners with an opportunity to create their own learning environment, interacting with one another outside the classroom offline as well as online. The main learning activity was an enquiry of the impact of waste management on the Nigerian environment. This paper reports an investigation of these students’ experiences from their perspectives and also teacher observations.

Research questions

The study sought to find information on students’ experience of working on a module supported by technology in three areas: Learning processes, working in teams and taking leadership roles. The main questions in this regard were on:

- Perception of the manner of, knowledge and confidence in carrying out a number of activities and processes relating to their learning;
- Whether there was any difference between their learning experience before the technology supported course or not; and
- If there was a difference, how significant this might be.

Participants

The participants are full time registered fresh students of the Federal University of Technology, Akure (FUTA). Altogether, a total of about 2200 students across five faculties took the course facilitated by one contract and four full-time teachers along faculty groupings/lines. For the purpose of this report however focus would be for the most part on students of the Faculty (School) of Agriculture who were the only group surveyed using the quantitative instrument for this study. This comprises seven departments made up of five hundred and ten (510) students in the second semester of 2007-2008 academic session. It was felt that this would be a manageable unit to consider as a starting point for the online survey in our experience of a paradigm shift.
Methods

The methods employed for this investigation included both quantitative and qualitative techniques. The quantitative is used to analyse the relationships between variables while the qualitative is used for processes that were not set up to be measured in terms of amount and frequency.

The questionnaire

The instrument for the quantitative measurement is the questionnaire, adapted from University of Manchester’s CEEBL website. Sections 1 and 3 pose closed-ended questions. Section 1 contains thirty two questions about goals, knowledge, skills and abilities (competencies) and confidence on the course and its processes. In section 3, questions seek to confirm in a more definitive way students’ confidence in the use of computer and internet in learning, and taking leadership roles, issues also earlier enquired about in Section 1.

Questions in Section 2 aim to get the students to reflect on their learning processes, outcomes and difficulties encountered during the course. These combine with comments offered on the Wiki front page: http://futagns.pbwiki.com by students over the duration of the course about their impressions, experiences, difficulties and expectations.

The Observation

This consisted of observing the processes of team formation, functioning and collaboration on activities and tasks. The teacher initiated and facilitated group formation in class, class members elected/appointed group leaders after a few confident ones had volunteered to be leaders, and members signed up for whichever group they wanted to be in out of class; thereafter they assign roles to each group member, that is, every member has a leadership role to play. The group list was submitted to the teacher who ascertained that no member was signed up or appointed to roles without their knowledge and consent. Agreed group meeting schedules are submitted to the teacher and also logged on wiki group pages by students; the teacher monitors some of the meetings. An “impressionistic approach” (Wallace, 2003:9) is taken with group meeting/work observation. This provided the researcher with opportunities to have a glimpse of how meetings went, how many members usually attended, what participation levels were and what activities members engaged in and importantly, in what language they interacted. During such observations notes were taken. Of a total of 52 teams, only a few (10) were observed for all these purposes, however. But no group knew which ones were going to be visited and which were not, all 52 expected to be observed.

Wiki pages

The wiki pages offer opportunities for monitoring and gathering data. Front page comments are encouraged and this keeps a log of all users’ comments. The comments give an insight into how students feel; what problems they are having every step en route to the end of the course and what they would like introduced or changed. This could be used as a reflective tool in their learning curves. The ‘Allpages’ logs offer the teacher-researcher data on ‘hits’ on user visits to the wiki. Tracked students’ logs, footprints and activities on group pages online offer the final source of information.

6. Results and discussion

As stated earlier the Wiki was not set up for experimental purposes, but rather as practitioners’ response to the challenges in our teaching and learning situation. The project was therefore not set up as an ideal research project whose results could be applied wholesale across the teaching-learning spectrum and in all contexts. The teaching team knew the advantages of the change initiative and kept some records of the processes for a research report of practice that informs action.

The purpose of the end-of-course evaluation was to find information on students’ experience of working on a course supported by technology. The questions in section 1 sought information on students’ experiences on the course in relation to their: understanding, difficulties, team work, leadership role, research, lecturer support, course methods and more, and their knowledge and confidence in carrying out a number of activities relating to their learning; and these served to indicate improvement levels at the end of the course.
It was a pre-requisite that before the end of the course all students should have functioning e-mail accounts. At commencement of the course, investigations revealed that less than two thirds had functional e-mail addresses and use the internet frequently and unaided; this pattern is in consonance with freshmen investigations in previous two sessions (Aborisade, 2007). The evaluation questionnaire was sent to all of the five hundred and ten (510) students of the School of Agriculture and Agricultural Technology (SAAT). Two hundred and thirty-five (235) of responses received by the deadline were considered, giving a response rate of 46.07%; those that came after the deadline were rejected. Given the students’ enthusiasm, two factors were known to be responsible for the response rate. First, some students’ email addresses were apparently not written correctly in the process of typing a hand-written list submitted and when the evaluation was sent the message bounced back for a good number of them. Secondly, some other students who had correctly written e-mail addresses could not get the mails because they had moved to villages and small towns after the semester where there was no internet access. Not all the 235 responses completed the questionnaire in full; a total of 160 which answered all the questions were used for analysis.

The 32 questions that make up section 1 were grouped into three main areas for purposes of analysis: Learning processes, Team work and Leadership role. Questions 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 18, 20, 21, 25, 28, 29, 30, 31 and 32 came under the category ‘Learning processes’. Likewise, questions 4, 14, 15, 17, 22, 23, 24 and 26 came in the category ‘Team work’, while numbers 19 and 28 went for ‘Leadership role’. Questions 3, 12, 16 and 18 were reversed in meaning for the analysis because they were framed in the negative. Respondents were asked to mark an ‘x’ to indicate a choice, on a scale of 1 - 5 from strongly disagree to strongly agree, statements of what they felt, did, learnt etc on the course. Scales 1 - 3 were classified as low improvement while 4 and 5 were classified as high improvement. Tables 1a, 1b, 1c present the data for the three areas.

Table 1a: Learning processes – improvement rates

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low improvement</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>High improvement</td>
<td>160</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The findings from this table indicate that all respondents reported considerable improvements in their learning processes and have had rewarding learning experiences. This relates directly to the first research question, that is, students’ perceptions of the manner of, knowledge and confidence in carrying out a number of activities and processes relating to their learning. From this, students are quite positive in their perception of the value of a technology supported course.

Table 1b: Team work – improvement rates

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low improvement</td>
<td>3</td>
<td>1.9%</td>
</tr>
<tr>
<td>High improvement</td>
<td>157</td>
<td>98.1%</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Like in the first category, improvement in team work received very positive ratings from the respondents, albeit a little lower than for the learning processes. 98% of respondents have reported high improvement rates. Table 1c below shows fewer numbers of students are ever ready to take on leadership positions, however by a value of 78.8% the outlook is equally bright. In comparison to the two earlier categories it tells the story of how difficult it was getting students to take up leadership positions.

Table 1c: Leadership role – improvement rates

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low improvement</td>
<td>34</td>
<td>21.3%</td>
</tr>
<tr>
<td>High improvement</td>
<td>126</td>
<td>78.8%</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Going by the figures and values in the three tables above, respondents’ views of their learning processes indicate very positive gains from the course in all respects. The same is true of their attitude to and participation in team work and taking/playing leadership roles. How much of these claims are corroborated by some of the other data in this evaluation would determine how correct respondents might be in their views. Questions can be raised on the extent to which every respondent felt this course has been useful to them; we may not rule out the influence of the ‘Wao!’ effect of the initial stages of technology introduction – a development that excites the youth.
Section 3 of the evaluation questionnaire completes the quantitative data of this investigation. Six questions are posed here, a pair for each of the following three issues, before and after GNS 102:
- confidence level on taking a course supported specifically by a Wiki
- confidence level in taking on a leadership role in a team
- knowledge of using the Internet to run a course

The first pair of questions asked about the level of confidence before and after. For instance, question 1a asked, “At the beginning of GNS 102 my confidence level in taking a course supported by Internet (using a Wiki) was ____ out of 10”. Respondents chose a number between 1 and 10 to indicate their level. In posing these questions we wanted to find out specifically how much confidence and knowledge of e-learning students had before this course; and how much they had learnt (and how much their confidence level had grown) about taking leadership roles in collaborative learning. Opinions offered in this section would go to dispel or corroborate claims made earlier in section 1. The responses are analysed using Paired Sample Statistics for dependent sample t-test, Paired Sample Correlations for relationship test and Paired Samples Test for significance. A null hypothesis was formulated for each question.

**Ho1:** There is no significant difference, before and after the course, in students’ confidence level on taking a course supported by a Wiki.

**Ho2:** There is no significant difference, before and after the course, in students’ confidence level in taking on leadership role in a team.

**Ho3:** There is no significant difference, before and after the course, in students’ knowledge about using the internet to run a course.

Tables 2a, 2b, and 2c show the results of the first hypothesis about the difference in confidence level of students on a course supported by Wiki.

**Table 2a: Paired samples statistics- internet supported course**

<table>
<thead>
<tr>
<th>Pair1:</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taking a course supported by Internet -after the course</td>
<td>7.84</td>
<td>160</td>
<td>1.983</td>
<td>.157</td>
</tr>
<tr>
<td>Taking a course supported by Internet -before the course</td>
<td>5.08</td>
<td>160</td>
<td>2.579</td>
<td>.204</td>
</tr>
</tbody>
</table>

**Table 2b: Paired samples correlations- internet supported course**

<table>
<thead>
<tr>
<th>Pair1:</th>
<th>N</th>
<th>Correlation</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taking a course supported by Internet -after the course</td>
<td>160</td>
<td>.483</td>
<td>.000</td>
</tr>
<tr>
<td>Taking a course supported by Internet -before the course</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2c: Paired sample test- internet supported course**

<table>
<thead>
<tr>
<th>Paired Difference</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Std. Error Mean</td>
<td>Lower</td>
<td>Upper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair1:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taking a course supported by Internet -after the course</td>
<td>2.763</td>
<td>2.375</td>
<td>.188</td>
<td>2.392</td>
<td>3.133</td>
<td>14.712</td>
<td>159</td>
</tr>
<tr>
<td>Taking a course supported by Internet -before the course</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results for Section 1 of the evaluation indicate high improvement in the three areas of learning processes, team work and taking leadership roles. Tables 2a, 2b and 2c combine to show the significance value for the difference between before and after, in taking a course supported by the Internet (Wiki). By the difference of the Mean of 5.08 (Before) and 7.84 (After) the Paired Samples Statistics indicate a positive improvement. Table 2b (Paired Samples Correlations) indicates a positive value and positive relationship of improvement being linked to technology support. Table 2c is the main test for the hypothesis. By the Mean of all values (2.763) and the test statistic value of 14.712 the hypothesis that ‘There is no significant difference, before and after the course, in students’ confidence level on taking a course supported by a Wiki’ is rejected; there is improvement and this is indeed significant. This same pattern is indicated for the two other hypotheses, on leadership role and knowledge about using the internet. Students indicated that before the course they had no knowledge of technology-supported courses. The three tables of paired samples show that for each of these three hypotheses, there have been differences and these are significant; positive values and relationships are established, and these are significant. The null hypotheses are therefore rejected.

**Table 3a: Paired sample statistics- leadership role**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>7.61</td>
<td>160</td>
<td>2.291</td>
<td>.181</td>
</tr>
<tr>
<td>Taking a leadership role- After</td>
<td>4.71</td>
<td>160</td>
<td>1.998</td>
<td>.158</td>
</tr>
<tr>
<td>Taking a leadership role – Before</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3b: Paired samples correlations – leadership role**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Correlation</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>160</td>
<td>.438</td>
<td>.000</td>
</tr>
<tr>
<td>Taking a leadership role- After</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taking a leadership role – Before</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3c: Paired sample test – leadership role**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std.Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>T</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
<td>Upper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>2.894</td>
<td>2.286</td>
<td>.181</td>
<td>2.537</td>
<td>3.251</td>
<td>16.009</td>
<td>159</td>
</tr>
<tr>
<td>Taking a leadership role- After</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taking a leadership role – Before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4a: Paired samples statistics – knowledge of using internet for courses**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>8.13</td>
<td>160</td>
<td>1.826</td>
<td>.144</td>
</tr>
<tr>
<td>Knowledge of using internet- After</td>
<td>5.12</td>
<td>160</td>
<td>2.669</td>
<td>.211</td>
</tr>
<tr>
<td>Knowledge of using internet- Before</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4b: Paired samples correlations - knowledge of using internet for courses**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Correlation</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>160</td>
<td>.432</td>
<td>.000</td>
</tr>
<tr>
<td>Knowledge of using internet- After</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge of using internet- Before</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4c: Paired samples test – knowledge of using the internet for courses

<table>
<thead>
<tr>
<th></th>
<th>Paired Difference</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After Knowledge of using internet</td>
<td>3.012</td>
<td>2.500</td>
<td>0.198</td>
<td>2.622</td>
<td>3.403</td>
<td>15.240</td>
<td>.000</td>
</tr>
<tr>
<td>Before Knowledge of using internet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the findings of the two sections of the post-course evaluation, students have positive perceptions of the course supported by technology; as to whether there was any differences between their learning experience before and after, evidence in Section 3 corroborate students’ perceptions expressed in Section 1. Further, it is shown that the difference in experience is indeed significant.

Section 2 of the evaluation is qualitative, asking students to reflect on their learning processes and identify some of the things they thought they found positive or negative (e.g. useful, helpful, difficult and so on). We have selected the two most mentioned items for each question as listed in Table 5. The following topped their lists:

Table 5: What students liked/did not like

<table>
<thead>
<tr>
<th>Helpful</th>
<th>Use internet more; use library</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful</td>
<td>Group work; internet</td>
</tr>
<tr>
<td>Changed way of learning</td>
<td>Team work; autonomy</td>
</tr>
<tr>
<td>Made learning effective</td>
<td>Internet; challenging tasks</td>
</tr>
<tr>
<td>Found most difficult</td>
<td>Searching for materials</td>
</tr>
<tr>
<td>Need to do to improve</td>
<td>Do more research; work harder</td>
</tr>
<tr>
<td>Need to stop doing</td>
<td>Playing too much</td>
</tr>
<tr>
<td>What teacher needs to</td>
<td>More autonomy; continue in new way</td>
</tr>
<tr>
<td>stop, do, continue</td>
<td></td>
</tr>
</tbody>
</table>

Taken together with the other sections of the evaluation it is clear that students on the Wiki course are excited about innovations to a course that had always been a bore. In response to what they found most difficult, however, they failed to mention the initial difficulties they had adapting to the new technologies, perhaps in their excitement with technology having overcome initial challenges. It must be noted nevertheless that team work and autonomy were identified as having changed their way of learning and the Internet made learning effective; these two categories combine in what they found to be most useful. These are without doubt the affordances of a technology supported module within the blended learning approach to e-learning. We note also that our students found searching for materials a difficult activity; this is not unconnected with the problems associated with the amount of information and sources that turn up when they search without adequate refinement of their search terms. Using appropriate search engines and refinement of terms is an area that has to be attended to subsequently. It is a short in the arm for change drivers to indicate their support for technology supported modules and a request for more autonomy in view of faculty reticence to take up the media, although these have to be handled with care.

Teacher observation of the processes indicated that setting up groups and getting them to bond was a particularly difficult part; most hesitated in taking up leadership positions but once in were usually ready to accept responsibilities. After explaining how the group would work and its importance to the process, we called for individuals who had played and who would like to lead the groups to volunteer on departmental basis. But only about 50% of the required number had the confidence to do so. The others had to be prompted, cajoled and egged on by their colleagues. Getting the groups to function was considerably more difficult in the two to three weeks scheduled for settling in and bonding; but once they got under way, our notes indicated that fewer than 10 groups (≤19%) had problems of bonding. The teacher was not able to critically observe all 52 groups and had to randomly select 10 for this purpose, although all groups received at least a visit. Students had no idea what groups were
being observed as all expected more visits. Note was taken on attendance, contribution to discussions, language of interaction, and readiness to take on tasks. Several group leaders came up to the teacher to report uncooperating colleagues but it is noteworthy also that groups were usually reluctant to openly report recalcitrant members of the group in class; surprise visits to some groups gave away these members. Usually also these individuals were called upon by the teacher to present/defend group positions on given activities in class, this gets members to take things more seriously. Measures taken and known to students on individual assessments reduced the number of truant students to less than 5% by mid semester. Initially it was difficult for members to keep to meeting schedules, but knowing that teachers checked on them unannounced helped to keep most on track, and for them to participate in the group work and carry out assignments. Although most students shared the same L1, interaction in groups was mostly in L2. Asked why there was such a high degree of L2 interaction during group work while most students’ interaction out of class was either in pidgin or mixed codes, many students during observation visits agreed it was because assignments/activities had to be written or defended in the English L2. Virtually all groups visited experts for consultations on their chosen topics, and this reflected in the write ups. Everything considered most students benefited from group work and were willing to say so even to students at other levels and courses.

The Wiki logs, footprints and front page comments offer, if not a most accurate quantitative evidence, very useful insight into students' online activities and reflections of their learning experience, and their expectations of the environments and pedagogy that could meaningfully engage them in knowledge construction. After set up by the four teachers, the Wiki (http://futagns.pbwiki.com) comprised a total of 671 pages: about 657 set up by teachers and 14 set up by students on their own (trying to learn to set up). Group pages yielded about 1287 visits, mostly for edits, and this is apart from visits to the front page to post comments. Initially, many students had difficulty logging in to do any work at all. For a while, many messed up the front page not knowing how to proceed to group pages. Often teachers explained over and over again that the front page was not a work station for students. Finally we had to post a warning on the front page, asking visitors not to edit, cancel or delete the page. By mid-semester everyone had mastered the navigation systems. The Wiki had the advantage of restoring every page to the default or an earlier date/point and we could monitor visitors' footprints, especially because every student had registered and had an identity on the site. Given the number of hits on the group pages, considering that the site was on for only about seven weeks of the semester and that many could neither log in immediately nor edit the pages themselves, interest in the wiki is apparent and high. A particular group page recorded 96 visits (not all of these indicated meaningful edits, however).

Assessment on the course took account of the number of visits to group pages and the amount of work done on the page. A definite number of tasks had to be completed on the site and submission of certain assignments was on definite pages set up for the purpose. All these were monitored and accounted for a portfolio for each group.

As stated above, comments on the front page were encouraged and these covered every aspect of the course as students might wish to make their voices heard, but were warned not to turn the page into a social networking one. In spite of this many posts featured social issues and many of these were written in Nigerian pidgin. Nevertheless, the front page comments offered some of the most insightful statements, reflecting the students’ learning curves. A few of these are brought out to show the trajectory of students’ learning experience. They are reproduced unedited, spelling, grammar errors and all:

This site is not well programmed. It is rejecting my valid email address. pls help me out israelmarc@ymail.com

sir, we are having a problem with our page, we do not know how to correct it. HELPBBBBBBBBBBBBBB.BB.AAAT FWL GROUP 4

THE WIKI IDEA IS GREAT ONE, AT LEAST NOW, OTHER UNIVERSITIES AROUND THE GLOBE CAN SEE FROM OUR DIFFERENT PERSPECTIVES AND LEARN FROM OUR OWN IDEAS TOO. IT'S REALLY A GREAT ONE, I MUST CONFESS. KUDOS TO THE INITIATORS
your efforts are really appreciated towards making this course an interesting one. It has helped in diverse ways: sourcing for information, exchanging ideas, surfing the internet for vital information and working on time.

This course affords students the rare opportunity of team work experience on the world wide web. I think it's the beginning of better days ahead for Nigerian student if innovations as these are imbibed in our academic culture. Its simply wonderful!

hi, fellow members pf my grp. dayo, mistura, tunde and tosin. Thanks 4 ur cooperation, i hope we have good grades. i cant wait to start writing my Project.

7. Outcomes and challenges

The great advantages of the technology supported module for large classes using blended learning reside more in the possibilities of extending the classroom beyond the walls, on- and off-line; providing for collaboration and interaction while engaging with materials in the process of carrying out an enquiry. Following the process-product approach, students' ICT and Internet skills improved from most not being able to do more than check and send e-mails to sourcing for information online and editing materials. Moreover they are able to use the computer and Internet for academic purposes towards writing a term paper which is a major outcome and product of the course. En route to this major goal the course ensured interaction between students in the process of group work and in class.

Reflecting on the processes and achievements on this module, a number of challenges have come up which were neither expected nor necessarily thought of at inception, but would continue to determine progress in our efforts at enhancing learning through technologies. First, the great level of enthusiasm shown by our students after initial doubts has brought about great expectations that we cannot afford to fail to deliver on. The expectations must be matched by appropriate speed and caution. This requires provisioning by administration in the areas of ICT infrastructure and training (since no ready pool exits in Nigeria) of learning technologists. Secondly, in order to match the enthusiasm and expectations of students, strategies have to be devised for gradual but steady learning technologies uptake by faculty in students' core disciplinary areas. Thirdly, as is well accepted now that supporting learning with technology requires knowledge of its pedagogy, our institution requires a planned course of action to get faculty trained on an on-going basis on pedagogy. Associated to this is the all important matter of assessment methods. If learning processes are changing so must the assessment methods and processes as well as dictated by the pedagogy. Knowledge of new pedagogies would necessitate and dictate the way to go, but the critical issue is reluctance to change by faculty and staff already grounded in their own ways and methods.

8. Conclusion

In technology poor environments of third world countries a whole lot can be done to enhance the learning experiences of our young learners who are more at home with new technologies. The attempt reported here using the Wiki is the first that we are aware of in Nigeria. For us, creating learning teams and forging collaboration among learners leveraging one another's abilities, the wiki experience extended the 'classroom' beyond the physical space and engaged students in interactive communication in the second language. The experience of our students is an impetus to go on and extend the possibilities. But there are challenges, for our institutions, teachers, governments and students themselves. If we are ever going to tackle the problem of large class numbers in Africa and the rest of the developing world teachers would have to look towards technology and appropriate technologies for their situations. The current evaluation is far from being quantitatively exact in technical terms, but it does give an idea of how we have been able to integrate technology and the effect this is having in our educational context.

References


Weblogs in Higher Education – why do Students (not) Blog?

Monika Andergassen, Reinhold Behringer, Janet Finlay, Andrea Gorra and David Moore
Leeds Metropolitan University, UK
m.andergassen5699@student.leedsmet.ac.uk
r.behringer@leedsmet.ac.uk
j.finlay@leedsmet.ac.uk
a.gorra@leedsmet.ac.uk
d.moore@leedsmet.ac.uk

Abstract: Positive impacts on learning through blogging, such as active knowledge construction and reflective writing, have been reported. However, not many students use weblogs in informal contexts, even when appropriate facilities are offered by their universities. While motivations for blogging have been subject to empirical studies, little research has addressed the issue of why students choose not to blog. This paper presents an empirical study undertaken to gain insights into the decision-making process of students when deciding whether to keep a blog or not. A better understanding of students’ motivations for (not) blogging may help decision makers at universities in the process of selecting, introducing, and maintaining similar services. As informal learning gains increased recognition, results of this study can help to advance appropriate designs of informal learning contexts in Higher Education. The method of ethnographic decision tree modelling was applied in an empirical study conducted at the Vienna University of Technology, Austria. Since 2004, the university has been offering free weblog accounts for all students and staff members upon entering school, not bound to any course or exam. Qualitative, open interviews were held with 3 active bloggers, 3 former bloggers, and 3 non-bloggers to elicit their decision criteria. Decision tree models were developed out of the interviews. It turned out that the modelling worked best when splitting the decision process into two parts: one model representing decisions on whether to start a weblog at all, and a second model representing criteria on whether to continue with a weblog once it was set up. The models were tested for their validity through questionnaires developed out of the decision tree models. Results show that the main reasons for students not to keep a weblog include a preference for direct (online) communication, and concerns about the loss of privacy through blogging. Furthermore, the results indicate that intrinsic motivation factors keep students blogging, whereas stopping a weblog is mostly attributable to external factors.

Keywords: weblog, blog, higher education, informal learning, ethnographic decision tree modelling, motivation research

1. Introduction

This paper aims at a deeper understanding of students’ motivations to use, and not to use, weblogs in informal learning contexts. Weblogs, or blogs, are chosen as an example of the educational use of social software tools.

The term ‘social software’ first appeared in the 1990s (Allen 2004), although some of its concepts were discussed long before under different names. Today it is broadly used to describe software that supports communication and interaction (Shirky 2003), feedback by the group, the creation of social networks (Boyd 2003), and collaboration. Typical social software tools include wikis, social networking tools, social bookmarking tools, and weblogs. The use of social software tends to be driven by a bottom-up approach, starting from the individuals’ desire to affiliate and to connect with each other (Baumgartner 2006; Boyd 2003).

Social Software is often mentioned in connection with ‘Web 2.0’. Kerres (2006) points to three boundaries which are changing or dissolving towards a new perception and use of the internet: user and author, local and remote, private and public. Applied to education, this shift implies that students (the former ‘users’) as well as teachers (the former ‘authors’) become the new authors; learning happens everywhere and thus becomes ubiquitous, and can not be addressed to being at a specific location (for instance, at school or at home); and learning activities are presented and made public to the teacher, peers, or the whole internet community.
This shift points to a student-centred design of learning. Social software tools have the potential to complement the traditional Learning Management System (LMS), which delivers courseware in a more or less uni-directional way (Downes 2005). Instead of e-learning being purely structured around courses (O’Hear 2006), social software can facilitate self-governed, problem-based and collaborative activities, and the building of networks (Dalsgaard 2006).

When learning becomes ubiquitous, informal learning gains increased importance. Reinmann (2005) defines informal learning as all learning activities that happen outside of seminars and courses and that are not guided by teachers. Informal learning is self-regulated and interest driven and usually embedded in concrete contexts. Cross (2006) estimates that at least 80% of all learning is informal.

Among the various social software applications, weblogs have been increasingly used in education in the past few years (for instance, see Brooks et al 2004; Churchill 2009; Du and Wagner 2005; Safran 2008). Weblogs are individual or collective online journals, sometimes compared to diaries. They contain few to many entries, sorted in inverse chronological order, where every entry has a unique date stamp and URL. Thus, every entry can be bookmarked, referenced, or commented on by others (Baumgartner 2005; Gross and Hülsbusch 2004; Mosel 2005).

The potential for learning with weblogs has been discussed in various studies. Some researchers adopt a constructivist view on learning, and describe weblogs as supporting active knowledge construction, incremental improvement, self-directed learning, and situated and context related knowledge construction (Du and Wagner 2005; Jadin 2007). Others see today’s learning as gaining the competence to form connections. Under the term ‘connectivism’, learning is described as ‘collecting knowledge through collecting people’ (Siemens 2004). From both these theoretical points of view, social software, and blogs in particular, seem to provide the necessary requirements to enable learning.

2. Why do few students blog in informal learning contexts?

According to Sifri (2008) weblogs are still continuing to evolve, with the weblog search engine Technorati having indexed 133 million blogs since 2002. Schmidt and Mayer (2006) report on motivations for blogging which include, among others, the sharing of ideas, the recording of ideas and experiences, and the making of new contacts. However, despite the potentials for learning and the positive expectations of educators towards social software, this enthusiasm is not always reflected through extensive use of social software in education by students.

Ebner et al (2008) have conducted two studies among students at Universities in Graz (Austria) and Zurich (Switzerland) in 2007/08. Results indicate that, although 80% of students in Graz (resp. 86% in Zurich) possess laptops, and 84% (resp.98%) have access to internet, few students actively use Web 2.0 technologies. Less than 60% know what weblogs are, and among those, less than 10% actively blog. Experiences with Web 2.0 technologies are mainly constrained to passive use of Wikipedia and YouTube, and participation in the social networking platform StudiVZ.

Bennett et al (2008) discuss other empirical studies with similar results – students being equipped with technology and Internet access, but ‘only a minority of the students (around 21%) were engaged in creating their own content and multimedia for the Web’ (Bennett et al, 2008: 778).

Finally, Andergassen (2007) presents results of a survey conducted at the Vienna University of Technology (Austria) in 2007 on the use of weblogs, indicating that just around 7.5% of students used informal weblogs. 20% of these weblogs contained around 79% of entries, which indicates that just very few students blogged with a high frequency.

When looking at these studies, it is not surprising that an intensive discussion has arisen around the nature and characteristics of today’s students. Some authors advocate the idea of a generation which is ‘different’ because it grew up with digital technologies. Bennett et al (2008) summarise these allegedly distinctive characteristics in their critical article as (1) the assumption that the new generation has sophisticated knowledge and skills with information technologies, and (2) they have therefore particular learning preferences, which differ from prior generations. Prominent exponents of these theories include Tapscott (1999) who talks about the ‘net generation’, and Prensky (2001) who uses the term ‘digital natives’ to describe a generation which is ‘radically different’.
However, empirical studies like those above support critics of the concepts of this ‘different’ generation. Schulmeister (2008) compares more than 45 empirical studies on media usage and user motivation of children and teenagers. He comes to the conclusion that they generally do use media extensively, but that this does not make the generation ‘different’ from prior generations, as they have the same interests, like making friendships, as the generations before them. Also, he notes big differences in digital literacy among the young generation, and thus argues that concepts like the ‘net generation’ are, if at all, applicable only to a minority of the generation. A transfer from competencies gained through use of computers (in the leisure time) to learning seems not to happen to any large extent.

Despite the different views on the topic, the discussion demonstrates the large interest of researchers in the new developments of digital technologies, and in the students and their learning needs in the knowledge society. This paper presents an empirical study undertaken to elicit motivations for students to blog, and – most important – for students not to blog. The results might form a step towards deepening the understanding of today’s students and how they think.

3. Empirical study: ethnographic decision tree modelling

The empirical study aims to investigate the decision making process of students about blogging or not. Specifically, the following research questions are being addressed:

- Research question 1: What makes students decide whether or not to lead a weblog in an informal education context?
- Research question 2: Why do many of the students stop blogging?

The Vienna University of Technology (TU Vienna), Austria, provides the context for the research. Since 2004, the university has been offering a free weblog service for all members of the university (Rappold 2004). Every student and staff member gets the opportunity to open one or several weblog accounts. Besides their use in seminars, blogs can be kept outside of course settings, on a voluntary basis, and without assessment pressure. These informal usage scenarios by students are the subject of the presented empirical study.

To address the research questions, the approach of ethnographic decision tree modelling, described in detail by Gladwin (1989), has been adopted. It is a method of ‘both describing and predicting group behaviour’ (Beck, 2005: 243). In the describing process, decision tree models are developed out of statements of informants. This is a qualitative process. These models should then serve to predict decisions under similar circumstances. Therefore, as a second step, these models are tested for their validity through questionnaires developed out of the models, and given to a new selection of interviewees. The analysis of these questionnaires follows a quantitative approach (Gladwin 1989).

3.1 Data collection: guided interviews

Guided interviews were held with students of TU Vienna in 2007. Three interviewees were selected from each of the three following user groups: bloggers, former bloggers, and non-bloggers. Log files helped to identify bloggers and former bloggers. From the total of all weblog entries at TU Vienna, the 20% of blogs contributing most entries, formed the pool for selecting the blogger sample.

The interviews aimed to elicit students’ decision criteria on whether to blog or not. The form of guided interviews was chosen to give students the maximum freedom to talk about the topic from their point of view in their own time, rather than imposing the opinion of the researcher or pre-defined categories on them (Bell 2005).

3.2 Ethnographic decision tree modelling part 1: building the models based on interviews

Gladwin (1989) differentiates between an indirect and a direct approach for building the ethnographic decision tree models. The indirect approach starts from an individual model of the first interviewee. All subsequent models build up on this first one. The direct approach first builds all individual models independently, and then seeks to combine them in a second step. This latter approach is the approach adopted for the current study. It has the advantage of being more immediate and natural, although this approach does not check whether each informant considers the other decision criteria as valid or relevant (Gladwin 1989).
Figures 1, 2 and 3 show examples of individual decision tree models. The various decision criteria were elicited from the interviews and arranged in the diagrams, following the thoughts of the students. Dotted lines and forms in the figures represent what students mentioned as important factors in the decision making process, solid lines represent their actual decision making process.

It turned out that the modelling worked best when splitting up the decision process for each individual into two parts: one model representing the decision criteria for whether to start a weblog (Figure 1 and 2), and a second model representing the decision criteria for whether to continue to blog, if this decision was applicable (Figure 3). This is what Gladwin (1989) describes as ‘sequential modelling’.

**Figure 1:** Individual decision tree model of interviewee #3 about whether to start a weblog

**Figure 2:** Individual decision tree model of interviewee #5 about whether to start a weblog
Figure 3: Individual decision tree model of interviewee #5 about whether to continue blogging

CONTINUE BLOGGING @ TU; DON'T

(B6) Do I like people to react on my posts?

Yes

(B7) Is the weblog easy to use?

No

STOP BLOGGING

No

(B5) Do I find the time to blog?

STOP BLOGGING

Yes

CONTINUE BLOGGING (Int 5)

Figure 4: Composite decision tree model representing decision processes of interviewees on whether to start a weblog

Each model can be read as a series of if-then conditions (Gladwin, 1989: 31). For instance, interviewee #3 decided against a blog. The decision making process is represented in Figure 1. The
model can be read as follows: “If this service provides useful (exam) information for you, and a lot of people use it related to your study, on a regular basis, then start blogging”. Since the if-conditions were not true for interviewee #3, he decided not to start blogging. By contrast, interviewee #5, represented in Figure 2, decided to start blogging: “If this service provides a webspace, and if you can publish without having to layout, and if you like to test the new technology, and if you have a theme for a weblog, and if you like to publish on the internet, then start blogging”. Figure 3 is the follow-up model for interviewee #5. It shows interviewee #5 thinking as follows: “If you like people to react on your blog, and if the weblog is easy to use, and if you find the time to blog, then continue blogging”.

Once all the individual decision tree models were created, they were brought together into a composite model. It is important in this step to combine all the individual models into one decision tree, while still preserving the individual decision paths.

Figure 4 presents the composite decision tree model for whether or not to start a weblog. Figure 5 presents the composite model for whether or not to continue blogging, once a blog was started.

![Composite decision tree model](image)

**Figure 5:** Composite decision tree model representing decision processes of interviewees on whether to continue blogging

It should be noted that the number of informants in this qualitative part of the study is relatively small. Gladwin (1989) proposes a minimum sample of 20 informants for the qualitative process of model constructing. The drawback of working with few informants is that not all possible decision criteria might be elicited in the interviews. The testing of the model validity described in the next section overcame some of these problems. However, further work is needed to cover a wider variety of informants and so strengthen the model.
3.3 Ethnographic decision tree modelling part 2: testing the models

The final step in the process of ethnographic decision tree modelling is the use of questionnaires to test the models for their predictive validity. This might be an iterative process, as is described in this section.

![Revised composite decision tree model about whether to start blogging](image)

**Figure 6:** Revised composite decision tree model about whether to start blogging

Each composite model gets its own specific questionnaire. Each decision criterion from the composite models becomes one yes-or-no question in the questionnaire. For instance, the first question reads as follows: “Do you like to publish personal information/opinions on the Internet?”. As in the modelling process, the questionnaire in this study consists of two parts: the decision process concerning whether to start a blog, and the decision process concerning whether to continue blogging.

The questionnaire was posed to the three groups of bloggers, former bloggers, and non-bloggers, but with a new sample of students.

The questionnaire was completed by 30 students and the results were compared to the models. If the result of a questionnaire, and thus the decision path of a student, corresponded to the decision tree models, the questionnaire was counted as a ‘successful’ case. The division of the successful cases to the total number of cases led to the success rate of the composite decision tree models and their ability to predict the decision (Gladwin, 1989: 49). Model 1 (Start Blogging; don’t) did have a predictive rate of only 63.3%. This means that when deciding whether to start blogging or not, the decisions of
11 students wound up in the wrong place in the first model. Model 2 (Continue Blogging, don’t!), on the other hand, had a predictive rate of 85.7%. After Gladwin (1989: 49), a model is adequate if it predicts 85-90% of choices. Thus, model 1 required a revision to become an adequate model, whereas model 2 is adequate to predict the decision about whether continuing to blog or not.

Two items in model 1 were identified where most of the decision strands from the questionnaires turned to a different direction than would have been predicted by the model:

- The negation of the question “Is this service personal and immediate enough for me?” led 7 students to the decision not to start blogging. However, 4 other students started to blog after negating this question, although the model implied that they would not. When probing further, some students reported that they were curious about the weblog system.
- The question “Do I have a theme for a blog?” was answered in the affirmative by one student who started to blog. However, it was negated by four other students, who nonetheless started to blog, although, according to the model, they should not have started to blog.

In the revision process, changes in the model can be made by re-ordering items, omitting items, or adding new items. However, if a new item is added to the model, it is not known what the previous informants would have responded to the question related to this item. In this case, the model becomes again descriptive rather than predictive (Gladwin, 1989: 53). Following these possibilities, the item “Is this service personal and immediate enough for me?” was broadened by introducing a new item, “Am I driven by curiosity to try out the system?”. The item “Do I have a theme for a blog?” was omitted in the revised model. Figure 6 presents the revised version of the model.

The new model is consistent with 86.6% of the questionnaires. However, with the introduction of a new item, a new questionnaire would need to be developed out of the new model in order to test it for its predictive ability. This iteration cycle will be investigated in further research.

4. Results and discussion

When comparing the models to the initial research questions, the following observations can be made:

4.1 Research question 1: What makes students decide whether or not to lead a weblog in an informal education context?

Four major points could be identified which motivate students to start blogging:

- **Writing**: A general will to write/publish on the Internet is an important basis for starting to blog. Those students who explicitly mentioned this factor in the guided interviews, were still blogging at the time of the interviews.
- **Technology**: A few students were originally interested in testing the new hype/technology. There is a differentiation between wanting to test the new technology and having to test it, eg for job reasons. Indeed, having to test the technology did lead to people ceasing to blog later on.
- **Communication**: When being abroad, blogging is seen as a suitable tool to communicate with friends/family at home.
- **Socialising**: The will to make social contacts in web platforms is a very important driver for many students to engage in the Internet. However, this need is mostly covered by tools other than weblogs. As a side note it can be said that almost all of the nine students from the guided interviews mentioned that they are subscribed to the social networking site StudiVZ.

Conversely, three reasons seem particularly important in preventing students from blogging.

- **Lack of (study) information**: One factor behind the decision not to start blogging lies in the perception that this service does not provide useful study information. This is a different sort of criterion from the four above mentioned, because it is not driven by an active will to do something, but rather by the expectation that something is provided for the student.
- **Lack of immediacy and personal communication**: Here, blogs were compared to instant messaging services like ICQ, which is preferred by many students. 13 out of 30 participants reported that blogging was not immediate and personal enough, and in 7 cases this was the decisive criterion not to start blogging.
• Loss of privacy through blogging: 10 out of 30 students reported that they mind the loss of privacy through blogging. Just in the case that the students had to test the technology, e.g. for job reasons, they would start blogging (3 out of 10 cases).

4.2 Research question 2: why do many of the students stop blogging?

The following reasons are suggested by our data:

• Lack of privacy and immediacy: A comparison of the composite models 1 and 2 shows that all the students who started blogging despite the fact that they thought it was not personal and immediate enough for them, or despite the fact that they minded the loss of privacy, stopped blogging again. These arguments seem to overrule other reasons for blogging on a longer term view. The perceived lack of immediacy might explain why many more students use instant messaging tools than blogs (see Ebner et al 2008). On the other hand, the concern for privacy reported by many students, seems at first sight to disprove Tapscott’s (1999) observation that the ‘net generation’ is giving up their privacy on the Internet. When probing further, though, it turned out that almost all participating students actively used social networking sites, which indicates that social networking sites are perceived as providing more privacy control than weblogs. Tapscott points out in this regard that ‘the maker of that application can see anything you put on your profile, like your dating interests, your summer plans, your political views, your photos, the works’ (1989: 68). The password protection of social networking sites is thus just an assumed privacy control. Further research on the issue of privacy is needed to better understand the concerns of the students, and to enhance their understanding of privacy.

• Software interface: some students reported that the interface was not intuitive enough; in particular the file upload was seen as too complicated.

• Lack of interaction: One student reported on the missing interaction of peers, which did not motivate him to go on blogging. This was coupled with the lack of possibilities to promote the blog through the university.

Summing up, it can be noted that drivers for both starting blogging and continuing to blog are personal and active in nature. A connection to the concept of intrinsic motivation, ‘doing something because it is inherently interesting or enjoyable’ (Ryan and Deci, 2000: 55), can be drawn: writing, testing technology, communicating, and socialising are generally perceived by students as enjoyable actions.

Conversely, motivations not to blog or to stop blogging are mainly attributable to external factors, for instance the lack of privacy or immediate communication, and sometimes with a negative connotation (eg, “this service does not provide study information”). ‘External’ factors are factors that are beyond the direct influence of the student, for instance the software interface.

5. Conclusion

The paper has presented an empirical study about motivations of students when deciding whether or not to blog, through the method of ethnographic decision tree modelling. Results indicate that the main reasons for blogging include a general will to write and publish on the Internet, and an interest in testing the technology. Many students do not decide to blog because their needs to socialise on the Internet or creatively write and publish are satisfied by other tools already. Furthermore, they would expect useful study information from such a service in order to use it. The perceived lack of privacy through blogging prevents many students from starting to blog or is an important factor for ceasing to blog.

The study indicates that students with high expectations towards external factors, like the software interface, or peers with whom to interact, are more likely to stop blogging than students being driven mainly by their will to write.

What use could decision makers at universities make of these ethnographic decision tree models? The models give insight into the decision criteria of the students. Furthermore, they point to some of their specific needs with applications like blogs, for instance:

• The software interface works well for students with a high digital literacy. Many students complain, however, about difficulties, for instance with uploading pictures. Further research could address usability aspects of the software in more detail.
Social networking and immediate communication is very important for most students. However, many students report that this need is covered by other tools. Weblogs offer some functions which help networking and immediate communication, like the comment functions, trackback and pingback, and RSS feeds. These possibilities could be promoted more strongly, perhaps accompanied with additional tools for better connecting blogs to each other. Furthermore, the wish for more privacy could be tackled by enhancing the levels of public, semi-public and private spaces within the blog application.

Blogging during an exchange semester seems to be appealing and could be promoted more strongly.

The study has some limitations. As mentioned earlier, the number of interviewees in the guided interviews as well as in the questionnaires is relatively low. For more validity, the empirical study should be extended to more participants.

Another limitation – or difficulty – lies in the method itself. Can we really draw a tree-like model of decision making processes? The process of merging the individual models into the composite decision tree models required going back to the interview transcripts and individual models several times, to check the sort order of the decision criteria according to the interviews. The interview transcripts did not always indicate clearly which decision criteria would appear at which time during the decision making process. Applying the direct method of modelling instead of the indirect approach, described earlier in this paper, would have facilitated the modelling process in this respect.

Finally, a more fine-grained grouping of interviewees could be done. For instance, a differentiation between frequent and non-frequent bloggers could be made, as well as a differentiation between students who stopped blogging after a few entries versus students who have blogged for a longer period of time. This would give a broader picture of factors behind decisions concerning blogging.

Despite these limitations, this study is important because it gives some insights into students’ motivations for blogging and their demands for the use of internet tools.

References


GEARS a 3D Virtual Learning Environment and Virtual Social and Educational World Used in Online Secondary Schools

Jonathan Barkand1 2 and Joseph Kush2
1National Network of Digital Schools, East Liverpool, USA
2Duquesne University, Pittsburgh, USA

Jonathan.Barkand@nndsnonline.org
Kush@duq.edu

Abstract: Virtual Learning Environments (VLEs) are becoming increasingly popular in online education environments and have multiple pedagogical advantages over more traditional approaches to education. VLEs include 3D worlds where students can engage in simulated learning activities such as Second Life. According to Claudia L’Amoreaux at Linden Lab, “at least 300 universities around the world teach courses and conduct research in Second Life.” However, to date, VLEs have been very limited in use for K-12 education. One option for secondary schools was developed by Game Environment Applying Real Skills (GEARS) and can be used in online or traditional schools. The 3D VLE is named ARC: The Impending Gale. This program has been used successfully for over a year as part of the Lincoln Interactive online curriculum. ARC allows students to create their own custom avatar and enter the educational environment. The actual content of the game differs depending on the subject the student is taking. Current courses include earth science, geography, pre-algebra, and spanish. The 3D VLE experience is designed to serve as a reinforcement of the concepts learned in the traditional lessons. The game environment itself has been very well received by students primarily because many of the continued development features were derived from student suggestions. One unique feature that was most requested was the inclusion of voice chat. Voice chat was only added as part of the ARC headquarters where students were able to meet before going out into the game world for their own specific content. The students are also highly motivated to progress through the content. ARC has been a great success for Lincoln Interactive and its parent company the National Network of Digital Schools. The social aspect of ARC was limited, and the ARC Headquarters prompted a plan to create a 3D Virtual Social and Educational World (VSEW) for the 15,000 students that had access to the Lincoln Interactive curriculum in 2009. With the inclusion of a social component, the concept of an online community was evaluated. Garrison’s et al. (2000) Community of Inquiry framework is used to explore the Lincoln Interactive Community. The VSEW contains a 3D social space with custom avatars, chat, Voice Over Internet Protocol (VOIP) communication, social objects in the form of community musical instruments, and a tutor zone for teachers. In 2009 four educational games are included in the VSEW. These educational games focus on basic concepts in the three disciplines of math, social studies, and language arts. Garrison et al, (2000) Social Presence, Cognitive Presence, and Teaching Presence are each explained in regards to the VSEW. Both ARC and the VSEW are implemented, and as of November 2009 they are currently being used by students. While there is still much to learn and explore in regards to 3D VLEs and Social Worlds, practical application by GEARS in an online secondary school has been positively accepted by faculty and students. National Network of Digital Schools: http://nndsnonline.org/ Lincoln Interactive Curriculum: http://www.lincolninteractive.com/ Game Environment Applying Real Skills: http://gears.nndsnonline.org/ 3D Virtual Social and Educational World: http://www.learnwithfriends.com/

Keywords: VLE, game environment, virtual learning environment, online, GEARS, virtual world, online community, social environment

1. What is a Virtual Learning Environment?

The term Virtual Learning Environment (VLE) can be used in very broad terms. The virtual component of VLEs usually refers to an online, internet, or web-based component. Virtual systems by nature are able to be accessed from remote locations. The learning component is the identifying difference between an educational environment and other environments such as Multi-User Virtual Environments (MUVEs). The environment component is simply a location in which users can gather together in a social context.

The environment of a VLE can range from web sites to virtual classrooms to 3D immersive worlds. When considering websites, a set of web pages does not constitute a virtual learning environment unless there is social interaction about or around the information (Dillenbourg, 2000). A few examples of virtual social interactions may be instant messaging, discussion boards, emails, blogs, and podcasts.
The type of Virtual Learning Environment that will be explored in this paper will be 3D. A 3D VLE adds immersive content to the standard VLE. A 3D VLE allows the student to explore and learn at his or her own pace and time schedule. Users can visit virtual communities at any time, with any computer, and from any location (Lu, 2008). This flexibility makes the connection to asynchronous online coursework a great partnership.

A 3D VLE that has been widely used in higher education is Second Life. Second Life provides the ability to create an avatar and travel around a 3D world. Universities have begun establishing their own private islands in Second Life where classes can be conducted. Private islands are a great way to maintain a safe and controlled learning environment within a world with almost infinite possibilities.

For distance education classes, Second Life can be a great way to bring the class together and meet in a 3D VLE. The actual lectures make the students feel as though they were in a real class. Before class, students can be found standing in groups and talking amongst themselves. Also, depending on the distance and angle from the professor, the professor’s voice would be soft or loud and be heard from the left or right.

Second Life has been very effective for higher education, though K-12 education has been more difficult to implement in Second Life. As a K-12 educator looking to use Second Life for his or her classroom, it is important to look at some specific requirements. Some other virtual worlds are intended for children, but not Second Life, except for its “Teen Grid,” or on safely walled-in private “estates,” which some schools have established (Trotter, 2008). The ability to control the learning environment will be a critical part of using 3D VLEs in K-12 institutions. This has led to many organizations creating 3D VLEs that are specifically designed for K-12 and are closely monitored and controlled.

2. Pedagogical advantages

The pedagogical advantages of using a 3D VLE are a critical component. Using a 3D VLE in an educational setting needs to reinforce student learning. The potential to have a full course in a 3D VLE is possible, but a close look at the amount of content and assessments is necessary. There exists a need to classify using games for education and using games for learning. A meaningful and relevant context provides a springboard for inquiry, information-gathering and sharing, and reflection of theoretical concepts and relationships, and norms and practices (Lim, 2008).

There currently exists considerable research on the use of games in the classroom. Using games as a classroom becomes a possibility with 3D VLEs. The ability to facilitate and guide learning is a very important part of using games in an educational setting. Learning can occur in many forms, and a key feature is in reinforcing a concept that is being taught. This is where designing games to match content can make 3D VLEs more effective teaching tools. The ability to teach a lesson on construction and management and have the students build and manage a theme park in Roller Coaster Tycoon is a good reinforcement tool, but it could be better. If that same lesson was integrated into a 3D VLE and the game matched the lesson concepts and provided an immersive learning experience, the overall learning effect on the student would be increased.

A 3D VLE also provides a different learning experience that appeals to students’ personal learning styles. Students who learn more effectively in a visual and hands-on environment would also excel in a 3D VLE. Constructivist learning theory can be easily shown in a 3D VLE. An example of students in a guided social constructivist approach using a 3D VLE is River City. Several experiments have been conducted and compared against a similar paper-based control group classroom. The examination of the results indicates that on average, students in a guided social constructivist experimental group (GSC) achieved 16% higher scores on the post-test in biology than students in the control group (Clark et al. 2006). The guided parts of River City were messages that would give students hints or help when accessed. This allowed the game environment to act as a facilitator of learning. A similar approach was used in the following 3D VLE that was developed by GEARS.

Student motivation has been shown to be a very powerful factor that contributes to learning. Motivation for students to access the 3D VLE doesn’t appear to be a problem for many of the current educational games on the market. This is likely due to students pre-disposition to using interactive games. When combining time spent with computer games and video games into a measure of total interactive gaming it is revealed that interactive games consume more than an hour daily of U.S. 8 to
18-year olds’ time. (The Henry J. Kaiser Family Foundation, 2005). Students already enjoy interactive game environments and adding an educational component to the more than an hour per day can serve as a learning tool as well. When considering how many different types of interactive games that exist, it might be concluded that students will not be willing to add another game into their daily lives. A study done by The Henry J. Kaiser Family Foundation in 2005 has shown that many young people do not limit themselves to just one kind of interactive game platform, and that when all interactive gaming is taken together, gaming occupies a substantial portion of U.S. childrens’ media time.

3. Game Environment Applying Real Skills (GEARS)

GEARS is a division of the National Network of Digital Schools (NNDS). NNDS offers comprehensive technology solutions and delivers high quality curricula to students, teachers, and administrators. NNDS also provides innovative and effective educational experiences. GEARS is integrated with the Lincoln Interactive curriculum that is exclusively distributed, maintained, and developed by experienced educators and professionals at NNDS. The courses are supported by certified teacher facilitators both in the online curriculum and within the game world. The Lincoln Interactive curriculum is designed for K-12 online delivery and can be used by both online schools and traditional brick and mortar schools. The curriculum consists of over 250 asynchronous online courses and in 2009 these courses were available to over 15,000 students.

Four Lincoln Interactive asynchronous courses were chosen to be integrated with the 3D VLE. Students enrolled in Earth Science Parts 1 and 2, World Geography Parts 1 and 2, Introduction to Algebra Parts 1 and 2, and Spanish Parts 1 and 2. Each course is a full year course broken in two parts that are one semester each. These courses are offered with and without the GEARS 3D VLE integration. GEARS integration is part of the course assessment and is calculated as 40%. All GEARS courses are designed to reinforce and provide application of the concepts learned in the asynchronous course. The ability to actively engage in the content as well as interact with other students and teachers in the 3D VLE provides a great social learning system for students.

Students are supported by teachers in their online asynchronous course which is offered through Blackboard. The course provides content, quizzes, exams, and assessments. The students are also supported by teachers in the 3D VLE. The 3D teachers can help students with quests, glitches, or other issues. A student support forum for GEARS is also available for students to suggest improvements, ask questions, and get technical support. The teachers and technical support are also available by email or phone. Email responses during business hours Monday through Friday from 8 a.m. to 4p.m. EST on average are within 1-3 hours, and outside business hours a response will be within 24-48 hours.

4. ARC: The Impending Gale

ARC: The Impending Gale is a product developed by GEARS. ARC stands for Active Response Corps, which is an organization in the game world that provides disaster relief assistance. The students are part of ARC and have a significant role in setting up relief efforts and preparing an emergency response system. The game was originally released to a small group of students in fall 2007. Due to the success of the program, ARC was released to an even wider audience for spring 2008. Content zones and expansions have been continually added since the release in 2007 and the current content for the game spans an entire year long course. The GEARS program is still operating and has approximately 100 currently active students in the 2008-2009 school year. Roughly 200 students participated in the first year of GEARS courses for the 2007-08 school year.

ARC is an adventure game with role-playing game elements. Students use problem solving skills to work through a variety of quests and overcome obstacles. The role-playing element exists because each student has specific goals and objectives depending on the course enrollment. Each student must do course specific objectives in order to help the relief effort. A few objectives may range from setting up weather monitoring equipment to translating Spanish communications or relics.

Reinforcement of the curriculum based content is a large part of the GEARS environment. There are also additional features such as socialization. Students will meet other students from all four courses and can work through content and help each other. More often a student that is further along or more experienced will help the new students. There is also a monitored chat system for in-game communication. This is a more instantaneous form of communication as opposed to discussion.
boards. The students can interact with fellow students and engage in dialogue in a more informal classroom setting.

There are also cultural, geographical, and political aspects of the game. The game world is located on Municipio Peninsula de Taxtapal in Central America. There are small villages, a large port city, and Mayan ruins. The city is very wealthy and the surrounding villages are economically depressed. The students will be interacting with the locals. There is also a political side of the game where the players must interact with the mayor and understand the struggle between the government and the local Indios. The cultural blend of the game and attention to details and local cultural references gives the students the feeling of being in a different country and many of them begin to understand the local customs as they progress through the game.

Students have the ability to create their own custom avatars. They can either represent themselves or be creative. While students’ personal identification is not shown to everyone in the game world, each account maintains their personal information for assessment purposes. There are also leisure activities that provide the players with in-game money. These games often have the students accessing the game world even in their free time. Most students that are in the game world will talk with other students and usually complete a curriculum based lesson as well. Students can also purchase customizable clothing, equipment, and accessories to further personalize their character. Students have reacted favorably to creating their own character instead of having a pre-defined character which is the case in other 3D VLEs.

5. Missing social interaction

ARC was originally designed to be a multiplayer online game in which four students would work together as a group to progress through the curriculum. The four students would be from each discipline of math, science, social studies, and foreign language. The original plan called for all students to be online at the same time to complete quests/assignments. In one such quest, it was not possible to enter the temple unless the Spanish student was present to translate the mechanism to open the door. The multiplayer feature was dropped due to the asynchronous mode of delivery. The VLE was trying to impose synchronous time limitations on an asynchronous curriculum.

The system originally assigned students to groups, so if a student was sick or not present the other student could not pick up another team member. Also, due to the curriculum being asynchronous some students were lessons ahead of the group content and had to go back to work they had already completed. It was decided that removing the group component and allowing students to progress through their content at their own pace was best. The social interaction and collaborative learning component in ARC was minimized due to the asynchronous method of delivery.

After breaking the group dynamic structure into individualized instruction the system was modified to enhance communication and a sense of community. While completing quests and progressing through the content, students can communicate with students from all courses in the general in-game chat. This allows for the mentoring system in which veteran students can help new students with basic information on getting started and finding some of the locations within the game world. The students are not able to actually see any of the other students in the main game world because each student gets their own version of the game world in which they are the only player present.

The ARC headquarters was created to allow students face to face meeting in which students can see each others avatars and use the different gesture commands to communicate. The ARC headquarters was designed to be a meeting ground where students could communicate before heading out to complete their work. This was originally text based but the edition of Voice Over Internet Protocol (VOIP) allowed students to use headsets/speakers and microphones for verbal communication.

6. Virtual Social and Educational World

The ARC headquarters laid the groundwork for a plan to create a social environment for online secondary students. The new virtual world would not be tied to a specific course. It would be an immersive environment for students to socialize and play educational standards-based games. Based on research findings, Warburton (2009) explained that the immersive nature of the virtual world, crossing physical, social and cultural dimensions, can provide a compelling educational experience, particularly in relation to simulation and role-playing activities.
Jonathan Barkand and Joseph Kush

The Virtual Social and Educational World (VSEW) has two main components that will be explored. The first component is the multiplayer competitive educational games. The second component is the social and community building aspect. The VSEW was developed due to fully online students missing a key social piece in education. Students in the VSEW are building a sense of community, making friends, talking about courses, studying, and playing educational games. Figure 1 is a screen capture of the social space with student and teacher specific information removed.

![Image of the VSEW](image)

**Figure 1**: 3D virtual social world with the gesture menu open

Key Components and Sub-Components:
- Location: Mediterranean Island
- Theme: Ancient Roman Architecture
- Time Period: Modern/Semi-Futuristic
- Custom student avatars
- Variety of gestures and emotes
- Teacher Avatars with Icon designation
- Vendor to purchase new items
- Field Trip Dock (future use)
- Tutor Zone
- Collaborative Music Area
- Hall of Heroes
- Deep Factor Game
- Pizza Chop Game
- Fountain of Knowledge Game
- Spell Hex Game
- Forum

The VSEW is browser based and only requires the installation of a web plug-in. The ARC game system was a stand alone software install. When running the game, it was very difficult to switch to online course materials or other resources. A browser based system also opens opportunities for
more students to use the VSEW. Instead of opening a program, they can just open a new browser tab or window.

7. Educational games

Deep Factor, Pizza Chop, Fountain of Knowledge, and Spell Hex games each have an education outcome in mind. The games do not hide the fact that they are educational, but rather they embrace the concept. Focusing on basic concepts allows the age range of players to be very diverse. Each game also has a specific theme and is designed to have a high level of replayability. Three external motivation factors are used within the VSEW games. These factors are competition, multiplayer, and reward. The top ten highest scores are visible on each games homepage. Eventually added is the top player from each game will have his or her avatar displayed in the Hall of Heroes in the 3D virtual world. While each game does have a single player practice mode, the fun part is playing against a friend. Students will challenge their friends to a game that does not involve who gets the most headshots first, but who can solve math problems the quickest. The reward for playing provides reputation and money. Every student that plays receives reputation and money, but winning provides the student with double reputation and money. Reputation is used to qualify for theme specific outfits to wear in the 3D virtual world. The money is used to purchase the additional articles of clothing. Students that play certain games may want to show off their talents by wearing a full themed outfit of their favorite game.

The four current games are Deep Factor (math), Pizza Chop (math), Fountain of Knowledge (social studies), and Spell Hex (language arts). All four games load within the main window in Figure 1, this allows chat and navigation to be accessible at all times. Deep Factor is a math based puzzle game that focuses on addition and multiplication. The students use quick mental math to earn the most points and slow down their opponent. Deep factor is a two player game. Earning reputation points unlocks the diving suit in the virtual social space.

Pizza Chop is also math based, but focuses on fractions. The fractions are displayed on the orders for how the pizza should be chopped into pieces. The students use accuracy, speed, and points

![Figure 2: Deep Factor in single player mode](image)
earned to defeat their opponent. Pizza Chop is a two to four player game. Earning reputation points unlocks the ninja outfit in the virtual social space.

Figure 3: Pizza Chop in single player mode

Figure 4: Fountain of Knowledge in single player mode
Fountain of Knowledge is a trivia game with general social studies questions. Students must also explore the map searching for the fountain of knowledge while gaining knowledge points. The game can become quite competitive because the students can attack each other's knowledge points and slow their search for the fountain. Using special items at the right moment can mean the difference between victory and defeat, which adds a strategic element to the game. Fountain of Knowledge is a two to four player game. Earning reputation points unlocks the conquistador outfit in the virtual social space.

Spell Hex is a turn-based spelling game. Each word placed on the board must be used to build other words. It is a timed game with a twist because letters are destroyed if they sit unused for 20 seconds. Not only must students spell correctly, but they must spell quickly. The player with the most points at the end of the game is the winner. Spell Hex is a two player game. Earning reputation points unlocks the wizard outfit in the virtual social space.

8. Creating an online educational community

A sense of community is a key part in every student's education. Community exists in a traditional brick and mortar school, but it is more difficult to create in a fully online secondary school. In order to evaluate an online community, the Community of Inquiry framework (Garrison et al, 2000) was chosen. While this framework was not originally directed at asynchronous online learning, Garrison has revisited the framework in numerous follow-up articles. In his review of the framework, it is mentioned that to date there are very few studies that examine the three elements of the framework simultaneously (Garrison & Arbaugh, 2007). The three elements of the Community of Inquiry framework are Social Presence, Cognitive Presence, and Teaching Presence (Garrison et al, 2000). The framework is a great fit for the Lincoln Interactive online curriculum, and the recent edition of the social space allows all three elements to be met.
Social presence in online learning has been described as the ability of learners to project themselves socially and emotionally, thereby being perceived as “real people” in mediated communication (Gunawardena & Zittle, 1997). Virtual courses have difficulty in projecting social and emotional communication with both students and teacher. The ability to have a 3D avatar that can do gestures, use moods, and custom appearance is part of projecting a presence. The ability to be “face-to-face” with a teacher for tutoring or with other students for a study session provides a social space. Students might work at a distance and individually, and thus, they are not necessarily aware of the activities of other students (Dalsgaard & Paulsen, 2009). It is difficult to feel a sense of belonging to a community when students are not even sure where they belong. If the students were more aware of their “class”, information sharing, collaboration, and discussion would be enhanced by social presence. Studies of online socialization within distance learning have found positive correlations between opportunities for socialization and students’ perception of learning (Edirisingha et al., 2009).

Garrison, Anderson, and Archer (2001) described cognitive presence as the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse. Asynchronous online learning by design requires students to construct knowledge and reflect. Asynchronous learning does not place a time limit on learning and understanding. The Lincoln Interactive curriculum serves as the information exchange medium and also connects ideas. Due to the curriculum being created and viewed as a collective K-12 model, special attention can be paid to scaffolding and controlling prior knowledge. The integration of ideas to help trigger prior knowledge is a key factor of the cognitive presence. The lessons themselves are comprised of three parts to help differentiate instruction and are indicated through images. The three parts are Key Concept, Reinforcement, and Enrichment. The key concept is the goal or outcome and is tied to the standard(s) the lesson is addressing. Reinforcement is used to trigger prior knowledge or adjust instruction for students that struggle with the key concept. Enrichment is used to extend the lesson to real-world application or more advanced understanding of the key concept. The interactive multiplayer games described above can be used as reinforcement and can serve as a cognitive presence as well.

Garrison et al. (2000) contended that although both social and content-related interactions among participants are necessary in virtual learning environments, interactions by themselves are not sufficient to ensure effective online learning. They described teaching presence as the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes. The teachers for the Lincoln Interactive curriculum are called facilitators. Asynchronous course design places emphasis on the quality of the curriculum in the form of learner objectives. It also lends itself to facilitation more than direct instruction. Teacher facilitators in the Lincoln Interactive courses facilitate posts on the discussion boards. Discussion boards vary between courses and teachers, but usually involve assigned discussion board(s) and general open discussion boards. Discussion board policies and attention to on-task behavior is monitored. Direct instruction can occur in the form of additional tutoring within the 3D social space. There is a specific tutor zone where students and teachers can meet up and discuss real-time with voice, text, and gesture communication. The Lincoln Interactive teacher interacts both socially and in a content specific manner which according to Garrison et al. (2000) is necessary to ensure effective online learning.

9. Conclusions

Being a relatively new form of educational delivery, there is an urgent call for those who are utilizing 3D VLEs and VSEWs to collaborate and conduct research regarding their experiences and success for use in future program development. The creators of GEARS are constantly striving to improve the educational experience for students in the 3D VLE and VSEW. Eric Hardman, the Creative Director of GEARS states, “starting only with quality curriculum and a desire to develop social virtual experiences, we have worked directly with students and virtual classroom teachers to create something specifically tailored to online learning. Rather than a generic world, these are interrelated, purpose-built learning tools tuned to maximize engagement and generate rich social interactions.”

The pedagogical elements underlying 3D VLEs continue to expand, and as the practical use of 3D VLEs in education is critically evaluated, the need for current research will becoming increasingly important. The Lincoln Interactive online asynchronous courses appear to be a practical and advantageous match for integration with GEARS 3D VLEs. However, the ability to use the GEARS environment in traditional face-to-face classroom instruction is another area that NNDS is currently
expanding. As K-12 school districts look at the future of education and experiences that traditional classrooms will be unable to provide, 3D VLEs and VSEWs will be the likely choice.

The 3D VSEW is helping create a sense of community in the Lincoln Interactive asynchronous environment. Many of the arguments against online learning state that the social environment is significantly lacking. Since the launch of the VSEW students have been discussing courses, interests, and most of all making friends. Many online students were either not given the time or the ability to communicate with their fellow classmates. The VSEW is also providing teachers the ability to appear to students in ways other than text or a voice from computer speakers. A traditional brick and mortar school allows students to talk with their teachers before and after class and talk with friends between classes. This is a key feature in building a sense of community. The VSEW discussed in this paper is an initial attempt to provide this feature and give socialization a chance in an online asynchronous environment.

Keeping pace with technological advancements is an ongoing process with a 3D VLE and VSEW. As new technology emerges in the game design market, the need to upgrade current systems will become necessary. There are already advances in avatar creation, rendering capability, and the overall graphics. The original ARC 3D VLE has existed for three years and will soon be replaced or integrated into the new VSEW. Based on experience, a 3D environment needs updated every three years to stay current or ahead in the 3D VLE and VSEW market. As 3D VLEs become more popular as education environments, there will be significant improvements to 3D VLE technology. Effective use of the new 3D VLE technology to promote student learning should be the objective for all online education institutions.

References
Moving From Analogue to High Definition e-Tools to Support Empowering Social Learning Approaches

Paula Charbonneau-Gowdy\textsuperscript{1} and Ivana Cechova\textsuperscript{2}
\textsuperscript{1}The Canada School of Public Service, Government of Canada, Canada
\textsuperscript{2}University of Defence, Brno, Kounicova, Czech Republic
\texttt{paula.charbonneau-gowdy@cspsefpc.gc.ca}
\texttt{cechova.ivanain@unob.cz}

Abstract: Traditional educational and training settings have dictated that the act of learning is an activity that is motivated by learners, directed by a teacher expert and based on information transfer and data manipulation. In this scenario, it has been assumed that learners more or less acquire knowledge or develop sets of skills as a result of such activity. With this model in place, learning ends when the training activities cease - and implies that repeated doses of similar training are required over time. Various computer technologies, as they have been generally integrated into educational settings, have taken on the role as tools to support such a model. In some cases they are used to replace the teacher in these contexts although not without serious implications for learners and their learning it has been argued. During the last three decades, a growing movement in educational research, based on the theoretical support of Leon Vygotsky and Mikhail Bakhtin, is advocating that the traditional conceptualization of the learning process is misconceived. From the perspective of this movement, learning is understood as a life-long, social act of constructing knowledge in a dialogic activity with others. Within this model, social interaction is the precursor to higher order thinking rather than the reverse. The challenging question emerging for many educators is how new technologies can support knowledge and skill building in social constructivist-based learning settings. And a corollary to this question arises: Depending on the particular technology chosen, what are the implications for learning and identity construction? In this paper, we describe the Language Learning Through Conferencing project (LLTC) in which an affordable video-based web conferencing technology and desktop computers were used to conduct language learning sessions via the Internet. The project description, project content, and the experiences that took place over a sustained period, as well as the potential future for this approach to distance learning in a variety of fields are presented. The aim of the Language Learning Through Conferencing project (LLTC) has been to exploit a particular Web 2.0 technology to connect language learners internationally between Canada and new democracies in Central and Eastern Europe and more recently in the public sector in Canada. More specifically, the project was a means to respond to learners who faced challenges in finding opportunities for language learning both in Europe and in Canada. Outcomes from ongoing qualitative and quantitative findings gathered by the respective authors are indicating that these dialogic opportunities are also having a powerful influence on learners’ professional, linguistic and personal identities as well as their views of technology and learning.

Keywords: Video-based web conferencing, guided social learning, learner agency, identity and knowledge construction

1. Introduction

The buzz these days about High Definition (HD) television and its superiority over the old analogue rabbit-ear TVs that some of us grew up with, is leading to interesting analogies with computer technology as it relates to learning. Advocates of HD, and there are many, describe the qualities of this new technology in glowing terms. With HD they say, you feel “just as if you are there”. What does that mean, we ask? In the context of watching a Canadian (or Czech) hockey game on television, the answers the HD band wavers give can be summed up by three qualities of the transmission that are highlighted by this new technology. They talk about the \textit{clarity} of the faces of the players and the fans on the opposite side, of being able to read their emotions, see their lips well enough to understand comments the fans and players make. Advocates of HD talk about the depth and realism of the \textit{colours} of the uniforms the players are wearing, the MacDonald ads on the sides of the rink and the fabric of the announcer’s suits. They talk about the \textit{context} – the rink, the stands filled with fans and the flashing billboards, the cheers, all seem at one with the viewer who feels a part of the action although watching from a place so far away. Compare this HD experience with that of watching analogue TV with its fuzzy, black and white, or later somewhat distorted coloured image where the viewer is only privy to bits of action and is left feeling as an outsider looking in. \textit{Clarity}, \textit{colour} and \textit{context} are features that considerably improve the experience of watching a game; they are also vitally important to learning.
In formal learning settings over the past twenty years, computers have been traditionally used for information management and processing. In the field of second language education, for example, computers have often acted as receptacles for paper versions of programs filled with de-contextualized activities, dressed up with the odd image, video or audio clip. Interactivity is limited to learners’ clicks. Learners move from activity to activity, often forced to choose a ‘correct’ answer from a list in a set of multiple choice questions or faced with pages of written text to read and to respond to through questions pre-determined by IT and content specialists. These ‘learning’ experiences, like those offered by analogue television, are limited and limiting. They reduce learners to being outsiders deprived of the interpersonal activity which from a socio-cultural perspective is essential to learning. In these traditional-style spaces supported by technology, learners are passive receivers rather than active players. Their individual and unique interests and experiences are inconsequential to the learning.

Outside such formal learning sites, many individuals are no longer content just to have access to computers simply for information management and processing. Increasingly, individuals are drawn by the powerful and potential outcomes that result when computers help them to interconnect to organizations and others in the local and global community. Web 2.0 technologies such as blogs, chat rooms, and especially video and image sharing sites which place less emphasis on written text-based communication, are examples of the now commonplace and powerful ways of using computers to make human to human interconnectivity possible. And as Naomi Baron (2008) acknowledges these technologies are profoundly influencing the way we learn.

Not surprisingly, the use of computers for mediating communication is having an increasingly important impact on formal learning environments as well. Our work with video-based web conferencing we believe offers a compelling example of how technology allows such communication. With this HD-type synchronous tool, understanding among learners and teacher are enhanced with access to the nuances in the tones of the speech and the nonverbal cues such as gestures and facial expressions which are so lacking in other communication tools and yet important to understanding the messages we wish to convey. It is the quality of the exchange of this interpersonal information that, we argue, leads to the effective knowledge construction characteristic of social learning.

Video-based web conferencing technology is at the same time reconstructing what it means to teach and learn. With the enhanced qualities of the interactions supported by this technology, teachers in our studies are being drawn to adopt an interactive, communicative and non-teacher-directed approach. Learners, initially hesitant, are reacting to such opportunities for agency by negotiating more powerful subjectivities. The evidence that has been collected in the various contexts of our work over the last six years strongly suggests that learners do not only develop linguistically as well as more empowered identities when it comes to using the language. Learners in these groups also show clear signs of taking on a self-directed role in terms of their learning. The promotion of life-long learning is the goal of all effective learning situations. Thus with this encouraging evidence comes great hope for the potential and powerful outcomes of implementing affordable video-based web conferencing technology in a variety of learning contexts.

2. Language Learning Through Conferencing project

Language Learning Through Conferencing (LLTC) is a multinational project aimed at promoting communication with the support of a Web 2.0 web conferencing technology. The project began in 2001 in the context of a doctoral research project (Charbonneau-Gowdy, 2009) as a distance education program for English as a foreign language via the Internet. Groups of military in Eastern and Central Europe were connected with a teacher in Canada. Sustained interest in the original project has led to continuing the distance program and an on-going second doctoral project by the other author. The original project has also been expanded to include programs for learning French and English in a government context in Canada.

The program reported here took place from October 2007 to March 2008 and consisted of creating virtual classrooms for 2 groups in the Czech Republic and 4 groups in Canada. For all 6 groups, the teachers were located in Canada:

1) Czech Republic
   - A group of military students located at the Faculty of Economics and Management, University of Defence (UoD )in Brno, Czech Republic;
Paula Charbonneau-Gowdy and Ivana Cechova

- A group consisting of teaching personnel at the UoD; in Brno, Czech Republic;
- 2) Canada
  - Two groups of federal government employees learning French within the Prairies region
  - Two groups of federal government employees learning English in multiple locations in the Atlantic, Quebec and Ontario regions.

---

Figure 1: Videoconferencing classroom

ICIWave Design is the Canadian company that provided the communication service for the distance courses. The company, located in Quebec City, researched, developed and continues to develop specialized low-cost videoconferencing telecommunication services for this project. The audio and video “multi stream” technology allows individuals in multiple sites to connect over the Internet. Through this interface, real-time connections between Canada and the Czech Republic were made possible. The technology provides a controlled, yet easy access to the website. Users are equipped with headsets and web cameras. For the overseas connection, London England is a break point and at the same time a location for boosting the transmission of sound and picture thus ensuring a better quality video and audio reception than traditionally possible between North America and Europe. A North American server supports the Canadian transmission. The particular interface used in the project permitted up to ten people to be present at the website using individual screens (See Figure 1). Interactions between the teacher and participants were facilitated with special technical features such as shared desktop and whiteboard as well as small-group breakout rooms which ICIWave Design created for this particular application. ICIWave was also able to add a unique control mechanism that allowed some of the participants in remote areas of Canada with low bandwidth to be included in the distance learning. This feature was appealing to the Government of Canada for which the obligation to provide language training to its employees in all parts of the country is particularly challenging.

The participants in the language program between Europe and Canada consisted of eight to ten students located in the same room in the Czech Republic and an English language expert located in Canada. In the Canadian government context, participants in different locations were formed into groups of eight, each group connected to one of two teachers in Montreal for the inter-regional groups and one of two teachers in Winnipeg for the intra-regional groups. With this particular interface, each participant is able to view the other participants on the screen. There is one slightly larger screen for a teacher and a similar-sized one that is designated as the visitor’s screen. This screen is used for various English-speaking guests who come in from their diverse locations and who participate in the discussions. It is possible to show a picture on the screen (see Figure 2), to play a video, to have
students draw pictures, write text, to show charts and diagrams to students and to have learners move to small break-out rooms. With the exception of the break-out room scenario, learners are still able to see each other and the teacher even if the above mentioned activities are displayed on the screen. There is a chat space accessible to both teacher and students in the room which serves as a whiteboard for writing new words, phrases or giving written explanations.

Figure 2: Screen shot of group using picture sharing feature

The LLTC provides an on-line opportunity to practice primarily speaking and listening but also reading and writing through interacting in English and French. The approach to teaching is learner-centred, based as much as possible on the students’ real communication needs and interests.

The aim of the videoconferencing sessions is to expose the learners in the program to a large variety of topics for discussions in order to help these individuals become confident speakers in the target language in different situations, including and especially in occasions that arise in their own work. The language focus is on fluency rather than on accuracy, although teachers regularly draw attention to structural or vocabulary issues in context and as the need arises. Not only are the students encouraged to find the words and expressions they need with the help of other learners, they are also aware of keeping their listeners interested in what they have to say. Through this interactive process they develop ways to support other learners in the classroom even the most reserved and to create a space for their own voice. Importantly, there is strong evidence that this on-line interactivity leads to progress in their language learning.

In planning the content of the videoconferencing sessions for the Czech Republic, students and tutors collaborate in choosing various topics of relevance and interest to the participants' military, professional, cultural and individual lives. The materials used to spark conversations are chosen from a wide variety of authentic material. In the Canadian government context, in one site teachers use the materials included in the Speaking to Learn program, a discussion-based language maintenance program based on case studies of professional subject matter. In the other Canadian site, discussions were based on work and interest-related topics. For all groups, online Communities of Practise (CoP) learner sites were available to encourage writing-based information sharing and interaction among learners during periods between the web-conferencing sessions.

The fact that the LLTC is designed to be a learner-centred program where students have an agentive role in the knowledge producing activities is not without precedence. As Thorne and Black (2007) have observed, computer-mediated communication has the potential to transform what is often teacher-centred communication in traditional classroom settings into more multidirectional interaction.
in computer-mediated contexts. Indeed, the LLTC program is based as much as possible on the UoD students’ needs and interests, and in the Canadian context, on the professional experience of the government employees not on the instructor’s pre-planned agenda. Strong conviction derived from extensive study and our combined many years of experience in education suggests that this approach best prepares the military personnel for interoperability in the international contexts in which they serve and encourages important networking and professional development among employees in the Canadian government context. George Siemens (2008) observes that students “being a part of” (p.3) and belonging to the process of dialoguing, creating and exchanging knowledge, both locally and globally “is the framework that should drive our consideration of education” (p.3). We would add that this belonging to in formal education contexts is an essential ingredient to the kind of identity construction that leads to life-long learning.

3. Methodology

Both qualitative and quantitative research was conducted in this particular inquiry:

The qualitative data collected in the Canadian government sites took place between October 2007 and March 2008 using ethnographic methods - collaborative face-to-face and on-line dialogues with individuals and groups, teachers’ journals, observations of images and videotapes, written comments in a Communities of Practice (CoP) site, as well as field notes. The participants consisted of 32 federal government employees, male and female, representing a variety of professions and departments in the Prairie, Quebec, National Capital and Atlantic regions of Canada. The aim of this research approach was to permit the voices of the participants to emerge through the findings, believing that their voices could lead to a critical understanding of learning experiences involving technology and as a means of promoting change in theirs and potentially other learning contexts.

The quantitative data presented here was collected in the Czech Republic between October 2005 and March 2006. After an initial process to determine the research groups, the 88 participants, consisting of male and female military university students were divided into three groups. All three groups took part in pre and post standardized language tests which are official tests used in NATO military language programs. The tests measured listening, writing, reading and speaking skills. Statistical data from the test results were analyzed for significance. Individual interviews with participants were also conducted.

4. Language learning in the Canadian government context

Regardless of location, Canadians of both official languages, French and English, are guaranteed by government law to have the right to communicate in their first language when accessing government services. This language right places an enormous responsibility on government departments to ensure that a designated number of their employees are able to respond to this dual obligation to the public. Also, depending on the region in Canada, supervisors within the public service may be required to communicate with individual employees in the language of the employee’s choice. Many of the jobs in the Public Service are thus designated ‘bilingual imperative’. Those employees who are in ‘bilingual’ positions are rewarded financially for their status and at the same time are obligated to maintain their other official language. Many employees who are not in bilingual positions report feeling the pressure to improve their second language skills in order to be eligible for advancement into such positions. Added to this pressure is the regular language high-stakes testing that ensures that employees have maintained the level of proficiency over their years in service for their current positions or improved their levels for new positions. While regular classroom training courses are available in the larger centres in Canada to meet these requirements, the very nature of the geography of the country makes it costly and time-consuming for those civil servants in areas outside major centres to access maintenance and/or development training. Many report that they lose interest, become discouraged and apathetic or worse still, embittered over the loss of control over their careers. Feelings of being marginalized in their second language and reluctance to use the knowledge already possessed in the other language are typical reactions reported when opportunities for using the second language arise. These feelings run counter to the spirit of the law which seeks to inspire learning the other official language as a value rather than an obligation.

The LLTC project was set up in the Canadian context employing a participatory action research (PAR) approach to the inquiry to critically explore with the participants their experiences using computer technology for second language learning. We negotiated changes to their current perceptions of computer-assisted language learning (CALL) through the use of computer-mediated communication
(CMC). The on-line courses using the video-based web conferencing were conducted in the early morning twice a week for 1.5 hours per session for eight weeks. Learners were expected to go to the CoP sites for at least one hour between these online sessions to read case studies. The case studies, based on professional themes, are intended to spark discussions of the participants’ personal work experiences in the classrooms and to have these discussions continue in written dialogue with other participants between sessions at the CoP site.

5. Language training at the University of Defence

Language training at the University of Defence is carried out on both a full-time as well as an elective study basis. E-learning is an integral part of both forms of language study programs. In some ways, language training at UoD is based on a blended learning model along with other models such as skill driven learning (aimed at skill development), attitude learning (aimed at approach/attitude development) and competency driven learning (aimed at competency development). At present, ICT in the language training program is extended to include the Language Learning through Conferencing (LLTC) program.

When the process of incorporating Professional Language Programs (PLP) into the UoD curriculum began, student evaluations of the project were carried out. It was found that learning outcomes and student acceptance levels were very high. In 2005 we designed what was called the Pedagogical Experiment to find out if and how ICT contributes to the quality of the language training and communicative skills. The research was divided into three phases.

A group of 88 students took part in the experimental study. The study consisted of the following processes:
- Questionnaire
- Interviews
- Pedagogical Experiment (group building, entrance tests, final tests and their evaluation)

The questionnaire had 12 questions and the goal of its first part was to find out students’ preferences and needs while using ICT in the language classes. In this part of the research, 104 students participated. The students were asked to respond to questions such as:

**In my language learning, I want to:**
- use up-to-date technologies, the Internet, an in-house Study Portal and on-line sessions in language lessons and in my self-study.
- use ICT in my self-study.
- be taught in a classical way (without computer technology programs).

![Figure 3: The use of videoconferencing technologies in the language learning study](image-url)
Almost 80% of students prefer language lessons with the use of up-to-date technologies and 22% of students want to use ICT in their self-study (Figure 3).

The second section of the questionnaire was designed to ascertain from the responses of the student participants whether Web 2.0 web conferencing technology can enhance language skills, or influence the language training. Students were asked questions such as:

**Online sessions with web-conferencing technologies:**
- can influence my English training in a positive way
- can influence my English training in a positive way but only in a combination with classical lessons
- do not have any or have minimal influence on my English training.

![Figure 4: Web-conferencing technologies and language training](image)

More than 60% of students think that web-conferencing technologies in combination with a classical way of language training can influence English training in a positive way, while 25% of students think that using web-conferencing technologies alone can influence the language training.

The results of this phase of the research showed that UoD students prefer language lessons with the use of up-to-date technologies and that they feel positive about these technologies being implemented in their language training. They also support the positive role technologies play in helping them develop their communicative skills in the language training program.

The second phase of the research included a semi-structured interview to determine the students’ priorities and to assist the researcher to build groups:

- Group 1 – 27 students - using a classical approach to language learning without ICT;
- Group 2 – 32 students - using a language learning approach that includes ICT through access to an in-house Study Portal, materials from the Internet and web quests;
- Group 3 – 29 students - using a language learning approach that includes ICT through access to the in-house Study Portal, materials from the Internet, web quests AND complimented by online synchronous communication with Canada.

Each group took part in their respective language training programs during two semesters of sixty lessons. At the beginning of the academic year, all students were tested to find out their entrance level of English using the American Language Course Placement Test (ALCPT). On average, entrance scores for all three groups and for all skills were found to be similar with no significant differences among the three groups (Fig. 5).
At the end of the two semesters, the same students were retested using the STANAG 6001 test, a standardized NATO language testing tool, in order to compare all language skills (listening, speaking, reading and writing). The test results were evaluated by the statistics-based STUDENT TEST in EXCELL.

6. Findings in the Czech site

The outcomes of the research in the Czech site (Fig 4) acknowledge considerable benefits of video-based web conferencing technology in the educational process. These positive statistics add to the already significant qualitative data gathered in the Canadian context as well as in other research contexts during the larger study (Charbonneau-Gowdy, 2009). Importantly, these empirical data are supported by well-recognized theories that indicate that learning is by its very nature a socio-cultural activity (Vygotsky, 1978) and dialogue-dependent (Bakhtin, 1981) and that the learner-centred practices that were made possible by using the web conferencing technology had a powerful influence on the fact that participants’ identities changed (Weedon, 1997).

The test results from the STANAG 6001 evaluated by the statistics-based STUDENT TEST in EXCELL are the following:

**Reading:**

The results of final tests show that there are no statistically important differences among the three groups in reading. This is not to say that progress in reading competencies were not made but that at the end of the study period each of the groups were approximately equally capable in this skill.
Results on the listening test show significant statistical differences among groups in listening. We can confirm with a reliability of 95% that Group III performed better than Group II and Group III and Group II performed better than Group I in listening.

There were no statistically significant differences between Group I and Group II in speaking but we can confirm with reliability of 95% that the participants in Group III performed better than Group I and Group II in speaking.

Participants in Group III with ICT + online sessions performed better than participants in Group I with ICT and Group II with ICT.
The data indicated that there were no statistically significant differences between Group I and Group II in their writing performance on the tests. But with a reliability factor of 95%, the data indicated that Group III performed better than Group II in writing at the end of the 2 semesters. Students from Group III, those using a language learning approach that includes ICT through access to the in-house Study Portal, along with materials from the Internet, web quests AND complimented by online synchronous communication with Canada, had significantly better test results in listening, speaking, and writing, in comparison with the two other groups including those who just used ICT without the online sessions. If we sum up all skills, we can confirm with reliability of 95% that there are statistically significant differences between Group I and Group II, Group II and Group III and Group III and Group I which confirm the influence of web conferencing technology in the educational process.

Student reactions to this program gathered from the interview process are very positive. All PLPP participants were interviewed and their feedback was only positive. The following are some examples of students’ comments about their online experience:

“I take part in PLPP in order to practise listening and speaking skills. There I have to respond instantly. Though I know the topic of our conversation in advance and can read something concerning the topic beforehand, I am not prepared to answer every single question. That is very difficult, but I enjoy it. It is very useful, I mean, to react promptly, and then to write something about the lesson. Actually, it is like a real life conversation: action and reaction.” (Kamila, May 2005)

“This way of learning is much easier in comparison with the classical one; it is not so complicated and I have a feeling that I can understand things better.” (Zuzana, June 2005)

Kamila’s reaction to the advantages she has noticed while using the web conferencing technology for learning English are typical of those expressed by others in the Czech site. In this context, finding opportunities to use English in authentic situations where one is not sure what the questions will be in a conversation are quite limited. Despite the challenges that such opportunities present to her linguistically, she finds them enjoyable and obviously worthwhile. She, like others, knows intuitively that such opportunities prepare her for the real-life situations, most probably international military operations, where feeling prepared to interact in English will be vital.

Zuzana too speaks positively about her experiences using the web conferencing technology. Compared to more traditional approaches based on rule and structure formation predominant in her institution for teaching English, learning online through dialogue is less complicated and more pleasant. She is also aware of the cognitive advantages of her experience in the PLPP, the fact that she understands better, which is an indication of long-term retention of what is being learned.

7. Findings in the Canadian site

Strong quantitative evidence and positive satisfaction from learners in the Czech site were supported as well by the addition of qualitative findings that were collected in the Canadian context. The participants in the Canadian context reported changes to previously felt marginalized second language identities. For example, many participants reported in interviews that prior to the sessions they refused to use the other language for fears of making errors and thus feeling inadequate, experiencing a loss of face. By the end of the program, these same individuals expressed that they experienced a change in those feelings and in their identities. The following comments vividly illustrate the significant change in subjectivity that just one of the participants, Anne, a francophone learning English showed over the course of the program.

Early interview

“I have to make all my thoughts simple to be able to express [myself]. Then I don’t feel intelligent….In French, I feel I am intelligent but not in English. I am afraid the [others] are going to think I am stupid. They will ask themselves – “How did she get that job?” (Anne, interview February, 2008)

Later interview

“Something happened to me during that course. Now I can speak on phone without problems. I feel confident.” (Anne, interview, April 28, 2008).
The dynamic change in Anne’s second language subjectivity in relation to speakers of the other language from fearful at being considered “stupid” and ill-chosen for her position to being a second language user of confidence who is proactive in the other language is powerful evidence of the influence that these sessions had on her learning and identity. Anne’s decision to communicate only in English, rather than the usual French, with her English-speaking supervisor rather than the customary French is not only a another sign of her changed in SL identity but of the self-directedness that is characteristic of a life-long learner. Her comments and decision-making at the end of the program are repeated again and again by many other participants in the web conferencing sessions.

Another powerful example of the changes that took place to participants in the Canadian context is shown in the following video-clip. In this clip, Denis speaks about his experiences learning English using the web conferencing technology:

http://www.youtube.com/watch?v=hrnwN1G3S4o&feature=channel_page

We hear in Denis’ words what he witnessed not only in terms of changes to his language learning in the course of the on-line sessions but to his second-language identity as well. He speaks vividly of his experience at the end of the sessions when he was faced with negotiating his professional opinion in a meeting in his second official language in a head office context where the balance of power would normally have left him silent. He realizes that the on-line sessions and the learning approaches that were involved in those sessions were responsible not only for the linguistic skills he had acquired over the course of the study but also for the changes to his identity that supported and empowered him in persisting to pursue his point of view.

Learners were not alone in noticing changes as a result of the on-line sessions. Some of the teachers expressed they too felt changes to their own language teaching identities and importantly to their teaching practices. Lori, one of the Montreal teachers who taught a group of participants in Quebec and the Atlantic Regions expressed these changes in her words:

“I find I don’t do as much from my lesson plans as I would do in a traditional classroom. I think the teacher on the web conferencing must be ever more flexible and patient than they need to be in a traditional class ….it’s easier to leave the floor for the students and for me to speak less.”

(Lori, Journal notes, February 2008)

For Lori, the on-line sessions offered her little choice but to let the students in her group take charge of the discussions. Her teacher-directed ways were forced to be put aside and her role took on a more facilitator approach. It is this kind of teaching approach that is being shown elsewhere in the literature to be most conducive to self-directed learning, the highest form of learning. Such teaching practices have also been shown to lead to learners constructing more powerful identities – the kind of identities that have implications for life-long learning.

Some teachers in the study expressed less favourable experiences during the on-line sessions. Data findings indicated that less comfort with the technology and a reluctance to encourage a learner-centred approach had implications for learner involvement in the discussions. In these cases, the evidence of learners’ linguistic and identity changes were less dramatic. These findings have important implications for the powerful role that teachers and their approaches play in learning, no matter what the context, traditional or involving technology.

It is also interesting to note that activity on the interactive writing-based CoP site, where participants were to interact in writing between sessions was generally quite limited. The CoP activities the participants did do consisted almost exclusively in collecting material for the classroom discussions. Indeed, this general lack of engagement at the CoP site occurred despite teachers’ strong encouragement of learners and their awareness of the positive implications of writing in the second language as a means to error correction and developing speaking skills. Disappointingly, learners reported that using valuable time to compose comments in such a public space was too overwhelming a task. While a few participants did post a comment or two initially on the site, they reported that due to receiving no response from others that even their interest quickly waned. It appears that the lack of commitment and basis for relationship building that this particular writing-based Web 2.0 technology offered to this group of learners held little enticement to interact. Baron (2008) predicts the demise of some technologies in her comment: “Like language, technology does not remain static. At the same
time, just as certain components of language hang around for centuries while others come and go, we can anticipate that some - but not all - electronic language media will have staying power.” (p.233-234). Baron is not alone in her predictions. Recent reports, even on relatively new Web 2.0 technologies such as blogs and wikis, especially those that are entirely writing-based, are already showing dips in usage among younger generations.

Baron quotes Diane Rehm, the celebrated host of National Public Radio in America saying in a May 2007 university commencement address:

“In this day and age of email, voicemail, office memos and text messaging, we hardly ever hear each other in real time anymore, much less listen to each other. In fact, I think many of us have forgotten how to listen.” (Baron, p.230) We believe that it is by interacting and listening to one another that we have the greatest potential to gain knowledge, about ourselves and others.

8. Implications

The research results that are briefly reviewed here strongly support the fact that the shift to Web 2.0 technologies in educational institutions is having serious impact on learning and teaching approaches and results (Warschauer, & Grimes, 2007). Just as the comparison of analogue versus HD television suggests, however, not all technologies, including here some Web 2.0 technologies offer the full range of features that lead to the richness of live face-to-face interactions. Both quantitative and qualitative assessments of the participants’ experiences using web conferencing technology provide convincing evidence to suggest the powerful implications that such technology has on enriching interactions. One caveat to these positive results however, is that the technology alone can not bring about the dramatic results that are reported here. An openness to accept the approaches that this technology supports is intricately entwined in these favourable results.

The evidence also indicates that both learner and teacher participants witnessed and for the most part were able to take advantage of the empowering possibilities that the use of the technology offered for their agency. This recognition led to changes in the ways that some of the participants used and viewed the technology for learning. The data also clearly showed that there was strong evidence that many of the participants experienced changes to their linguistic capabilities as well. More research is needed in a variety of learning contexts to substantiate these results. Our hope is that the present evidence along with further support from a wide spectrum of applications in learning sites could lead to a greater engagement on the part of those involved in education to critically examine their practices and technologies. With the increasing speed at which new computer technologies are evolving, the authors argue that there is an urgent need on the part of all those preoccupied with learning to ensure that the technologies that are being chosen can support effective and efficient learning approaches and are providing empowering opportunities for learners’ identities, in other words fertile ground for self-directed learners.

9. Conclusion

With the arrival of Web 2.0 technologies into informal and formal learning contexts, a new virtual space or what Lefebvre (1991) calls a third space is opening up that is redefining where, when, why and what kind of learning takes place and the influence that learning is having on learners’ agency and ultimately their identities. It is in this third space that we see hope for individuals to connect and construct knowledge in ways that even traditional contexts have not always allowed.

The ongoing studies being conducted by the authors using video-based web conferencing technology are showing strong support that this particular technology can provide a context for effective and efficient learning. The changes in the identities of some participants in becoming more empowered and self-directed are crucial factors that also surfaced in the findings. Many of the participants who used the video-based web conferencing technology for learning were able to evaluate themselves, their learning progress and to focus and benefit from their success. This is an important factor for the participants who in this case were learning another language. The value of having the chance to develop second-language identities that led to many of the participants being able to use their knowledge and add to it when learning opportunities did present themselves should not be underestimated. In other words, for this group of participants, a more enriched use of computer technology for audio-video-based communication, the kind that provides the clarity, colour and
context of live interactions, led to empowering conversations and self-directed learning – a vital ingredient of life-long learning.

Acknowledgements

We wish to acknowledge the Government of Canada (the Canada School of Public Service), and the University of Defence, Brno, Czech Republic for their generous encouragement and support for our research as reported here. The opinions expressed herein however, are those of the authors and do not necessarily reflect those of the supporting institutions.

References

Efficacy of Teaching Clinical Clerks and Residents how to Fill out the Form 1 of the Mental Health Act Using an e-Learning Module

Sarah Garside, Anthony Levinson, Sophie Kuziora, Michael Bay and Geoffrey Norman
McMaster University, Hamilton, Ontario, Canada
garsides@mcmaster.ca
levinson@mcmaster.ca
sophie.kuziora@learnlink.mcmaster.ca
baylaw@sympatico.ca
norman@mcmaster.ca

Abstract: Background: Every physician in Ontario needs to know how to fill out a Form 1 in order to legally hold a person against their will for a psychiatric assessment. These forms are frequently inaccurately filled out, which could constitute wrongful confinement and, in extreme circumstances, could lead to fines as large as $25,000. Training people to fill out a Form 1 accurately is a large task, and e-learning (Internet-based training) provides a potentially efficient model for health human resources training on the Form 1. Objective: In this study, we looked at the efficacy of an e-learning module on the Form 1 by comparing baseline knowledge and skills with posttest performance. Methods: 7 medical students and 15 resident physicians were recruited for this study from within an academic health sciences setting in Hamilton, Ontario, Canada (McMaster University). The intervention took place over one hour in an educational computing lab and included a pretest (with tests of factual knowledge, clinical reasoning, and demonstration of skill filling out a Form 1), the e-learning module intervention, and a posttest. The primary outcome was the change between pre- and posttest performance. A scoring system for grading the accuracy of the Form 1 was developed and two blinded raters marked forms independently. Participants were randomly assigned to one of two sequences of assessments (A then B vs B then A), with a balanced design determining which test the participants received as either the pretest or posttest. Inter-rater reliability was determined using the Intraclass Correlation. Repeated measures analysis of variance was conducted. Results: The Intraclass Correlation (ICC) as the measure for inter-rater reliability was 0.98. For all outcome measures of knowledge, clinical reasoning, and skill at filling out the Form 1 there was a statistically significant improvement between pretest and posttest performance (knowledge, F(1,21) 54.5, p<0.001; clinical reasoning, F(1,21) 9.39, p=0.006; Form 1 skill, F(1,21) 15.7, p=0.001). Further analysis showed no significant differences or interactions with other variables such as between raters, the order of assessment, or trainee type. Conclusions: Under laboratory conditions, this e-learning module demonstrated substantial efficacy for training medical students and residents on the theory and practice of filling out the Form 1 of the Mental Health Act. E-learning may prove to be an efficient and cost-effective medium for training physicians on this important medico-legal aspect of care. Further research is required to look at the longer-term impact of training and broader implementation strategies across the province for medical trainees and practicing physicians.

Keywords: medicine, skills, training, healthcare, education, psychiatry

1. Background

Every physician in the province of Ontario, Canada needs to know how to complete a Form 1 of the provincial Mental Health Act in order to legally hold a person against their will for a psychiatric assessment. Despite the medico-legal importance, medical students, residents and physicians in practice receive very little or no formal training in how to perform this task. These forms are frequently inaccurately filled out, which could constitute wrongful confinement and, in extreme circumstances, could lead to fines as large as $25,000. In our academic teaching hospital, an audit of Form 1’s from the Emergency Department, Internal Medicine and Surgical wards revealed that over 50% of the Form 1’s were filled out incorrectly (Levinson and Garside, unpublished data).

To date, there is very little formal curriculum for undergraduate and postgraduate medical trainees in the content area of mental health law: as well as very few continuing medical education opportunities. This is striking given that several areas of the Objectives of the Medical Council of Canada (MCC) outline the importance of these topics (Medical Council of Canada 2009), and many of the other core MCC objectives reference these concepts. The increase in the aging population and high prevalence of hospitalized patients with dementia or delirium argues for the importance of training in mental health law issues.

ISSN 1479-4403
Reference this paper as:
Few published studies have examined gaps in physician performance or curriculum in this area, but those studies that have been done point to significant learning needs. A survey of Canadian emergency medicine residents identified learning needs in consent and capacity assessment (Pauls 2006). A survey of US emergency medicine residents identified training in informed consent for procedures as an important need (Gaeta 2007). Studies in the UK have also revealed significant deficits in physician knowledge in mental health legal domains such as consent and capacity (Jackson and Warner 2002; Schofield 2005; Evans 2007). Clearly many of these important issues are rarely addressed in training programs, a fact that is highlighted by the pretest performance of postgraduate participants in the study.

Training all physicians how to complete a legally valid Form 1 is a very large task. First, there are a lot of physicians and medical trainees in Ontario that require training: 23,266 fully licensed doctors; 5,185 postgraduate trainees/residents; and 3,245 medical students (OPHRDC 2008). Other elements that complicate the training: some physicians fill out Form 1’s relatively frequently (psychiatrists, physicians who work in emergency department settings), vs. some who are only required to fill out the Form infrequently. The Form itself is not that onerous – it is 3 pages long; and the associated Form 42 that must be provided to the patient in some circumstances is only 2 pages. However, the Form is not that intuitively designed and little-to-no time is devoted in training programs to this skill.

E-learning (Internet-based training) provides a potentially effective, standardized, and cost efficient model for health human resources training. A recent meta-analysis and systematic review by Cook et al showed large effect sizes for Internet-based instruction with health professions’ learners (Cook 2008). However, most of the studies in that comprehensive review looked only at knowledge outcomes, with very few reporting a skills outcomes. Cook et al found 16 of 130 studies (12.3%) comparing an e-learning intervention vs no intervention that reported a skills outcome, with a large pooled effect size of 0.85.

There have been no studies to date that have examined the use of an e-learning module to teach physicians how to accurately complete the Form 1. We hypothesized that an e-learning module would be an effective method to train physicians in this skill.

2. Objectives
The objective of this study is to examine the efficacy of an e-learning module on the principles and practice of filling out the Form 1 of the Ontario Mental Health Act by comparing baseline knowledge and skills with posttest performance.

3. Methods

3.1 Design
The study was a prospective pretest/posttest design, balanced with respect to assessment order (see below), and the experiment was conducted in a single sitting. The total study time was approximately 1 hour.

3.2 Setting
All participants performed the experiment in either a 25-station computer laboratory within our academic health science centre’s computer services unit or Internet-enabled classroom settings within the university. In both settings there was a study supervisor (author SK) whose interaction with the subjects was scripted through a pre-written protocol. Workstations in the educational computing lab were personal computers running the Windows XP operating system; in the Division of e-Learning participants used either a Windows PC desktop or laptop. Several sessions were conducted with different numbers of participants from the eligible cohorts from April-July 2007. Study sessions were proctored to ensure no additional communication between study participants until completion of the posttest.

3.3 Participants
All final year undergraduate medical students (clinical clerks, year 3 in the McMaster program) and residents from psychiatry, emergency medicine, internal medicine and surgery were eligible to participate. Recruitment efforts using email and poster advertisements were targeted among clinical
clerks during their psychiatry, emergency medicine and family medicine rotations; recruitment among residents focused on psychiatry, emergency medicine, surgery, and internal medicine residents. We excluded any participants who had previous exposure to the training module. The Michael G DeGroote School of Medicine within the Faculty of Health Sciences at McMaster University in Hamilton, Ontario, Canada has approximately 140 clinical clerks out of a total undergraduate medical school class of 420 students; and a postgraduate medicine program of approximately 1500 residents across all programs. Based on the fact that most pretest/posttest no intervention control studies show very large effect sizes of approximately 1.0, we calculated a sample size of 20 participants using the simple formula of $16/effect\ size^2$, using an estimated effect size of 0.9.

3.4 Intervention

The e-learning module was designed to provide physicians and medical trainees with a review of the legislation and the methods that are used to bring a person to hospital against their will in Ontario. In addition, key aspects of completing the Form 1 of the Mental Health Act were reviewed in detail, including the examination, criteria for dangerousness, concept of mental disorder, time-sensitive issues, and invalid Form 1’s. An example of the Form can be accessed through the province of Ontario’s Ministry of Health and Long-Term Care (MOHLTC) website at http://www.health.gov.on.ca/english/public/forms/form_menus/mental_fm.html. The educational module was designed and developed by two psychiatrists with knowledge and experience in using and teaching about the Form 1 (SG and AJL), and a lawyer with expertise in mental health law (MB). The Instructional Systems Development process was used as an instructional design framework, including previous formative evaluation methods such as additional subject matter expert review, one-to-one feedback and field trials with medical students and residents (Dick 2005). The module followed best practices with regard to multimedia learning using multimedia where appropriate, worked examples, and practice cases (Clark and Mayer 2007; Mayer 2001).

The module was designed to take between 30 and 45 minutes and contained the following contents:

- Introduction
- Associated resources (linking to the PDF of the relevant forms)
- Objectives
- Overview: how can a person be taken to a hospital in Ontario?
- Key points/concepts related to the Form 1
- Guided tour of proper completion of the Form 1 (multimedia, narrated Flash animation allowing the learner to have both a ‘guided tour’ or a ‘click and reveal’ self-directed exploration of the Form 1 with comments
- Worked example of a properly completed Form 1 based on a written case study
- Common errors on the Form 1, multimedia asset highlighting errors on the Form 1
- Summary of common errors review
- 8 practice cases using questions (either single- or multiple-select questions, with a clinical stem and 5 response options) with immediate expert feedback provided for each question
- Acknowledgements.

The module was created using eXtensible Markup Language (XML) and output for HTML using XSL transformation. The output format was compatible with the international SCORM e-learning standard (Advanced Distributed Learning 2009). The module was hosted on our Division of e-Learning server, and compatible with Internet Explorer and Firefox browsers on Windows, as well as Firefox and Safari on the MacOS.

3.5 Measurement

Two different assessments were created, Assessments A and B. Each assessment had 5 multiple choice questions to assess knowledge (e.g. factual questions regarding mental health law procedures); 5 multiple choice questions to assess clinical reasoning using clinical scenarios and asking participants to identify specific indicators/criteria that would suggest appropriateness of using the Form 1; and 1 clinical scenario that the participant would use as the basis for filling out a Form 1. There were no overlapping items between Assessments A and B. Participants were randomized to
the order of assessments in a balanced design such that half of the participants received Assessment A as the pretest (with Assessment B as the posttest), and half received Assessment B as the pretest (with Assessment A as the posttest). All multiple choice questions in the assessment of knowledge and clinical reasoning were worth 1 point each. For multiple-select questions with more than one correct response, the following marking criteria were used: each question was worth 1 point; if the participant did not follow directions in terms of choosing too many answers (when a single correct response was indicated), then it was scored as a zero. If there were three possible answers, selecting all three correct answers was scored as 1 point; selecting two of three correct answers was scored as 0.667 points; and selecting one of three correct answers was scored as 0.333 points.

Two raters (SG and AJL), both psychiatrists with extensive experience reviewing Form 1’s created a scoring method for the Form 1, breaking down the various elements of the form into regions, each region being worth 1 point if filled out accurately. A correctly filled out Form 1 was scored out of a maximum of 12 points. Sample forms were marked blinded for reviewer calibration. The Intraclass Correlation (ICC) as the measure for inter-rater reliability was 0.98. In total, the maximum number of points for the assessment of knowledge was 5; the maximum score for the assessment of clinical reasoning was 5; and the maximum for the Form 1 was 12 points. All assessments were completed on paper, with subsequent data entry by a research assistant blinded to participant information and study hypothesis. The primary outcomes of interest were the change between pre- and posttest performance on tests of knowledge, clinical reasoning and ability to accurately fill out the Form 1 of the Mental Health Act based on a written scenario.

3.6 Data analysis

All data were anonymised and coded, and transferred into SPSS (version 17 for MacOS) for statistical analysis. Inter-rater reliability was determined using the Intraclass Correlation. Repeated measures analysis of variance (ANOVA) was conducted with two within-subjects measures each with 2 levels (pretest vs posttest and rater 1 vs rater 2), and two between-subjects factors of trainee type with 3 levels (medical student vs non-psychiatry resident vs psychiatry resident) and the specific order of the assessment test performed with 2 levels: (assessment order A/B vs assessment order B/A). We elected to include trainee type as a factor in the ANOVA as we hypothesised that psychiatry residents might have more experience and training in how to fill out the Form 1.

3.7 Ethics

Approval was obtained from both hospital and university research ethics boards, and all participants provided written informed consent. Identifying information was collected but kept separately from assessment data, and subject participation was voluntary. There were no course credits or evaluations related to participation.

4. Results

7 undergraduate medical students (clinical clerks) and 15 postgraduate resident physicians (n=22 total) were recruited and enrolled in the study, and complete follow-up data were recorded for all participants. Of the 15 residents, 5 were recruited from psychiatry, 1 from emergency medicine, 1 from surgery, and 8 from internal medicine. For all outcome measures of knowledge, clinical reasoning, and skill at filling out the Form 1 there was a statistically significant improvement between pretest and posttest performance (knowledge, F(1,21) = 54.5, p<0.001; clinical reasoning, F(1,21) = 9.39, p=0.006; Form 1, F(1,21) = 15.7, p=0.001). Further analysis showed no significant differences or interactions with other variables such as between raters, the order of assessment, or trainee type. See Table 1 and Figure 1 for details.

Table 1: Pretest vs posttest results for each assessment measure

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pretest mean (SE)</th>
<th>Pretest 95% Confidence Interval</th>
<th>Posttest mean (SE)</th>
<th>Posttest 95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge (out of 5)</td>
<td>3.0 (.269)</td>
<td>2.4-3.6</td>
<td>4.6 (.140)</td>
<td>4.3-4.9</td>
</tr>
<tr>
<td>Clinical reasoning (out of 5)</td>
<td>3.3 (.234)</td>
<td>2.9-3.8</td>
<td>4.1 (.204)</td>
<td>3.7-4.6</td>
</tr>
<tr>
<td>Form 1 (out of 12)</td>
<td>9.4 (.416)</td>
<td>8.5-10.3</td>
<td>11.2 (.336)</td>
<td>10.4-11.9</td>
</tr>
</tbody>
</table>
Figure 1: Pretest vs posttest scores for each outcome of knowledge (out of 5), clinical reasoning (out of 5), and filling out the Form 1 (out of 12). Error bars represent standard error of the mean. For all outcome measures there was a statistically significant improvement between pretest and posttest performance. ** p<0.01; *** p< or =0.001

5. Discussion

In this study, we looked at the efficacy of an e-learning module to teach physicians how to complete a Form 1, by comparing baseline knowledge and skills with posttest performance. For all outcome measures of knowledge, clinical reasoning, and skill at filling out the Form 1 there was a statistically significant improvement between pretest and posttest performance following a 45-minute online educational intervention.

5.1 Limitations

Our study has several limitations. First, it was an efficacy study under laboratory conditions; it is unclear whether effectiveness would be the same under less controlled conditions, where there is often attrition in online training programs (Clark and Mayer 2007). Second, there was only an immediate posttest, with no delayed posttest to assess far transfer of skills beyond the hour of the study. Third, there was no attempt to evaluate whether or not the learning could be applied in the real-world clinical setting. Fourth, there was only one Form 1 graded for each assessment, with slightly different scenarios (a community-based scenario vs hospital-based scenario), whereas it might have been better to have had additional Form 1’s assessed. Fifth, pretest/posttest studies typically show large effect sizes, as we saw in our study. These limitations taken into consideration, our study proving efficacy under tightly-controlled conditions is still a valuable pre-requisite before conducting additional effectiveness and quality assurance experiments.

5.2 e-Learning for skills training

In a recent meta-analysis and systematic review, Cook et al analysed both e-learning vs no-intervention controls, as well as e-learning vs alternate instructional media. No intervention control studies looking at skills outcomes (n=16) showed a pooled effect size of 0.85, but there was large inconsistency across trials (Cook 2008). Interventions with practice exercises showed a significantly higher effect size, but other instructional design variables such as interactivity, repetition, or having an associated discussion component were not shown to affect outcomes. Half of the studies used a posttest only design, with only 3 of the 16 studies using a single-group pretest-posttest design as we used in our study. 11 of the studies had a similar participant pool of either medical students or physicians. In the meta-analysis of studies using e-learning compared with non-Internet interventions, only 12 studies reported skills outcomes. The pooled effect size for these studies was only 0.09, indicating only a small effect for the use of the Internet as the training medium vs alternate instructional media.
Our intervention had practice exercises for the clinical reasoning cases, but not for the skills outcome of filling out the Form 1. However, there were several worked examples demonstrating how to fill out the form and the improvement in outcome is consistent with a body of literature that suggests that worked examples can be as effective as practice exercises for training learners with low prior knowledge (Clark and Mayer 2007; Clark 2008; Clark 2003). Moreover, worked examples are often easier to create for the program developer, and they can be more time efficient for the learner. We employed best practices in the instructional design of the e-learning intervention, consonant with the key evidence-based principles of multimedia learning (Mayer 2001; Clark and Mayer 2007). However, we did not conduct a ‘within-media’ comparison of alternate instructional designs in this study, as in some of our previous work (Levinson 2007). In a systematic review and meta-analysis of instructional design variations within Internet-based learning, Cook et al found modest effect sizes for the use of the instructional design elements of high interactivity, practice exercises, feedback and repetition on improving learning outcomes (Cook 2009). However, only 3 of the 52 studies reviewed reported on a skills outcome. It is possible that we might have been able to achieve even greater efficacy with an alternate design (e.g. more practice exercises). In future experiments, we plan to explore the use of performance support or job aids to help physicians fill out the Form 1 in the workplace setting. Given the legal importance of the Form – but the infrequency for some physicians of completing the task – a job aid at point-of-care may prove to be more effective and pragmatic than educational modules (Rossett and Schafer 2007). Assessment of long-term retention of the skills will also be of interest. We hope to conduct additional evaluation and Quality Improvement protocols looking at a modified Kirkpatrick ‘Four Levels’ (Kirkpatrick and Kirkpatrick 2006) to better measure physician behaviour change and return-on-investment of the training.

5.3 Conclusions

Despite these issues and limitations we have developed a highly efficacious and relatively efficient intervention in a medium (e-learning) that can be easily disseminated to trainees and physicians across the province of Ontario (or modified for other jurisdictions) in an under-represented and important topic. Under laboratory conditions, this e-learning module demonstrated substantial efficacy for training medical students and residents on the theory and practice of accurately completing the Form 1 of the Mental Health Act. E-learning may prove to be an efficient and cost-effective medium for training of physicians on this important medico-legal aspect of care. Further research is required to look at longer-term impact of training and broader implementation strategies across the province for medical trainees and practicing physicians.

Acknowledgements and disclosure

Dr. Levinson is supported in part through the John R. Evans Chair in Health Sciences Educational Research and Instructional Development. The authors thank Janine Duff and Lisa Colizza from the Division of e-Learning Innovation, McMaster University for assistance with data entry, analysis planning and execution. These individuals received compensation as part of their regular employment. There were no relevant conflicts of interest.

References

Blended Learning in the Visual Communications Classroom: Student Reflections on a Multimedia Course

Jennifer George-Palilonis¹ and Vincent Filak²
¹Ball State University, Muncie, USA
²University of Wisconsin-Oshkosh, USA
jageorge2@bsu.edu
filakv@uwosh.edu

Abstract: Advances in digital technology and a rapidly evolving media landscape continue to dramatically change teaching and learning. Among these changes is the emergence of multimedia teaching and learning tools, online degree programs, and hybrid classes that blend traditional and digital content delivery. At the same time, visual communication programs that are traditionally print-centric have had to make room for Web design and multimedia storytelling courses, as well as technical skills development. To add parsimony to these two areas of study, we chronicle how a blended model has been introduced in a required, 100-level visual communication course through a longitudinal study that followed 174 students through two versions of the same course, one that used blended learning strategies and one that participated in a more traditional method of course delivery. In combining an analysis of statements made by the participants in weekly journals (n=13,552) and the data gathered through a survey (n=174), we compared reactions between the two groups. Additionally, qualitative data from the journals was used to fully explicate the reactions students had to the course. This study sheds light on the effectiveness of a blended model in the context of students’ enjoyment, engagement, and perceived learning outcomes. The results revealed that the blended model was in no way different from the traditional course in terms of engagement and attachment. Journal data revealed students in the blended sections were significantly less negative about the course material, personal achievement, technology, and their emotional reactions than their traditional counterparts. Additionally, statements made by students regarding the issue of fear of the course and problems regarding technology substantially faded over the 15-week semester. Our overall findings indicate that students are able to adapt well to the technology and processes that make blended learning different from traditional classroom learning. Implications for pedagogy and future research are discussed.

Keywords: blended learning, visual communication, multimedia teaching and learning

1. Introduction

“Someday, in the distant future, our grandchildren's grandchildren will develop a new equivalent of our classrooms. They will spend many hours in front of boxes with fires glowing within. May they have the wisdom to know the difference between light and knowledge.” – Plato

The depth of Plato's 2,000-year-old insight is profound if not incredibly eerie. Indeed, advances in digital technology and a rapidly evolving media landscape consistently change the ways we approach teaching and learning. Among these changes is the emergence of multimedia as a pedagogical concept, online degree programs, and hybrid courses that blend traditional methods with new technology. As educators attempt to combine new methods with widely available technologies, an opportunity arises to study blended course models.

At the same time, visual communication curricula are bursting at the seams. Programs that were once predominantly print-centric have also had to make room for Web design and multimedia courses, as well as more software training and other technical skills development. Likewise, the potential for animation and interactivity brought about by digital media constantly changes design. To make matters more complex, none of these “new” approaches replaces the old. Rather, we strive to maintain the integrity of our foundations in print while adding courses in new media.

This research was predicated on the notion that a blended learning model might provide visual communication educators with an effective method for addressing some of the concerns noted above. To test this notion, a blended model was developed for a required, 100-level visual communication course for journalism and broadcast news students at a Midwest university. Subsequently, a longitudinal study followed 174 students through two different iterations of the course, one blended and one traditional. Although the complete research measures the blended course’s effectiveness from a number of different perspectives including, how different types of learners (visual, verbal, and...
kinesthetic) responded to the blended model and how learning outcomes were affected by both versions of the course, in the interests of focus and length, this paper directly addresses students' enjoyment of and engagement with the course, as well as their perceptions of the learning experience.

2. Literature review

Research on blended learning has noted many positive results. Studies have found that adult learners prefer blended course designs because they offer opportunities for personalization, self-direction, variety, and learning communities (Ausburn, 2004) and that student engagement and satisfaction in a blended course was higher than in previous, traditional versions of the same course (Cooner, 2005).

Many universities have begun to offer courses with some degree of digital learning for a number of important reasons. First, online technologies offer a consumer-centric approach to delivery (Larkin & Belson, 2005) that gives students greater control over the learning experience. Second, digital learning and online technologies can create highly simulative and rich interactive experiences for students. Third, online dissemination can broaden and increase student audiences (Fearing & Riley, 2005). As educators, researchers and policymakers press for updated learning models to migrate from a 1950s approach to education, electronic learning is gaining support as one viable way to meet the needs of a changing and complex world (McCombs & Vakili, 2005).

An increasing number of educators are also experimenting with “innovative technology-mediated” approaches to teaching, dramatically changing the ways students interact with course content (West & Graham, 2005). This relatively common adoption of digital learning technologies has increased the integration of multimedia teaching and learning tools into the traditional, face-to-face classroom setting (Bonk, Graham, Cross & Moore; 2005). This “blended” or “hybrid” (Young, 2002) approach to content delivery has experienced widespread growth in secondary and higher education. In 2003, the American Society for Training and Development listed blended learning among the top ten trends to emerge in education (Rooney, 2003).

By 2004, 2,000 of the 6,000 courses offered by Brigham Young University were using Blackboard as the primary delivery platform for online content (Graham & Robinson, 2005). Graham and Robinson discovered that although the prevalence of blended learning was increasing at breakneck speed on BYU’s campus, most blended environments were enhancing pedagogy as opposed to transforming the ways teaching and learning occur. “For there to be greater adoption of transforming blends among faculty, we believe that there needs to be a greater focus on developing cases and models that can help faculty to see what the possibilities are and how to achieve those possibilities within the resource constraints of their institutions” (Graham & Robinson, 2005: 108).

Other noteworthy studies related to pedagogical issues associated with blended learning have shown that blended learning increases active learning strategies among students (Collis, Bruijstens, & van der Veen, 2003). Likewise Danchak and Huguet (2004: 209), assert that the process of ‘choosing what to present is as important as how it is presented.’ They add, “Since students learn in different ways, we must provide multiple learning activities from which the learner can choose.”

A number of studies have targeted specific blended learning strategies to examine their individual strengths and weaknesses. Heinze and Procter (2006) found that discussion boards present an equal number of challenges (too much communication, frequency of off-topic discussions, and general lack of initiation of communication) as benefits (study help, increased social interaction, and the development of a student community). Peer-to-peer learning strategies (Hartman, Dziuban, & Moskal, 1999), as well as learner-centered strategies (Morgan, 2002; Smelser, 2002) have also been primary areas of interest. Some researchers are even experimenting with short message service (SMS) technologies as a way to integrate text messaging and mobile phone use as a blended learning strategy (Randall, Seet, Lim, & Elangovan 2006).

Several studies have also been conducted to explore learning outcomes as they relate to different blended methods. Hughes (2007) asserts that blending online learning with targeted classroom sessions can improve retention and identify “at risk” learners, particularly in largely online programs. Garrison and Kanuka (2004: 97) assert, “the real test of blended learning is the effective integration of the two main components (face-to-face and Internet technology) such that we are not just adding on to the existing dominant approach or method.”
Jennifer George-Palilonis and Vincent Filak

Osguthorpe and Graham (2003) identify a number of strengths and weaknesses of traditional face-to-face instruction and predominantly online course models. They note that in addition to the general absence of time flexibility, traditional models often fall short of addressing the many learning styles represented by the students in the room. On the other hand, online courses often create isolated learning environments for students, which can reduce individual motivation. However, in spite of the push and pull of benefits and challenges associated with each discreet method, “the important consideration is to ensure that the blend involves the strengths of each type of learning environment and none of the weaknesses” (Osguthorpe & Graham, 2003: 228).

In 2001 the U.S. Department of Education reported 83 percent of university instructors used the traditional lecture as a primary teaching method, yet many are beginning to experiment with multimedia tools. Duke and Purdue, for example, offer hundreds of podcast courses, allowing students to download lectures to MP3 players. Scholars at these institutions have argued this allows students to combat boredom, learn at their own pace, and go back through troubling portions of a lecture (Andreatta, 2006). And ultimately, the biggest proponents of blended learning predict future models for teaching and learning will be defined not by whether they blend, but how they blend (Bonk, Graham, Cross, & Moore, 2005).

3. Study rationale

A blended curriculum can take many forms, especially when professors are certain all students have equal and adequate access to the Internet and other necessary applications. Thus, our study represents only one unique model. However, data collected over two semesters (2007-2008) for a total of 174 student subjects provides both a comparative analysis between traditional and blended approaches to the same course, as well as a longitudinal reflection of the learning process that includes how students adapted to a blended course during a 16-week semester.

Three main goals prompted this longitudinal study: 1) compare learning outcomes between a blended approach and a traditional course plan; 2) examine issues of engagement, attachment, and enjoyment for students enrolled in both versions of the course; and 3) analyze the effectiveness and efficiency of a variety of multimedia tools as primary course content. It was not our intention to replace student-instructor interaction with virtual tools and online courseware. Rather, by experimenting with blended approaches, we seek ways to provide students with a broader range of course content in an equally broad range of formats.

4. Method

This study includes two subject sets and two data sources. The data was cleaned using mean substitution to replace missing data points. No more than 5 percent of any one variable or any one case was replaced in this manner. Any case missing more than 5 percent of its data was removed. After completing this task, 171 usable cases remained for analysis. Due to our greater interest in the outcome of the blended learning students, the sample was purposely imbalanced, giving us 117 participants in a blended approach to the course that combined face-to-face meetings between students and instructors with multimedia tools, such as an electronic textbook, video lectures, podcasts, online discussion boards, and digital handouts. Fifty-four students participated in a separate version of the course based on traditional visual communication pedagogy (i.e., in-class, instructor-led lectures, a printed textbook, and projects).

The first data source was comprised of weekly journals kept by students intended to gauge their feelings about progress in the course and respective learning methods. Journals produced a total of 13,552 statements that were coded based on a number of qualitative categories to provide researchers with a method for spotting trends in student attitudes about the course and its content. The second data source was a survey administered to students at the end of the semester focused on the complete course experience. Questions addressed students’ overall feelings about what they learned and the effectiveness of the learning methods in their respective courses.

This combination of methods allowed us to more fully assess both the overall feelings about the course and students’ up-to-the-minute reactions during the process. Of course, enjoyment is affected by many factors, including students’ comfort levels with the material and/or technology, perceptions of the quality of course administration, affinity for the subject matter, and personal motivation. To that
end, we gathered additional demographic data to better hone our focus on the benefits and drawbacks associated with blended learning in this course.

### 4.1 Course design

Both the traditional and blended versions of the course were structured according to five course units: basic design principles, Gestalt Theory, typography, color theory, and layout techniques. In the traditional course, students met twice a week for an hour and 50 minutes in a face-to-face classroom environment. Students were given regular reading assignments from a printed textbook, attended instructor-led lectures on each unit, and were provided with lab time to work on design projects that corresponded to each unit. Students were tested over their knowledge of the topics listed above and engaged in design critiques in class. Students were given 20 minutes each week to complete a journal entry.

In the blended version of the course, students also met twice a week for an hour and 50 minutes in a face-to-face classroom environment. And they were given regular reading assignments. However, they had the choice of using a printed textbook or a non-linear, interactive e-book. Instead of instructor-led lectures, they were offered both video and audio lectures. In class, students had time to work on projects and get one-on-one feedback form instructors, and the instructors engaged students in brief discussions over course topics and critiques of their work. Students were tested over their knowledge of the course topics and given 20 minutes each week to complete a journal entry. Online discussion boards were employed and students were prompted to answer specific, unit-related questions. The multimedia tools were accessed via an online Blackboard site.

### 5. Coded journal entry results

Journal entries yielded 13,552 statements for analysis, 7,548 in the blended sections and 6,004 in the non-blended sections. Two individuals coded data resulting in a Cohen’s Kappa of .88, making this a reliable set of codes.

We examined all of the statements over time and then studied various sub-groupings of the data. The data gathered from statements over time reveals a predominantly consistent and even pattern. The most entries accounted for in any one week is 9 percent of the data (1,221 statements in week 4) and the least is 4.1 percent (561 in week 15). We noted a precipitous drop between weeks 7 and 8 (1,108 to 873), with the data never reaching four figures per week again after that point. The data patterns do not differ between the two groups.

In assessing the key item groupings of interest, we found that the greatest statements were made in the expectations categories (4,563 total attributions). While 1,147 statements noted that the participant felt he or she had learned something, an additional 804 statements made suggestions for ways to improve the course. The remaining 2,612 attributions were coded positive, neutral, or negative statements about the expectations of the coursework (See Appendix A for the complete coding scheme).

To better assess the changes over time, we conducted a Chi-square analysis, which paired the three expectation variables with the time frame in which they were stated. As Chi squares require a minimum expected value of five cases per cell, and since the number of negative statements was low enough that we ran the risk of not meeting this parameter, we collapsed the time element into thirds (five weeks for three segments of a 15-week course). This allowed for equal distribution of the time element while giving us the best chance of meeting the needs of the statistic.

The Chi Square was significant ($X^2=43.03, p < .001$) and several cells made strong contributions to this statistic. However, the data ran counter to our initial theory that students would be initially negative but eventually warm up to the expectations of the class. The cell that contributed most to the Chi Square was the negative expectations cell in the third time period (standardized residual= 4.5) with the other negative cells also contributing heavily as well (first time period standardized residual= -2.2, second period= -.2.8). No other cell reached the 2 barrier in either the positive or negative direction. This demonstrates that overall, students were less negative in the earlier stages of the class, only becoming negative near the end. That said, the total number of positive statements was more than five times larger than the total number of negative statements, which likely accounted for the large residual swing in the last time period.
A split of the data revealed that both the students in the blended and non-blended sections both fit the pattern outlined above in terms of significance and data spread (blended $X^2 = 22.66$, $p < .001$; non-blended $X^2 = 33.74$, $p < .001$). What was of greater interest was a comparative analysis of the two groups based on the positive, negative, and neutral statements made. A Chi-square analysis revealed significant differences between the groups ($X^2 = 6.47$, $p < .05$) with the primary cells that contributed to the differences being in the negative expectations. The blended group had significantly fewer negative expectations than predicted by the statistical analysis (standardized residual= -1.7; 67 observed vs. 82 expected) while the non-blended students made more negative statements regarding their expectations of the course work (standardized residual= 1.6; 102 observed, 87 expected).

The statements participants made regarding their emotional states also accounted for a high percentage of our overall total (2,387 statements or 17.6 percent). Again, to better assess these statements, we collapsed the time period into the three segments and recoded the statements into three key categories: positive, negative, or neutral.

The Chi Square was again significant ($X^2 = 29.47$, $p < .001$) with several cells contributing to the statistic. In the first one-third of the course, students provided significantly more positive emotional statements than in the last third (first time period standardized residual= 2.3, last time period= -3.1). In terms of the negative emotional statements, the opposite was true (first time period = -2.3, last time period = 3.1). The neutral emotional statements remained as expected throughout the process. In comparing the two groups, both Chi-squares were still significant (blended $X^2 = 19.88$, $p < .01$; non-blended $X^2 = 12.80$, $p < .05$). However, the blended students expressed fewer negative emotions than expected in the first block (standardized residual= -2.3), while the non-blended students were closer to the expected count (standardized residual= -0.9). The blended students also expressed more positive emotional statements than expected (standardized residual= 2.2), while the non-blended students were closer to the expected count (standardized residual= 0.6).

We again compared the groups using a Chi-square analysis and found some interesting results. The statistic was significant ($X^2 = 91.50$, $p < .001$) and multiple cells contributed heavily to this outcome. The blended students were significantly less negative in their emotional statements (standardized residual= -4.3), while they expressed a higher number of positive statements than expected (standardized residual= 5.0). The inverse was true for the non-blended students (standardized residual for negative emotions= 4.3; positive emotions= -5.0).

In terms of satisfaction with their performance in the class and the performance of the instructor, we found that in both cases, participants were primarily positive. The Chi-Square on personal performance was significant ($X^2 = 23.14$, $p < .001$) with a pattern of data more consistent with what we had initially expected. Participants were initially more dissatisfied with their performance than the statistic would have predicted (first time period standardized residual= 2.3) but eventually that faded (third time period standardized residual= -3.2). Additionally, the number of positive statements they made about their performance also shifted in this direction (first period standardized residual= -1.6, third time period standardized residual= 2.2). In splitting the data, we found that the Chi-square for the non-blended students was not significant ($p > .2$) while it was predictive for the blended students ($X^2= 30.30$, $p < .001$), with the residual pattern following the pattern outlined above. The Chi-square analysis between the two groups was significant ($X^2= 3.89$, $p < .05$), with blended students making fewer statements regarding dissatisfaction with their personal performance, while non-blended students made significantly more statements of that type (standardized residuals= -1.2 and 1.1, respectively).

Regarding their instructors ($X^2= 16.20$, $p < .001$), the positive statements far outnumbered the negative (184 to 28) with a general ebbing of negative statements over time. Interestingly, the number of positive statements was highest in the first one-third, indicating that any problems the participants were having with the course was not laid at the feet of the instructor. Given the small number of data points in each cell, we decided not to split the data, but did conduct a blended/non-blended comparison and found the results to be significant ($X^2= 10.70$, $p < .01$). In this case, the non-blended students expressed more statements of dissatisfaction than would be expected (standardized residual= 2.3) while the blended students expressed fewer than expected (standardized residual= -2.0).
Last, we examined the participants’ statements regarding the technology. Although these students interact with technology on a daily basis, we felt this area might be among the most important to assess. We found that in the categories of technological anxieties, technological tension easement, and technological confidence, all three saw a sharp drop after either the third or fourth week. Participants showed a strong demarcation between those who highly feared the technology and were anxious about what it might do to their ability to succeed in this new course format and those who felt confident in their ability to do well. In assessing these variables, we found that after the students became acclimated to the course and the new approach to the material, they appeared to make little mention of their concerns with the technology. In the final 12 weeks of the course, no single week saw more than 16 statements regarding any one of these variables.

In terms of statements regarding the technology itself, the statements in the “technology good” category outweighed those in the “technology bad” category almost fivefold (87 to 16). In the final four weeks of the semester, only one statement was made noting any confusion with the technology, and overall, confusion seemed to be of little concern (total “technology is confusing” statements= 57). In addition, only 20 statements noted any difficulty with the videocasts and only four noted any problems with the electronic text (a total of 128 additional statements were categorized as having some technological problem; some of them revolved around issues with the students’ own computers and thus were outside of the purview of this study). Comparing the two groups, we found only two interesting differences. In terms of technology anxiety, the blended students made a fewer-than-expected negative statements (standardized residual= -1.9) while the non-blended students were higher than expected (standardized residual= 2.2). In addition, the blended students were more positive about the technology in the course (standardized residual= 2.3) when compared to the non-blended students (standardized residual= -2.7).

Likewise, students offered a number of comments in journals both about the quality of individual learning tools, as well as how to improve the course. In the survey material, students gave generally positive marks to the video lecture (M= 4.83), the handouts (M= 5.05) and the electronic textbook (M= 5.08). However, they also didn’t discount the value of more traditional approaches, stating some preference toward having more traditional lectures (M= 4.22) but not necessarily a traditional textbook (M= 3.67).

In regard to the video lectures, the comments were split, with 54 statements noting positive aspects of this tool while 49 noted a negative stance on it. In regard to the e-text, there were 182 positive statements on this, more than three times the number of negative responses (59). In terms of the podcasts, the responses were overwhelmingly positive (44 to 1) and the same could be said for the BlackBoard site (49 to 11) and the PowerPoint presentations (30 to 2). Students were more negative about the use of the discussion boards (19 positive and 25 negative), thus confirming to some extent earlier research on this topic.

Anecdotally, students often commented that video lectures were too static and the lecturer’s voice was “boring” and “not lively enough.” And although the e-book was generally well received by students, some noted that because it was in electronic form, it was more difficult to navigate back to sections that deserved more intense study. Many students in the blended sections also noted that they appreciated both the amount of “hands-on” design experience and personal attention from the professor. One student wrote, “I like that we use the course materials to learn the basics of design…and then the professor spends class time helping us with real class work instead of standing up there and lecturing at us. I learn better that way.” Albeit, this is proof only that this student thought he/she was learning more in the blended format. However, in a course that combines so much practice and theory, perceptions of learning and rote knowledge gain are equal parts of the pedagogical equation.

6. Survey results

We first examined the outcomes of the survey data, which was collected at the end of the course. The purpose was to assess to what degree, if any, the students in the blended condition differed from those students in the non-blended condition.

Overall, the students in both conditions reported a high level of technological acumen (Blended M = 5.29, Non-blended M = 5.14) and a strong interest in using digital tools to learn (Blended M = 5.59, Non-blended M = 5.54). Additionally, the participants all reported high levels of enjoyment when it
Jennifer George-Palilonis and Vincent Filak

came to the class (Blended M= 5.51, Non-blended M=5.21) while still feeling they gained competence in the subject matter (Blended M = 4.93, Non-blended M=5.11).

As for the effort, both groups reported feeling that they put forth a high level of effort in the class (Blended M= 5.86, Non-blended M= 4.48). The participants reported above average ratings regarding the number of options they had in how they learned (Blended M= 4.61, Non-blended M=4.62). They also reported below average ratings in regard to the amount of pressure they felt as a result of this course (Blended M= 3.63, Non-blended M=3.41).

A series of analyses of variances (ANOVAs) demonstrated no significant differences between these two groups on any of these variables, save one. The participants in the blended condition reported significantly higher ratings than those in the non-blended condition when it came to the effort variable. (F= 4.98, p < .05). Additionally, it’s worth noting a marginally significant finding on the enjoyment variable (F= 2.58, p = .1), with those in the blended condition reporting higher scores than the non-blended participants.

7. Discussion

Legendary Ohio State University football coach Woody Hayes was fond of noting that he hated the forward pass because when you attempted one, “three things can happen and two of them are bad.” This came to mind during the creation of our study because we viewed our work here as being the antithesis of Hayes’ view on the pass: three things could happen and two of them would be good. In comparison, blended students could show significantly higher levels of approval than their traditional counterparts, there could be no significant differences between the groups, or the blended learning students could be significantly worse off for their experience. Only in that third condition would we have viewed our outcomes as failure.

Although much of the survey data revealed little difference between the two groups, the analysis of the journal entries provided greater insight as to how the students approached this class. In most cases, the students in the blended courses were less negative in their reactions to the course, the work, their own performance and the instructor’s approach to the course. Furthermore, they were less negatively emotional regarding the course. In many cases, they demonstrated significantly more positive attitudes about what was occurring in the class, in spite of the massive changes they were required to adjust to as part of this study. To that end, the intercession of our study into their scholastic environment not only failed to create negative thoughts and consequences for them but in fact inspired them to view their learning experience in a better overall light.

These outcomes bode well for future research on blended learning for a number of reasons. First, the data demonstrates that there are differences between an end-of-semester evaluation and an ongoing assessment of real-time situational data. While students at the end of a course might synthesize their overall impressions of the course into a bland assessment, the immediate reaction to a failed project or a technological breakthrough can lead to a more thorough measure of their experiences in a course. Second, in reviewing their journal entries, we were able to parse specific aspects of their positive and negative reactions to the course. This would allow us to provide some valuable feedback to the instructors and aid future scholars in the field of blended learning. This micro-level approach has yielded valuable responses regarding the basics of the course (material, technology) and visceral responses (fear, satisfaction, personal achievement).

It’s also obvious from the journal responses that one future research effort would be to modify the multimedia teaching and learning tools, making “improvements” as seen fit, and repeat the study. Students’ criticism of the effectiveness of the video lectures and electronic text alone would suggest that positive feedback would increase as the teaching and learning tools improve. It’s also already been noted that limiting the number of professors in the course might also eliminate variables that may have affected this study. One additional option would be to add a measure for practical knowledge gain or skills improvement for a more holistic view of how blended learning can be implemented in a visual communication course. In fact, one might argue that a scenario in which a student dramatically improves his design skills and creates work that is obviously reflective of that improvement but doesn’t improve his ability to recite the seven basic design principles for a test would be a positive outcome and possibly evidence of the merits of blended models. It’s the difference between knowing blue and orange are complimentary colors and being able to apply that aesthetic in creative work. And ultimately, striking a balance between students’ knowledge of the concepts and ability to apply them is, after all, the ultimate goal.
In any case, we noted several patterns that were not incongruent with traditional learning. Initially, students were either excited or fearful of what they would see in the course. Technology was initially a concern but eventually became less so than other components of the course. In the end, the students felt they learned something and believed they could continue on their path toward a degree without having been hampered by the blended learning or traditional models. Perhaps the greatest outcome for us was the sense of normalcy that became part of the journals over time. Students simply viewed the blended approach as “part of the process” and to that end were able to adapt well to this environment.

This study is one of three we have constructed to measure various aspects of blended learning and how it compares to a more traditional model, so as for suggestions for future research, we would likely only be feathering our own nest. Still, we have collected data regarding specific educational outcomes that will be part of our future work as well as information regarding various learning styles and various learning tools. We hope to assess whether one model or the other is more likely to yield improved learning and to see whether learning styles lead to the utilization of specific digital tools. We believe these three studies will work in tandem to provide a well-rounded view of how blended learning effects students and their learning experiences.

8. Appendix A: coding scheme

Expectations
1 Neutral interpretation of course expectations (Statement has no quantitative value.)
2 Negative interpretation, unrealized expectation (Related to coursework selections)
3 Positive interpretation, desire met (Related to assignment, course content)
4 Negative interpretation, unrealized expectation (Emotional)
5 Positive impact, realized, exceeded expectations (Emotional)

Course content
6 Anxiety about course
7 Excitement about course
8 Eased tension about course
9 Confusion about course/content
10 Indifference about course/content
11 Confidence about course/content/skills
12 Uncertainty about course/content
13 Prepared for quiz
14 Not prepared for quiz
15 Anxious about quiz
16 Optimistic about future/expect to do better

Technology
17 Anxiety
18 Eased tension
19 Confidence
20 Technical difficulties (video)
21 Technical difficulties (e-book)
22 Confusion with tech
23 Tech is helpful
24 Tech is not helpful
25 General technological problem
Performance

26 Dissatisfaction, personal performance
27 Satisfaction, personal performance
28 Dissatisfaction, instructor performance
29 Satisfaction instructor performance
30 Uncertain of performance
31 Desire to achieve (change effort, performance)
32 Positive opinion of freedom, creativity

Opinions of teaching tools

33, 34 Positive, negative video
35, 36 Positive, negative e-book
37, 38 Positive, negative podcasts
39, 40 Positive, negative handouts
41, 42 Positive, negative quiz
43, 44 Positive, negative discussion/lecture
45, 46 Positive, negative Blackboard
47, 48 Positive, negative PowerPoint

Misc.

49 Irrelevant to study
50 Used modules to study
51 Liked personal attention/interaction/students or teacher

References


Podcasting to Support Students Using a Business Simulation

Andrea Gorra and Janet Finlay
CETL, ALiC, Leeds Metropolitan University, UK
a.gorra@leedsmet.ac.uk
j.finlay@leedsmet.ac.uk

Abstract: Audio or video podcasts can be a useful tool to supplement practical exercises such as business simulations. In this paper, we discuss a case study in which different types of podcast were utilised to support the delivery of a course in international business. The students work in groups and run a fictional company using business simulation software, which gives them the opportunity to evaluate their decision making skills. A number of podcasts were used as reusable learning objects for different student cohorts. Faculty members produced visually enhanced audio podcasts offering tutor discussions of key elements of the computer-assisted business simulation used by the students. The podcasts were made available via the virtual learning environment (Blackboard Vista), as well as for subscription by web browser-based RSS readers, such as Google and downloadable RSS readers, such as iTunes. Our evaluation of this approach to using podcasts takes into account pedagogic and technical issues. Firstly, faculty members involved in this case study were interviewed to obtain their views and experiences on the process of producing podcasts as well as the suitability of podcasts to support their teaching. Secondly, students were surveyed and interviewed about the value of the podcasts and the way in which they were used. This work is on-going and initial informal student feedback indicates that the podcasts engaged the students and supported their understanding of the international business module. This paper presents a snapshot of the current findings which generally support the value of this innovative way of using podcasting for learning and teaching.

Keywords: podcasting, reusable learning resources, e-learning, web 2.0, visually-enhanced audio, business simulation

1. Introduction

In this paper we present our findings from an on-going evaluation of a case study in which audio podcasts enhanced with visual media were used with students on Business courses to supplement practical group activities as part of a computer-based business simulation. We begin by outlining the rationale behind our use of podcasting in this context and the manner in which we designed them. We then discuss the case study in more detail before presenting our results and highlighting some observations for the use of podcasting based on our experience to this point.

2. Podcasting to support active group learning

It is generally accepted that the most effective educational interventions actively engage students in their learning (for example Biggs, 2003). Such engagement requires both action and thought on the part of students and is facilitated by guided group collaboration (Slavin, 1995). In line with these principles, students in Leeds Business School undertake a group-based interactive business simulation, as part of their module on Business Analysis and Practice. This is a complex and realistic activity, where student teams work in a ‘live’ market place consisting of all student companies, with other European Manufacturers acting as background ‘competition’ in the market. It was therefore felt that additional and flexible learning resources should be provided to support the activity. We anticipated that by offering such resources in form of podcasts, the students would be able to better understand the underlying principles of the business simulation and be able to make more informed business decisions.

Podcasts have a number of potential benefits in this situation (for a detailed discussion of the benefits of podcasting, see Salmon and Nie, 2008). They are continuously available and can be used flexibly by students, both via fixed and mobile technologies. Additionally the use of audio-visual and the novel presentation of material enhances both learning and motivation (Salmon and Nie, 2008). They can provide a realistic simulation of the activity, offering students a model from which to progress. Where the subject matter warrants, they can also be repackaged and reused as learning objects (Barritt and Alderman, 2004) for different modules. This is significant in our context, as the same case study is also used at Level 3 and postgraduate levels. Producing learning objects that are applicable to different levels of student is a recognised issue (e.g. Finlay et al., 2008) and podcasts are no
exception (Salmon, 2008). Podcasts can be produced at relatively low cost and there is, for example, open source freeware software available for producing audio recordings in mp3 format.

For these reasons we decided to develop a series of podcasts to support the team activity. There are a number of decisions to make in determining what type of podcast is most appropriate. We have applied the 10-factor design model of Edirisingha et al. (2008) to our scenario to help elaborate the design decisions made (see Table 1). Characterising the podcasts in this way is helpful to position them in relation to other work in the area.

Table 1: Interactive business simulation podcasts categorised according to Edirisingha et al.’s 10 factor design model

<table>
<thead>
<tr>
<th>Edirisingha et al.’s 10 Factors</th>
<th>The interactive business simulation podcasts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The purpose or pedagogical rationale</td>
<td>Enhanced support for group-based active learning.</td>
</tr>
<tr>
<td>2. The medium used</td>
<td>Visually enhanced audio. Audio recording overlaid onto static visuals to illustrate team activity.</td>
</tr>
<tr>
<td>3. The convergence (integration with other (e)learning</td>
<td>Podcasts provide support to a face to face group-based interactive business simulation, alongside lectures and other sessions.</td>
</tr>
<tr>
<td>4. The authors and contributors of content</td>
<td>Podcasts produced by module leader and features role play by other members of course team. No contribution from students.</td>
</tr>
<tr>
<td>5. The structure of podcasting (frequency and timing)</td>
<td>The podcasts were offered in short episodes each covering a different element of the simulation exercise.</td>
</tr>
<tr>
<td>6. The reusability of content</td>
<td>The podcasts were designed to be reusable with different student groups across levels all using the same case study.</td>
</tr>
<tr>
<td>7. The length</td>
<td>Average length 8 minutes.</td>
</tr>
<tr>
<td>8. The style</td>
<td>Staff role-played the team activity students were to undertake. Presented as a group discussion.</td>
</tr>
<tr>
<td>9. The framework of content organisation</td>
<td>Each podcast focuses on one element of the team activity, which is introduced at the start of each episode.</td>
</tr>
<tr>
<td>10. The access system</td>
<td>Delivered via the virtual learning environment and also made available via an RSS feed for subscription.</td>
</tr>
</tbody>
</table>

3. The business simulation case study

The case study we are considering aims to investigate the use of podcasts to support students in the Business School at Leeds Metropolitan University. We are primarily looking at the use of podcasting for students in their second year of study (Level 2), taking the module Business Analysis and Practice. The students taking this module study various courses in the Business School, such as BA (Hons) Business Studies and BA (Hons) Marketing. Additionally, the podcasts are used to supplement teaching materials for students of two other courses: Strategic Decision Making (Level 3) and for a Diploma in Management studies at postgraduate level. These podcasts are therefore used as reusable learning resources, as they are utilised for three student cohorts with approximately 700 students in total. It is possible to offer the podcasts to students studying at such a range of different levels, as the podcasts’ main focus is to support the learner using a computer-based business simulation.

The students typically work in groups of five to run a fictional car manufacturing company using this computer-based simulation. The interactive business simulation is complex, as the student teams are working in a ‘live’ market place consisting of all student companies with other European Manufacturers (e.g. Volkswagen, Ford) acting as background competition in the market. The podcasts cover some of the issues and decisions that the student groups have to make when producing a business plan and using the simulation software. These issues include, for example, task specific issues, such as how to choose the “Mission, Vision and Objectives” for a company, and management issues, such as how to deal with missing team members in a student group.
4. Development and delivery of podcasts

In order to produce a series of podcasts, four members of the faculty conducted a role play in which they followed a semi-structured script to discuss some of key elements of the business simulation software. The role play was digitally audio recorded and stored as an hour long mp3 file. This file was then split into seven audio files, according to the subject under discussion. For editing the audio file we used Audacity, a free open source software package. Visuals, such as screenshots of lecture slides and business objectives from actual companies, such as Microsoft, were then added to each of the files with help of screen video capture software (see Figure 1 for an example of a podcast). In the finalised version of the podcast, the students could listen to their tutors’ voices and view the still images relevant to the content discussed.

Figure 1: A podcast shown on an iPod (left image) and in the QuickTime media player on a PC (right)

Each of the podcasts was made available via the virtual learning environment (Blackboard Vista) and the podcast files could be viewed directly in an internet browser. In addition, the podcasts were offered to the students via RSS-based subscription. This meant that the students could ‘subscribe’ to the podcasts via web browser-based RSS readers, such as Google and downloadable RSS readers, such as iTunes. Once a student had subscribed to the podcast series, new ‘episodes’ of the podcasts would automatically download to the student’s computer and if available to their portable music player or iPod.

5. Evaluation of podcasts - views of students and faculty

Five interviews with faculty members have taken place to date. The module leader has been interviewed twice; once before the start of the project and then at a midway point. The other three faculty members, who were involved in the role play, were each interviewed several weeks into the project. All four members of staff were asked about their expectations, views and experiences on using podcasting for learning and teaching. They were encouraged to talk about what they perceived as benefits and possible negative aspects of podcasting for faculty and students.

In addition to capturing the views of faculty, students were also consulted. Surveys and interviews with the different student cohorts have been initiated. An eight question survey was distributed to the large student cohort of the second year Business Analysis and Practice course via the virtual learning environment (Blackboard Vista), and the same survey was handed out in paper-based format to 16 students studying at postgraduate level. In addition, a focus group was conducted with 10 students on the International Business course taught at Level 3; all of these students were non-native English speakers.

---

1 Available from http://audacity.sourceforge.net/.
2 We used Camtasia Studio (http://www.techsmith.com/camtasia.asp) but free open source software is also available, such as http://camstudio.org/
Finally, a second survey was handed out to the large Level 2 Business Analysis and Practice cohort of approximately 500 students in the last week of the academic year. This paper-based survey aimed to elicit the students' views on the podcasts made available to them during the semester. This end of year survey received a much larger response rate, probably due to the fact that it was handed out in paper format during the assessment week. 177 out of 476 students filled in the survey which equals a response rate of 37.2%.

Results, based on views of faculty and students, confirm our expectations in terms of the benefits of student motivation and supporting learning styles, as well as flexibility. Mobility is perceived to be less important to students. In addition we found unexpected outcomes in the staff learning (development) that occurred through the process. An issue that arose was the perception that podcasts were perhaps less beneficial to weaker students, providing learning enhancement only to stronger, more motivated students. This is an issue that requires further research to address.

5.1 Learning enhancement and motivation

Findings from the first survey of Level 2 Business Analysis and Practice students provided an early indication of student views, with the majority of respondents perceiving the podcasts to be useful. Out of seventeen students who responded to the survey, two found the podcasts ‘very useful’, eleven ‘somewhat useful’, and four ‘not useful at all’.

Faculty members identified supporting learning around specific issues and supplementing existing materials as some of the main benefits of the podcasts, as well as practical management of the role play activity.

“I thought it was really useful because although it was a role play, we had several learning points that we wanted to get over to students, so we made sure that we asked each other questions in the role play that we thought they were likely to ask. So it’s … a bit like a “frequently asked questions” and also to show the students that even when the lecturers sit down to do something, they don’t all agree and how they resolve a disagreement.”

(Staff 2, female)

Initial findings from the postgraduate survey indicate that students also agreed on the benefits of being presented with information in different formats, including multi-media, though some still appreciated the ‘traditional’ paper-based format:

“ I think it is a good idea to present information in as many different formats as possible”

“A useful learning aid but: prefer to read and take notes”

(Survey comments from postgraduate students)

This is a reminder that we should avoid emphasising a single medium and ensure that all our resources take account of different learning styles and preferences.

This view was also supported by faculty. In the interviews, all faculty members considered the question of whether podcasts could replace lectures and tutorials but were sceptical about this, as they saw them as different media. This is confirmed by existing research which has argued that the use of podcasts does not discourage students' lecture attendance (Hatch and Burd, 2008). Instead, faculty perceived podcasts as means to enhance the student experience, to be

“part of that mix of blended learning. […] the students expect that when they go to X-stream [the virtual learning environment] and have a look at something … there’s something other than PowerPoint slides.”

(Staff 3, male)

Another member of faculty also mentioned student expectations and saw the primary benefits of podcasts in that they suited students' different learning styles.

“ […] varying the mode of delivery is very good for keeping people’s attention. I think that students these days, well young people these days, are more used to visual and verbal stimulus than reading. And because students have all got different learning styles some of them will learn a lot more from hearing than they will from reading for example.”
The focus groups with the international students also highlighted the motivational aspects of using new and novel technologies in their studies, and, again, the value of multimodal resources:

Female student 1: I haven’t used podcasts very often in the past but I think, in general, it is a good idea. I’d like to use them … And the combination of audio and visuals, the combination of both is very good.

Female student 3: new technology I think, it’s also a new thing to learn.

(Focus group, International students, Level 3)

The majority of the Level 2 Business Analysis and Practice students (149 out of 177) who responded to the end of year survey stated that they would like to see more podcasts to support their studies. Additional comments were “It’s really appreciated how tutors put more work in to help us”, “Keep podcasts!”, “It appeals to a more interactive generation of students” and “It is a good idea, makes a change slides and sheet” which demonstrates the enthusiasm of the students for the use of multimedia files as supplementary learning materials.

5.2 Flexibility in learning

Flexibility was cited by both staff and students as a key benefit of podcasting. Faculty members mentioned that the students could replay the podcasts after the lecture to help their understanding and in preparation for exams:

“Benefits from the students’ point of view is that they can … dip in whenever they like. And if they don’t understand something, they can replay. Whereas you can’t replay a lecture.”

(Staff 3, male)

The focus groups with the international students also pointed to the benefits of being able to replay the podcasts:

Female student 2: … it’s good that you can repeat it as often as you want.

Female student 1: It is a very individual thing. And if you can’t come to a lecture you can do it at home ….

(Focus group, International students, Level 3)

The postgraduate students made similar comments about being able to catch up with help of podcasts in case they had to miss a lecture.

“Useful as an overview or if you miss a lecture. Anything to help is appreciated!”

(Survey comment from postgraduate student)

In line with these findings, the end of year survey with the large Level 2 cohort confirmed that “being able to re-play the podcasts” was perceived to be the ‘most useful’ feature of the podcasts by 66 students (see Figure 2). This was followed by “study in own time” as the second ‘most useful’ characteristic of podcasts by 54 students. However, the respondents also indicated that they did not necessarily perceive the podcasts to be helpful for ‘increasing their motivation and interest’ in their studies, as only 15 students perceived this as ‘most useful’.

![Figure 2: Responses to a survey questions by Level 2 Business Analysis and Practice students (N=177, multiple responses were possible)](https://example.com/figure2.png)
5.3 Mobility

Our findings from both students and faculty data collections suggest that the learners preferred to access the podcasts via their laptops or PCs and not via portable multimedia players such as iPods.

For example, students of the large second year cohort indicated in the final survey that only 8 out of 177 watched the podcasts on an iPod or similar multimedia player. In contrast, 123 stated that they had viewed the video files on a laptop or PC. One possible reason for this may be the low ownership of multimedia players by the students. According to the students’ responses, only 33 students out of the 177 owned a portable player, capable of playing video, while the majority (118 students) owned an audio only portable player.

This backs up our previous findings on using podcasts with another group of students (Finlay et al., 2008), and is supported by other studies. For example Wingkvist and Alexander (2007) suggest that the learners preferred to access the podcasts via their laptops or PCs. This casts some question over whether mobility is always a key perceived benefit of this type of resource.

The surveys showed that all 17 Business Analysis and Practice students, as well as the 9 postgraduate students, who responded to the survey, had watched the podcasts via their PC or laptop and did not download them to iPods or similar. The focus group with the Level 3 explored these issues in more detail:

Female student 4: you use your iPod when you want to relax and not study.
Female student 5: I don’t think it makes sense to sit on the bus and listen to important stuff from school or university.
Female student 4: I think you have to listen to it again when you are at home.
Male student 2: because we have the lecture all day here and then on the bus we just want to relax.

(Focus group, International students, Level 3)

It does seem that both students and faculty were, at best, ambivalent about the value of the mobility aspect of podcasting. As one faculty member commented: “but then it doesn’t matter whether they put it on an iPod or not. But I think, everybody has got a laptop these days, so they don’t need an iPod” (Staff 2, female).

5.4 Learning benefits for staff

One of the aims of the module leader was for his staff to “broaden their horizon away from ‘this is what we do’, you know very traditional approaches.” (Staff 1, male) and indeed this appears to have been achieved. All faculty members reported that they enjoyed taking part in the role play and felt it was useful to students. For some however it was more than simply enjoyable, but became a learning experience for them as well:

“Well, I found it interesting, me […] I’ve never done anything like this before. […] I found it beneficial as a learning tool. And it was good to listen to other lecturers play out their role. In fact, they were really getting into their roles. They others seem to have done this before but it was new for me.”

(Staff 4, male)

This was not an outcome we expected and it may be simply a factor of the type of group podcast made by this team, but it reflects positively on the activity as a whole for all concerned.

5.5 Support for all students

Even though faculty believed that the students generally welcomed the podcasts “That role play really went down well, judging from the students I’ve talked to, they said they learned a lot from it.” (Staff 4, male), they also made a distinction between the stronger, more motivated students and the weaker or less motivated ones, as the following comments show:

“The ones that are focused and they are there anyway, they don’t need all this extra help. It’s the ones that never turn up because they can’t get out of bed or had too much the
night before. It’s those that podcasts would be really beneficial [for] but the attenders and the focused students, they … embrace it."

(Staff 4, male)

“I think the better students will take advantage more than the weaker ones. Because you can see when you are teaching say a group of 20, there are probably about 8 or so who are really keyed into what you are saying and so on. And those students I think would be the ones who make the most [use].”

(Staff 1, male)

This highlights the need to see the podcasts as an additional resource but also to make the podcasts easily accessible to students, as adding additional materials to the virtual learning environment “requires the students to be more proactive” (Staff 2, female).

One of the postgraduate students emphasised the need of easy access to the podcasts:

“Good idea- just need to make sure I know where and how to access them”

(Survey comment from postgraduate student)

6. Conclusion

This paper has presented preliminary findings from our on-going research into the use of podcasting to support teaching and learning in higher education. Faculty and students agree that the podcasts are beneficial in terms of appealing to students with different learning preferences and providing enhanced motivation to study. However, we have found that the students value flexibility of use over mobility. In other words, the learners perceive it as very beneficial to watch podcasts outside the lecture time, either because a class was missed or because they want to review the key concepts. However, initial findings show that learners are less interested in accessing podcasts ‘on the move’. We will be exploring this further during the remainder of this research project.

We encountered some unexpected outcomes in terms of staff development, with the use of new technologies and joint production of (multi-media) lecture materials providing the scope for faculty peer-learning.

The other finding that we will explore further in this on-going research project is the question of how to ensure podcasts support all students, not just those who are already highly motivated. Offering additional materials in form of podcasts requires the students to be proactive and take action to view and download them, possibly therefore excluding weaker or less motivated students.

One suggestion from a student was to integrate the podcasts into the face to face contact time with tutors.

“Would have preferred to watch the podcast in lectures and then have a group discussion afterwards.”

(Survey comment from postgraduate student)

It may therefore be beneficial not only to let the students make use of the podcasts in their own time but also to blend this medium into the face to face contact time in order to engage all students. We will be investigating this issue further.

In summary, from our early experience on this project, we have found visually enhanced audio podcasts to be very useful as a supplement to face to face interaction and other materials. The podcasts are perceived to provide valuable support for the case study activity and the use of a novel technology, with the flexibility it has, is motivating. However it is critical that students can access podcasts quickly and easily, and it may be helpful to integrate them into face to face class activities, to allow students to benefit more consistently from their use.

7. References


e-Modeling – Helping Learners to Develop Sound e-Learning Behaviours

Susan Greener
Business School, University of Brighton, UK
S.L.Greener@brighton.ac.uk

Abstract: The learning and teaching relationship, whether online or in the classroom, is changing. Mentis (2008) offers a typology of teacher roles gathered from current literature on e-learning including instructor, designer, guide, mediator, curator and mentor, which offer the university teacher a striking range of ways in which to develop relationships with students in the mutual development of knowledge and understanding. A study of Higher Education teachers in the UK proposed a shift in their role and behaviour concomitant with the explosion of VLE usage in universities (Greener 2008). As online and blended learning become familiar features in the university landscape, pedagogical discussions are being given more priority and ideas about how students can be enabled to learn appropriate skills for employability and lifelong learning, as well as higher order thinking, claim attention. Online, the teacher’s status can easily be eroded, as learners can compare teacher-designed resources with video lectures from across the world on similar topics and chat directly with experts in the field through their blogs. Teachers who are open to new ways of thinking about their subject, and welcome such self-directed behaviour from learners, are most likely to integrate new technology into their teaching (Baylor and Ritchie 2002), and their own competence with technology will be a factor in how such integration works. But it is vital in these discussions not to lose sight of classroom behaviour in the rush to develop e-moderating and blogging skills for teachers. What teachers say and do in their face-to-face classes has always had a major impact on not only what is learned but also how it is learned. Bandura suggests that most human learning is done by observing and imitating others’ behaviour (1977) provided the potential learner attends, can retain, reproduce and wants to do these things. So if we aim to integrate at least the affordances of VLEs into teaching design for blended learning, one of our considerations must be how the teacher uses the VLE in front of the learner. There is no doubt that teachers are increasingly uploading materials and weblinks etc into VLEs to support learners (or are made to by institutional policy). However there is less evidence that teachers are role-modelling effective e-learning to their learners. Some of this is about competence, but it is rare for a teacher to lack the ability to learn basic technology use. More of this reluctance is about fear and anxiety, to be shown up as incompetent in class to what are considered the net generation. This paper will explore the concepts and behaviours implied in the role-modelling of effective e-learning in the classroom, drawing on data from teachers and learners involved in using VLEs and other Web resources in face-to-face sessions.

Keywords: role modeling, social learning theory, teaching methods, conceptions of teaching

1. Introduction

This paper starts by reviewing the basic purpose of Higher Education teaching and learning, then drilling down to find a basis for good teaching as we battle with the introduction of e-learning and blended learning on campus, working with Virtual Learning Environments. Why the notion of battle? This is because many university teachers are still reluctant to do more than upload existing materials and fail to take advantage of opportunities to develop effective learning strategies among students for dealing with web information overload and varying information quality. The proposition is that our approach to teaching in the classroom can affect e-learning practice by students. In fact, good teaching implies of course that, in order to develop effective learners, teachers need to be visible learners too.

2. What is learning and teaching about in universities today?

The author writes as a practitioner who grapples like other university teachers with the demands of timetabling, course design and delivery, student needs and making sense of some of this through her own approach to learning and scholarship. These of course are the day-to-day headaches and adrenalin rushes of faculty life. The broad aims of the university, particularly based on the Humboldtian concepts from the nineteenth century, suggest a role in preparing people for citizenship, forming their conceptions of learning and shaping democratic societies (Gare 2005). This notion of university is independent of state intervention, but supports the state by providing it with people able to contribute to society. My university’s corporate plan (University of Brighton 2007) speaks of “socially purposeful Higher Education”. Also within the plan the Vice Chancellor speaks of:

“finding creative and effective ways in which to strengthen the relationship between learning and teaching, disciplinary and professional practice, research and economic and social engagement.” (pIII)

Reference this paper as:
To do this, the university has a number of specific aims, which are clearly set out by Bourner (1997 p347) as to:

- Disseminate up-to-date knowledge
- Develop the capability to use ideas and information
- Develop critical faculties
- Develop the student’s ability to generate ideas and evidence
- Facilitate the personal development of students
- Develop the capacity of students to plan and manage their own learning

Bourner is keen to point out that there is no hierarchy among these aims. In his paper, he sets out suggested popular teaching methods which may fit these aims, noting that no one particular teaching method is “right” in any sense, but that collections of methods may be more appropriate for a particular aim.

The choice of teaching method, a practical as well as planned choice, is usually down to individual teachers, many of whom may have been more aware of their role as a scholar and/or leader in their academic discipline, than as a designer of teaching (Kember 1997 who cites Becher 1989 in support of this idea). Developing awareness of options and pedagogies in the classroom is now routinely done on start of academic appointment in most UK universities. However there are many faculty who have not had the opportunity to debate and reflect on their approaches to teaching during a specially designed induction to higher education practice. For these teachers, planning classes and modules/courses can be a repetition of what they experienced themselves or constrained by course leaders or teams with whom they are teaching. If a course has worked in the past in a standard lecture/seminar mode, and the materials already exist, many teachers will feel pushed towards using them, rather than venturing into design activities seen as time-consuming and unnecessary, provided materials are up to date.

3. So what is the problem?

The learning and teaching relationship, whether online or in the classroom, is changing. Mentis (2008) offers a typology of teacher roles gathered from current literature on e-learning including instructor, designer, guide, mediator, curator and mentor, which offer the university teacher a striking range of ways in which to develop relationships with students in the mutual development of knowledge and understanding. In addition to this level of change, each university is offering new software capabilities, mobile learning gadgetry and, increasingly, a requirement to conform to minimum use standards of a VLE. While some of the gadgets and software will actually support and develop the lecture mode of delivery (such as Personal Response Systems designed to engage and engender discussion among large groups), much of the software now available will involve students and teachers in online collaborative learning, and where teachers fear to tread, students will often lead the way and demand coherent use of VLEs, and preferably Web 2.0 technology, to support their learning.

4. Conceptions of teaching

A study of Higher Education teachers in the UK proposed a shift in their role and behaviour concomitant with the explosion of VLE usage in universities (Greener 2008). As online and blended learning become familiar features in the university landscape, pedagogical discussions are slowly being given more priority, through the use of varying corporate strategies (top-down imposition through to bottom-up “early adopter” leadership). In many universities, ideas about how students can be enabled to learn appropriate skills for employability, citizenship and lifelong learning, as well as higher order thinking (critical, creative and reflective thinking, and learning strategy development and implementation) claim attention.

Kember’s review of largely independent studies into conceptions of teaching by academics (1997) is particularly helpful here. His proposal is that of the thirteen studies he reviewed from the early part of that decade, there was a great degree of consistency in suggesting teaching conceptions (defined as meanings attached to the idea of teaching). These fit into his model of five conceptions, broadly situated on a continuum but incorporating quite distinct characteristics:

- Imparting information
- Transmitting structured knowledge
Teacher-student interaction
Facilitating understanding
Conceptual change

He sees the first two conceptions as being “teacher-centred” or “content-centred”, the final two as “student-centred” or “learning-oriented”, and the middle concept, teacher-student interaction, as a “transitionary bridge between the two orientations and their subordinate conceptions” (p264). The point of thinking about conceptions here, is that Kember suggests that the conception of teaching is a basis for teaching approaches and thus behaviour in the classroom (he is speaking of face-to-face teaching here). The teaching conception, similar to the notion of “antecedents” discussed by Jacobs (2005) as the basis for theories in practice and action in practice, is seen to drive teaching behaviour. This model is similar to findings by the author in a study of teachers who were enthusiastic about online learning (2007) where the grounded analysis theorized differences between teacher beliefs in their approach to classroom teaching and blended or online design. These were most distinct for those teachers who remained content-centred and teaching-centred rather than learner-centred.

5. The changing role of the teacher

According to Greener’s respondents in the above study, a good teacher was considered to be no different online from a good teacher face-to-face, in the sense that the activities listed below:

- awareness of student needs,
- levels of understanding and knowledge,
- ability to plan effective learning experiences,
- ability to communicate accessibly and
- to stay in touch not just with current discipline knowledge but also with contemporary influences on students’ learning

would be just as important whether in the classroom or online (Greener 2007 p77). However the study found that teachers had a greater opportunity to influence the learning experience at an early stage in online environments – not only through socialisation of students as discussed by Gilly Salmon (2000) in her model of e-moderation, but also through the design of online environments and activities with Virtual Learning Environments (VLEs) and by incorporating online learning into a blended design.

However, online, the teacher’s status can easily be eroded, as learners can compare teacher-designed resources with video lectures from across the world on similar topics and chat directly with experts in the field through their blogs. Teachers who are open to new ways of thinking about their subject, and whose conceptions of teaching are more student-centred, or learning-oriented, welcome such self-directed behaviour from learners. These teachers, who are open to change, are most likely to integrate new technology into their teaching (Baylor and Ritchie 2002), and their own competence with technology will be a factor in how such integration works.

6. We can’t change “openness to change”!

Or perhaps we can? Kember’s view suggests that teachers may adapt their conceptions, moving along the continuum towards more learning-oriented beliefs, as they become more experienced, perhaps more confident in their teaching role. As we discuss e-learning, new opportunities from software and gadgets and the wonderful world of Web 2.0, perhaps we need to remember that all these ideas can be a huge challenge to most teachers, particularly those with teaching or content-centred conceptions or beliefs. In the rush to develop e-moderating and blogging skills for teachers, it would be so easy to reinforce negative self-efficacy beliefs among teachers already challenged by heavy teaching loads and reducing unit of resource for teaching, while individual students clamour for more personal attention in return for increasing fees. If you already feel so constrained and stressed in the university environment of the 21st century, the idea of more personal learning, lots more preparation of blended designs, greater technology set-up times in rooms not quite up to speed with your needs – these things are more likely to reinforce a belief in focus on content and knowledge than an openness to change and learning orientation.

If we want to move towards that end of the conception spectrum, then we should perhaps keep a clear eye on the practice of teaching. We all learn from what we know and move forward into new
territory from existing paths. Even transformational learning (Mezirow 2000), qualitative changes in how we know things, leads out from our personal starting points or where we currently are. My contention is that by understanding and valuing great classroom behaviour, “good teaching” as exemplified by the work of Chickering and Gamson (1987), and Mehanna (2004), where a learner focus is based on interaction, dialogue, feedback – giving a clear lead to students on learning, we can help faculty develop confidence in what they currently do, and build self-reinforcing behaviours which become more open as technology affects more and more the teaching methods used. However, I would challenge the two articles just cited in that they give no clear emphasis on the practice of role-modelling learning for the student.

7. Why is role-modelling important?

Chickering and Ehrmann (1996) suggest that teaching methods are more important in helping learning than technology alone. While I would say that technology is more than just a tool for learning, it is increasingly a way of life for students and teachers alike; the way we put technology across to our learners does matter.

So if we aim to integrate at least the affordances of VLEs into teaching design for blended learning, one of our considerations must be how the teacher uses the VLE in front of the learner. There is no doubt that teachers are increasingly uploading materials and weblinks etc into VLEs to support learners (or are required to by institutional policy). However there is less evidence that teachers are role-modelling effective e-learning to their learners. Some of this is about competence, but it is rare for a teacher to lack the ability to learn basic technology use. More of this reluctance is about fear and anxiety, to be shown up as incompetent in class to what are considered the net generation.

What teachers say and do in their face-to-face classes has always had a major impact on not only what is learned but also how it is learned. In medical education, it has long been the practice to use consultants to role model professional conduct to junior doctors. A recent study (Paice et al. 2002) confirmed that such learners value openness, enthusiasm and integrity in their role models.

Bandura suggests that most human learning is done by observing and imitating others’ behaviour (1977) provided the potential learner attends, can retain, reproduce and wants to do these things. Social learning theorists such as Bandura and Zimmerman put forward in theory what most teachers know only too well in practice – that their behaviour in front of a group, or virtually within a group, strongly affects learner response.

Zimmerman (1989) asserts:

“The impact of modeling on self-regulation is given particular emphasis in social cognitive formulations. The modeling of effective self-regulated strategies can improve the self-efficacy for even deficient learners.” (p9)

Bandura suggests that modelling “coping strategies” can improve the self-efficacy of learners, even where the latter is negative on the basis of past experience (Bandura 1986 p 400). This works particularly well when the learner perceives some similarity with the model. In the context of this paper, the suggestion is that the university teacher who is prepared to role model dealing effectively with technology in the classroom, will become an intermediary factor in the developing of the student’s self-efficacy, which in turn is likely to support learning. Where the teacher experiences problems, similar to those faced by the student – for example in searching for appropriate literature through databases, in finding relevant information from a complex website, or in analysing the authority or credentials of information on the web from various sources, then to do this in front of the student in class, is likely to encourage their own learning and prompt them to use the technology more effectively when alone.

Role modelling good e-learning practice in face-to-face sessions with students, “e-modelling”, is suggested, on the basis of social learning theory, to be powerful, offering opportunities for attention, retention, reproduction and motivation to learn vicariously. Such practice is helpful for learners, particularly non-traditional students who may have varying experience of web use for learning, despite regular use for leisure and day-to-day living. When students start to use the web for higher academic study, the result can sometimes be “learned helplessness” (Seifert 2004) rather than improved self-efficacy, as the expectation of instant answers leads to a lack of depth in search and analysis.
The author has found that use of web technology in the classroom (based on the experience of undergraduate and postgraduate teaching over the last eight years in a UK university) offers a range of opportunities for the modelling of effective learning: for example, to answer student questions by searching and discussing findings, then leaving a track of useful findings on the VLE for students to reference. The VLE can be prepared with weblinks and questions for these activities, and asynchronous forums can provide places to record class discussion output as well as presenting it as it arises. Videos and podcasts from other universities and professional institutions can be sought and played if and when appropriate to class questions.

In addition, regular use of the VLE in class offers reinforcement of layout and navigation of module sites, often preventing repeated questions from students as to where and how to find information – both administrative and academic. Students complaining of difficulties of access can have problems resolved there and then, and be encouraged to move on in their use of both VLE and the web to support their reading and analysis. Formative feedback can be offered in class or outside to students who are encouraged to upload and share presentations on work in progress towards academic assignments. While all these things can happen effectively online, in a blended design it is vital to demonstrate these activities in class, with the teacher prepared to show effective learning approaches and openness in the face of new information and perspectives.

Demonstrating effective e-learning behaviours can draw on studies such as Greener 2007 to determine what students might need to see “e-modelled” by the teacher. The table below shows the results of this study in terms of ideas on appropriate behaviours and debates from respondents interviewed:

**Table 1: Results of this study**

<table>
<thead>
<tr>
<th>Behaviours or debates for online skills development in HE</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Appropriate and alternative vocabularies</td>
<td>Debate use of language in the subject studied and how this affects web searching</td>
</tr>
<tr>
<td>2. Knowledge of search tools</td>
<td>Academic resource searching online (how to use online literature databases, portals, how to find and use online journals)</td>
</tr>
<tr>
<td>3. Evaluation of information</td>
<td>Once arrived at academic resources online, how to judge their quality and relevance to the search topic, (and how to do this for non-academic but relevant websites), how to cut down on less relevant information, how to store and retrieve web pages and documents on personal media</td>
</tr>
<tr>
<td>4. Adopting personal reading strategies</td>
<td>Dealing with screen-reading versus printing issues</td>
</tr>
<tr>
<td>5. Referencing conventions</td>
<td>The institutional or publisher views on how to reference online sources</td>
</tr>
<tr>
<td>6. Presentation of academic writing online</td>
<td>Ground rules on academic writing online including a discussion of appropriate spelling and grammar rules such as texting language, use of emoticons, use of upper case, formatting, need for checking before submission, awareness of impact from lack of non-verbal cues.</td>
</tr>
<tr>
<td>7. Asynchronous discussion guidelines</td>
<td>Academic writing online in discussion boards for asynchronous debate (ground rules on content and length, how to attach documents, how to start new threads and respond to others, choosing appropriate threads to keep the board tidy, keeping messages simple and using multiple messages for separate ideas or contributions etc)</td>
</tr>
<tr>
<td>8. Blogging and journal writing for academic purposes</td>
<td>Academic writing online in weblogs, wikis or personal journals where these activities are enabled alongside or within the learning management system (course-relevant ground rules on what is and is not acceptable in personal comments, pictures, references to others, as well as frequency of contribution, making and responding to comments, maintaining shape and structure and the principles of reflective writing, how to organize and systematize reflection and distinctions between reflective and critical writing)</td>
</tr>
<tr>
<td>9. Social presence online</td>
<td>Group awareness online in order to use groups to set social rules, frequency of contribution and to use the group to solve problems, rather than try to do this individually, perhaps assigning roles (such as de Bono’s six hat thinking, or Belbin)</td>
</tr>
</tbody>
</table>
Behaviours or debates for online skills development in HE | Notes
--- | ---
10. Analysis and synthesis in online communication | Analysis online ensuring that students understand that description of experience, and sharing facts and sources are good practices but insufficient without analysis and synthesis of ideas presented. Encouraging the adoption of propositions, debate and précis online.
11. Self-directed learning online | Debating the concept of self-directed learning, its value, what behaviours are involved and demonstrating how online and physical resources can be used to develop thinking, add to and change impressions and ideas received from classroom sessions, and how this behaviour is valued in the academic course (relationship to learning outcomes and purpose). In particular, demonstrating the choice of activities and timelines available online and how these might be used according to personal priorities and learning approaches.
12. Synchronous discussion guidelines | Where synchronous discussion is used, how to use commands on screen, how to contribute and upload comments, how to keep track of discussions.
13. Adapting the virtual space | Personalising the virtual space, how to feel at home online without breaking university rules, using any tools provided to arrange the learning environment to suit study patterns, learning approaches and revision needs.

Such behaviours can be demonstrated, not just by doing things well in front of students, but sometimes being prepared to take risks and try new things, to build common ground with students who face such new activity and may frequently fail to get the instant returns they expect. Rather than do the same in front of students in class, the suggestion is that teachers, with whatever necessary preparation, role model such behaviours using projected screen, VLE and web tools, and compare them to more effective search and analysis strategies. Most teachers will have had to do this themselves in the course of developing modules and teaching, as well as in pursuit of scholarship. This means that by demonstrating these behaviours in class, rather than engaging in the mystical cult of the all-knowing lecturer, they can help learners to identify with an effective learning approach, answer student questions by searching online for answers with the class, rather than delivering an immediate answer and very probably learning more themselves, through student interaction, as a result. Modelling good presentation techniques in the classroom and lecture theatre has its place, but modelling learning, and learning using today’s opportunities afforded by technology, must be more helpful to students who need to become learning experts — not just to graduate, but also within their ongoing or future careers.

8. Conclusions

If we look back to Bourner’s aims for Higher Education, we find that working with an online environment in the classroom (for reference, genuine enquiry, demonstration, recording of interaction, as well as the more normal uses such as showing video, presentations and podcasts) becomes a teaching method well suited for many of the aims. These include the dissemination of up-to-date knowledge, through real-time information searching and discussion in class, as well as demonstrating how to use ideas and information, role modelling critical analysis of resources found or prepared, stimulating student creativity by engaging their combined efforts in class to guide searches and discussing outcomes, and role modelling approaches to learning based on a “learning” rather than a “content” orientation.

These ideas about using the web pro-actively in class are presented on the assumption that the teacher is prepared to appear open and perhaps vulnerable in class. That is, they are comfortable with not getting the right answer first time, valuing contributions found on the web (where there is genuine value) and not insisting on being the only person in control of what the students learn. What they are there to demonstrate is a valuing of learning processes, rather than a valuing of content. This clearly fits poorly with teaching conceptions which are knowledge or content focussed, so the strategy of using web technology in the classroom as a vehicle for learning, rather than as a static, controlled presentation medium may not be comfortable for all university teachers. However, it was suggested above that openness can be learned on the basis of improved confidence. Sometimes, this is a question of giving the student experience greater importance than the teacher experience in order to
produce the socially purposeful outcome of the able enquirer and critical thinker who is at home with evolving technology.

References

Measuring the Effectiveness of Educational Technology: what are we Attempting to Measure?

Jodie Jenkinson
University of Toronto at Mississauga, Canada
j.jenkinson@utoronto.ca

Abstract: In many academic areas, students’ success depends upon their ability to envision and manipulate complex multidimensional information spaces. Fields in which students struggle with mastering these types of representations include (but are by no means limited to) mathematics, science, medicine, and engineering. There has been some educational research examining the impact of incorporating multiple media modalities into curriculum specific to these disciplines. For example, both Richard Mayer (multimedia learning) and John Sweller (cognitive load) have contributed greatly to establishing theories describing the basic mechanisms of learning in a multimedia environment. However when we attempt to apply these theories to the evaluation of e-learning in a more dynamic “real world” context the information processing model that forms the basis of this research fails to capture the complex interactions that occur between the learner and the knowledge object. It is not surprising that studies examining the effectiveness of e-learning technology, particularly in the area of basic science, have reported mixed results. In part this may be due to the quality of the stimuli being assessed. This may also be explained by the context in which interactivity is being utilized and the model that is used to evaluate its effectiveness. Educational researchers have begun to identify a need for more fine-grained research studies that capture the subtleties of learners’ interactions with dynamic and interactive learning objects. In undergraduate medical and life science education, interactive technology has been integrated into the curriculum at many levels. This paper reviews experimental studies drawn from personal experience where an attempt has been made to measure the efficacy of educational technology. In examining the shortcomings of these more traditional experiments, we can then apply this understanding to characterizing a more flexible approach to evaluation and its potential in measuring the effectiveness of educational technology. Understanding the nature of technology-mediated learning interactions and the way in which they foster depth of understanding is a great challenge for both educational researchers and developers of e-learning technologies. By adopting an evaluative framework that takes a more flexible approach to measuring the emergent nature of understanding, we can examine the capacity of educational technology to support more complex understanding of curricular subject matter.

Keywords: science, e-learning, educational technology, evaluation, multimedia

1. Introduction

With the emergence of innovative electronic teaching and learning tools, technology has radically altered the surface of the educational landscape. From simply mining the Web for information, to engaging in simulated experiences, we increasingly situate educational technology as the driving force in learning. As we continue to integrate technology into teaching practice, we struggle with understanding the true value of these various media modalities in learning. Educational technology is a somewhat generic term that describes both the study and process by which technology may be used to advance learning. Scardamalia (2006) describes three distinct areas of technology that have potential implications for contributing to depth of understanding. These include: 1) Computer-assisted instruction (CAI); 2) Simulations, games, and laboratory instruments; and 3) Technology to support discourse. In particular, the use of CAI to complement traditional teaching has become a common feature of post-secondary education. However, the degree to which current uses of technology-assisted instruction contribute to deep understanding, has oftentimes proved difficult to measure.

There has been some educational research examining the impact of incorporating multiple media modalities into curriculum. In particular, Richard Mayer (1991, 1998, 1999, 2003) has contributed to establishing a cognitive theory of multimedia learning, which builds upon assumptions of how individuals learn. Firstly, Mayer asserts Paivio’s theory (1983) of dual coding, one that postulates humans possess separate channels for processing visual and auditory information. Secondly, Mayer notes that humans have a limited capacity for the amount of information that each channel can process at one time. Lastly, he asserts that individuals learn by active engagement with cognitive processes, such as the selection, organization and integration of information (sensory memory, working memory, and long-term memory). Mayer’s cognitive theory of multimedia learning addresses both the strengths and limitations of human perception and cognition is closely linked to John Sweller’s (1988) cognitive load theory. Sweller describes the limitations of working memory and devises instructional techniques to facilitate the acquisition of knowledge in long-term memory.
Cognitive load theory provides a framework for instructional design by distinguishing between 3 types of cognitive load (intrinsic, extraneous, and germane) and their association with learning. Intrinsic cognitive load has been described by Sweller and Chandler (1994) as arising from the interaction between the learning material and the expertise of the learner. Extraneous load is the cognitive load that extends beyond the intrinsic, and germane cognitive load is the load devoted to processes related to the construction and automation of schemas (Sweller, Van Merriënboer, and Paas, 1998). While intrinsic load is fixed, extraneous load and germane load may be directly impacted upon by instructional design (Paas, Ayres, and Pachman, 2008). Hence, experiments measuring cognitive load are often used to evaluate the success (or failure) of technology in reaching its audience. Both Mayer and Sweller’s research have contributed greatly to establishing theories describing the basic mechanisms of learning in a multimedia environment. However, when we attempt to apply these theories to the evaluation of multimedia in a more dynamic “real world” context, the information processing model that forms the basis of this research, and the traditional methods of measurement, both fail to capture the complex interactions that occur between the learner and the subject matter.

2. Evaluating interactive media

2.1 How are we measuring the effects of interactive media?

In a research paradigm that attempts to measure change, the gold standard is the experimental design model. Accordingly, the evaluation of educational technology involves the randomization of students into one of 2 treatment groups: control and experimental. Measurement in the form of a pre-test establishes a baseline for evaluating the efficacy of the tool. Students are exposed to the intervention and this is followed by a post-test. Any significant change between pre and post is reported and attributed to the intervention. Certainly this is a model with which we are all familiar and within which many of us have conducted research with varying degrees of success. Those who argue in favour of a quantitative approach to evaluating educational technology do so on the grounds that it produces reliable and ecologically valid results that are readily generalisable. Proponents of a qualitative approach to evaluating educational technology, would argue that qualitative methodology is a more sensitive form of measurement; one that generates richer, more meaningful results. This is certainly not a new argument. As Oliver (2000) notes, the ‘paradigm debate’ is perhaps one of the longest running discussions within the evaluation community. It is true that there are advantages and disadvantages associated with either research paradigm. Neither has been successful in arguing its merits over the other. Robinson and Schraw (2008) identify the need for “quality research” in e-learning, citing a number of scientifically-based research studies that make unsupported claims about the benefits of e-learning. Many of these claims arise from flawed experimental design, erroneous or non-statistically significant effect-size comparisons, or purely subjective measures. Similarly Reeves (2007) is critical of the abundance of “one-off” quasi-experimental studies that are not linked to any particular research agenda. However the problem of evaluation is not limited to the mismeasure (either qualitative or quantitative) of e-learning. At the crux of this debate is a question (one that is too often overlooked) of precisely what it is that we are attempting to measure when we evaluate educational technology?

2.2 What are we measuring?

Typically, studies measuring the impact of educational technology are examining either the efficacy of the tool in teaching students, or the end-user’s interaction with the system. Whereas efficacy is generally measured in terms of knowledge gain, usability studies are concerned primarily with the functionality of the device, regardless of whether or not learning objectives are being met. There is much research spanning a number of disciplines that examines successful approaches to measuring usability. Our attention here will be on the measurement of knowledge and understanding.

When initially we set out to evaluate the impact of technology upon learning, more often than not we are attempting to compare the benefits of a technological innovation with traditional pedagogy. Success of the technology is measured in terms of student performance, as demonstrated by tests assessing factual recall and knowledge of basic concepts. While it seems reasonable to assume that this is an accurate indicator of success, it often fails to tell us a great deal about the student’s interaction with the learning tool. In other words, while it may tell us what new knowledge is being learned, it tells us nothing of how new knowledge has developed. Furthermore, traditional assessments frequently fail to detect a significant difference between treatments. It may be that in such cases there truly is no difference, and that as Clark (1994) once suggested, the media has little
to do with learning outcomes. Or, it can be argued that media does play a role in learning and that we're just asking the wrong questions.

This problem of assessment is not limited to studies comparing traditional teaching methods with technology-enhanced teaching. Technology-to-technology comparisons are similarly difficult to assess and are plagued by a history of no significant differences (Reeves, 2007). Multimedia environments tend to be highly complex, containing a number of interacting variables. This poses a significant challenge when one attempts to assess the impact of educational technology upon learning. The standard approach to managing this complexity is to strictly control the manipulations to the variables being compared. For example, in two related studies (Jenkinson et al., 2007; Stewart et al., 2008) examining the effects of varied media modalities upon students understanding of dynamic processes, 154 first-year biology students were exposed to two e-learning modules, one of which contained animated graphics and the other containing static graphics. In every other respect the programs were identical. The purpose of this study was to identify whether animation was more effective than static graphics at teaching neurotransmitter release. A subsequent study (n=65) compared the efficacy of animated media with interactive media in teaching the same dynamic processes (both are illustrated in Figure 1). Both studies followed a structure that included pre-test, followed by time-limited exposure to one of 2 treatments, and then post-test. Neither experiment detected a significant difference between treatments (that isn’t to say that we didn’t see differences in the data; those differences were just not measurably significant). Interestingly, while the quantitative data failed to yield significant results, qualitative data (feedback forms and focus group evaluation) showed remarkable perceived differences in students’ perception of the effectiveness of the media with which they engaged. Unfortunately, our research methods were not tightly integrated enough to explain this discrepancy. Similar studies examining factors such as timeline pacing in animated media (Visscher et al., 2009), and the placement of embedded self-examination within animated media have correspondingly demonstrated no difference in treatment effect, but measurable differences in user perceptions (Lui et al., 2006). While the results of these studies would suggest that media modality does not influence learning, there is evidence in the literature suggesting, to the contrary, that it does have a positive impact upon learning (reviewed in Anglin et al., 2004; Hidrio and Jamet, 2008; Ainsworth, 2008; Tasker and Dalton, 2008).

In another example, a study measuring the efficacy of a three-dimensional model in teaching functional human anatomy to undergraduate students (n=80), comparisons are made between static cardinal anatomical views and a fully rotational model of the pterygopalatine fossa (Kryski, 2008; illustrated in Figure 2).
While this particular study failed to demonstrate a significant difference between treatments, similar studies examining the effectiveness of interactive 3D models in the study of anatomy have reported significant, but mixed results (Garg et al., 2002; Luursema et al., 2006; Nicholson et al., 2006). As with the findings associated with animated two-dimensional media, the findings reported by these studies are not surprising. In part this may be due to the quality of the stimuli being assessed. This may also be explained by the context in which interactivity is being utilized and the model that is used to evaluate its effectiveness. For example, in a study of a computer-based 3D model of the carpal bones of the hand, Garg et al. (2002) concluded that computer-based, manipulable, three-dimensional models are no more effective than static views in teaching complex spatial anatomy (in some cases they may even detract from learning). This is attributed to students’ tendency to gather important spatial information from several key views only. Thus, time spent studying non-essential oblique views effectively reduced students’ learning time. As the authors note, however, given the arrangement of the carpal bones (they naturally lie in two planes and lend themselves readily to two-dimensional representation), the object of study might not have been appropriate. In other words, the viewer gains very little new information about the carpal bones from side or oblique views. In this particular case it would appear as though the selected media modality (3-dimensional rotational model) is poorly matched with the learning objective (understanding the 2-dimensional planar arrangement of structures). As well, it may be that the data collection method (experimental design incorporating pre/post multiple choice tests) did not capture adequately how the students were learning from the interactive model.

3. A more flexible approach to assessment

In our efforts to measure the efficacy of educational technology it would appear as though we are at times sacrificing an opportunity to explore understanding in a more meaningful way, in favour of more replicable, generalisable results. To reiterate a concern expressed in the previous section of this paper, while this model of evaluation may tell us what new knowledge is learned by students, it fails to describe the transformative process by which new knowledge develops, and the factors involved in supporting and sustaining this change. If we are to create truly rich interactive experiences, we need to attend more closely to the contents of the ‘black box’ that is understanding. It is important that we distinguish between knowledge and understanding, and recognize that while knowledge may be more readily captured with traditional methods of evaluation, understanding, given its emergent nature, is more elusive.
3.1 Asking the right questions

Researchers in education (Ploetzner and Lowe, 2004; Ainsworth, 2008) have begun to identify a need for more fine-grained research studies that capture the subtleties of learners' interactions with dynamic and interactive tools. Shaaron Ainsworth (2008) has remarked that while some “first generation” experiments have been successful in producing robust and replicable results they fail to answer four important questions: 1) Who benefits from learning with (specific forms of) multimedia?; 2) How do people learn with multimedia?; 3) How does learning with multimedia change over time?; and 4) How does the wider context influence learning with multimedia? In order to answer these questions and capture the process by which learners interact with multimedia Ainsworth suggests that we should explore different, perhaps more flexible forms of evaluation design.

Robson's (2002) discussion of 'real world' research is an informative introduction to flexible research design in applied settings. Temporal and contextual factors, and questions such as who learns, and how we learn may be addressed using a mixed methods approach that combines quantitative research with qualitative data collection techniques such as ethnography, case study, phenomenology, cognitive task analysis, or microgenetic evaluation. For example, in a study examining how students interact with user-controllable animations while engaging in learning tasks, Lowe (2008) describes the effective use of combined qualitative and quantitative data sets that tightly integrate concurrent and retrospective verbalisations. “Think-aloud” protocols have proven very effective in eliciting user response to interactive systems, and in identifying important aspects of the novice-expertise continuum. Educational psychologists, perhaps most notably Siegler (see Siegler and Crowley, 1991) have used microgenetic methods for a number of years in examining the mechanisms that produce change. Microgenetic data sampling involves making a high rate of observations relative to the rate of change. It is an effective means of measuring change while it is occurring rather than examining pre- and post-change effects. More recent approaches to evaluation have combined these techniques with measurements of physiological changes (such as brain or eye activity). Eye tracking, for example, is used to index eye movements that occur when an individual is exposed to different visual environments (often while the user is completing a task). It is frequently used in combination with concurrent or retrospective verbal protocols. Eye tracking is well suited to providing a detailed account of attentional processes elicited by various multimedia representations, and possibly helping to explain how known learning effects (such as split-attention, or goal specificity) occur (Van Gog and Scheiter, 2009). Eye tracking has also been used effectively to compare novice and expert interactions with multimedia (Jarodzka et al., 2009; Van Gog, Paas, and Van Merriënboer, 2005). The various data collection methods that have been described here are suggested as possible means of accessing the proverbial black box. They are by no means a panacea for understanding the complex interactions of learners with educational technology. The sheer richness and dimensionality of that experience is what makes it so difficult to assess.

The question of how to assess would appear to be two-fold: 1) How can we measure the impact of technology-mediated instruction in a way that is sensitive enough to detect the its role in fostering understanding?; and 2) How can we do this is in a way that is both reliable, valid, and to some extent transferable? The point of this discussion is not to suggest that we abandon quantitative research methods but rather, that we thoughtfully integrate multiple methodologies and data sources in evaluating educational technology. Complementary exploratory, and experimental studies are necessary to characterize the learning that occurs as a result of complex interaction with educational technology.

3.2 Characterising flexible design

In proposing that we take a more integrative or flexible approach to evaluating educational technology, the suggestion here is that we adopt a research paradigm that sits somewhere between traditional randomized trials and qualitative research, affording reiteration and revision of measures as necessary in order to better understand the learning situation. Vicente (1999, 2004) has suggested that, in order to capture the dynamics of the human-technology relationship, we need to think of that relationship as a system, to be examined holistically. He further points out that this relationship is not a physical property of the system, but rather an emergent property, “a gestalt, which only comes into existence when the parts it comprises are brought together and configured in a particular way” (2004, p. 46). Capturing the emergent nature of that relationship, in order that we might answer these questions, demands a multi-faceted learner-centred approach to evaluation; one involving a range of methods and measures.
One such methodology, that is gaining popularity, is design-based research (Brown, 1992; Collins, 1992). Learning scientists engaged in design experiments would describe this research model as an extended and refined process of investigation based upon principles derived from prior research (Collins, Joseph, and Bielaczyc, 2004; Confrey, 2006). Whereas the goal of structured laboratory studies is to control for single variables, design-based research attempts to describe the system as a set of interdependent elements, recognizing that the system in which learning naturally occurs is, for lack of a better term, messy. Critics of design research argue that, at best, it can provide formative insights that must then be tested through more controlled experimentation (Barab, 2006). Critics argue further that design research is not a structured methodology but rather a loose collection of methods (Kelly, 2004), neither replicable, nor generalizable. These are legitimate claims, for design research is an emergent theoretical practice. That said, there is still a great deal we can learn from this perspective about recognizing the limitations of traditional methods and acknowledging the need for more integrative measures that are more successful at describing the impact of educational technology upon learning when situated in practice. In contrast to experimental studies, readily carried out with many participants in a controlled laboratory setting, research examining learning interactions most often requires intensive, fine-grained, high-frequency repeated assessment. These studies are time-consuming and difficult to carry out. As well, the nature of inquiry often demands that the researcher become part of the process. This further complicates matters, as traditionally such involvement would be seen as confounding the assessment process. However, within an evaluative framework that bases itself upon the premise that learning is a complex, dynamic, non-linear process, this involvement is seen as an inevitable, and therefore necessary element of inquiry (Jörg, Davis, and Nickmans, 2007). As Reeves (2007) notes, the advantage of such a research paradigm is that it invites collaboration between researchers and practitioners in the identification of teaching and learning challenges, and the creation, testing, and refinement of solutions. For too long we have developed and lab-tested innovative e-learning tools, which are subsequently inserted into the classroom without an adequate understanding of the context in which the tool is used.

4. Conclusion

Given the multimodal nature of interactive technology, it has a tremendous potential to support a variety of relationships and introduce new learning perspectives into students’ understanding of complex subject matter. Examining the nature of these interactions and the way in which they foster depth of understanding is crucial to an appreciation of the role educational technology plays in learning. It demands an understanding of how to best support student learning in an integrated, holistic way, and how to leverage technology to support this process; which, in turn, demands of us that we develop evaluative tools capable of capturing the learning process that occurs when students interact with technology. Reeves (2007) has suggested that as educational technologists we may need to rethink our view of the field as a “science”. Rather, if we accept that educational technology is first and foremost a design field then we can frame related inquiry with that perspective in mind. As a design field the goal of educational technology can shift from an experimental model to a more iterative model aimed at deriving design principles to inform future development and implementation of multimedia tools. From a learning perspective, by adopting an evaluative framework that takes a more flexible approach to measuring more meaningful learning effects associated with multimedia environments, we can examine the capacity of these environments to support more complex involvement with the learning material. We might then leverage technology to deepen understanding, by focussing less on knowledge outcomes and increasingly on the process by which understanding develops.

Acknowledgements

I am greatly indebted to my colleagues in Biomedical Communications at University of Toronto. In particular I would like to thank Professor Linda Wilson-Pauwels, former graduate student Diana Kryski, as well as Teddy Cameron (Discovery Commons) for their contributions to this paper. In addition I would like to acknowledge the significant contributions of my colleagues in Anatomy, Professor Mike Wiley, Chair of Anatomy, and Professor Emerita Patricia Stewart for their ongoing support and investment in research examining the impact of educational technology. Finally, I would like to thank Professor Earl Woodruff, Associate Chair of Human Development and Applied Psychology at the Ontario Institute for Studies in Education, my mentor in all things related to understanding.
References


Eating Your Lectures and Having Them too: is Online Lecture Availability Especially Helpful in “Skills-Based” Courses?

Steve Joordens, Ada Le, Raymond Grinnell and Sophie Chrysostomou
University of Toronto Scarborough, Canada
Joordens@utsc.utoronto.ca
M155adale@gmail.com
Grinnell@utsc.utoronto.ca
Chrysostomou@utsc.utoronto.ca

Abstract: At the University of Toronto Scarborough, we provide enhanced flexibility to our students using a blended learning approach (i.e., the webOption) whereby classes are videotaped as they are offered in a traditional manner, then posted online for subsequent student access. Students can attend lectures live, watch them online at their convenience, or both. Previous research examining the webOption in the context of Introductory Psychology revealed that (a) students were satisfied with the webOption in general, (b) students used and appreciated the pause and seek features afforded by the webOption interface, and (c) those who used the pause and seek features performed slightly better on exams (Bassili & Joordens, 2008). The current research examines similar issues in the context of two mathematics courses. These courses differ from the lecture-based Introductory Psychology class in their emphasis on the teaching of mathematical proofs; cognitive skills that, like any other skill, are enhanced with practice (Schneider & Shiffrin, 1977). Access to online lectures allows students to re-experience the professor as they teach these skills. Given this, the webOption might be especially potent in these learning contexts. Surprisingly, the results we report here do not confirm that prediction. Students do use and appreciate the features of the webOption as was the case in our previous work, but those students who augmented their class attendance with online viewing, and those who used the lecture-control features the most, were actually the students who performed most poorly. Said another way, those students who had the most trouble with the course did indeed use the webOption as a way of understanding the material better but, interestingly, doing so did not result in better performance. Several possible reasons for this surprising result are considered.

Keywords: online lectures, webOption, calculus, performance, surface versus deep learning

1. Introduction

You can eat your cake and have it too. That notion of consuming something, and yet not losing it for future consumption, is impossible when it comes to food. However, it is not impossible when it comes to lectures (e.g., Halper, Kelly & Chuang, 2007). It is relatively trivial to tape lectures as they are presented, then making them available online for subsequent student access, a form of blended-learning that we at the University of Toronto Scarborough refer to as the webOption. This approach allows students the flexibility of attending lectures live, watching them online after the lecture, or of consuming the lecture live yet having it too.

In the remainder of this introduction we describe the webOption process with some background, present previously published research findings based on it, and then introduce the primary question of the current work; Does continued access to an online version of in-class lectures provide an especially potent tool for students in courses that emphasize cognitive skills as opposed to those that emphasize concepts?

We have offered webOptioned courses at the University of Toronto Scarborough for over 6 years, and have conducted research examining student satisfaction and performance since our first use (e.g., Bassili & Joordens, 2008). Our goal is not to replace traditional lectures but, rather, to augment them by providing students enhanced flexibility. Thus, lectures are presented as they normally would be with the following additions. As the professor lectures they are taped by a videographer using a standard tripod mounted video camera. A wireless microphone system is used to transmit the audio directly to the video camera. The videographer attempts to capture the classroom experience to the best of their ability, focusing the camera on whatever aspect of the lecture seems most critical to learning. The resulting videos are captured and compressed into realmedia format, then posted on the web typically on the same day. Six years ago we offered only our Introductory Psychology
courses in this way, but the popularity of the webOption is continually growing to the point where we offered 17 webOption courses in Winter 2009, and 25 courses in the Fall 2009 term.

Our initial research was conducted in the context of our Introductory Psychology courses, courses that focus primarily on teaching students the theories, definitions, experiments and perspectives that form the field. For contrast, we will frame this sort of course as one that focuses on the communication of concepts rather than cognitive skills. It is clearly the case that most courses involve the communication of both concepts and skills, and we do not mean to imply that any course focuses exclusively on one or the other. But relative to the mathematics courses that will provide the context for the current work, it is fair to say that Introductory Psychology involves less emphasis on learning procedural skills of the sort needed to solve mathematical problems.

The findings from our previous research showed that students were satisfied by our implementation, a result bolstered by their loudly voiced desire to have more courses provided in this manner (Bassili & Joordens, 2008). Replicating previous work (e.g., Robertson, Wilson, Cetto and Pardo-Ballester 2008), overall performance did not differ depending on whether students experienced lectures online or in class. However, when students watched online they made extensive use of the pause and seek functions provided by the media player, essentially taking control of the rate of information presentation. Most intriguing, usage of these features was positively correlated with exam performance such that those who used these features more scored higher on a high-stakes exam. This result is consistent with the notion that the extent to which online learning might be beneficial depends critically on how much students interact with the online content (Davies & Martin, 2005).

Subsequent research on the webOption has been primarily concerned with what underlies student decisions to attend lectures or watch them online. For example, Bassili (2008a) showed that attitudes concerning whether students liked the option of having online lectures were predicted by motivational orientations, whereas the actual choice to attend lectures or watch them online was related to students' cognitive strategies. In addition, Bassili (2008b) showed that students' perceptions of media richness also predicted their tendencies to attend class or watch online, and that students were especially likely to attend classes when they perceived the content to be difficult.

However, the current work is most related to the original work by Bassili and Joordens (2008), assessing whether the performance advantage they documented might be especially potent in the context of mathematics. While there has been some previous research assessing tools that attempt to augment mathematics via online assignments (e.g., Carter, 2003; Kennedy, 1990; Kennedy, Ellis, Oien & Benoit, 2007), it appears that nobody has yet examined the effects of simply making lectures available after the traditional lecture has been presented. As mentioned previously, a correlation between use of the mediaplayer features and performance on a high stakes exam was observed in the context of Introductory Psychology, but those correlations were modest with Pearson r values in the 0.10 to 0.13 range. It seemed entirely plausible that the ability to pause or seek lectures, while clearly useful in the context of Introductory Psychology, might be even more valuable in the context of mathematics courses.

Mathematics courses, and especially the calculus courses we examine here, are notoriously difficult for many students (see Doorman & van Maanen, 2008; Pettersson & Scheja, 2008). This difficulty stems from several sources. First, students must keep up with the material as work tends to build incrementally. Having access to previous lectures should allow students to never miss a lecture, and to return to lectures they saw but perhaps forgot or never really understood. Second, the classes have a much larger emphasis on the deep learning of specific cognitive skills (Biggs, Kember, & Leung, 2001), the skills relevant to mathematics proofs. Typically these skills are demonstrated in class and then practiced by the students outside of class. If a student forgets some step between the presentation and the practice, they could encounter real problems. Having access to the lectures allows students to virtually return to the classroom and watch the demonstration again, perhaps with their homework problems in hand. These two issues alone suggest that the webOption approach might be especially beneficial to students in the context of challenging mathematics.

As every researcher knows, and as this paper will demonstrate, intuitions are only as strong as the data they predict. Given this, the purpose of the current work was to assess the impact of implementing the webOption in the context of two courses; Calculus I (MATA30) and Calculus for
Management I (MATA32). By performing the same study in two different classes we were also able to assess the reliability of the results.

2. Study

2.1 Method

2.1.1 Enrollment and participants

Participants in the study were enrolled in our MATA30 and MATA32 classes. Near the end of the term students were informed that we were performing research on their usage and satisfaction with the webOption, and they were invited to fill out an online survey. To motivate participation we had draws for iPod music players, with students informed that their name would be entered in the draw if they filled out the survey. For ethical reasons, the professors of the respective courses were not informed which students participated, and no component of the class was in any way linked to participation. Confidentiality was strictly maintained.

2.1.2 Materials

Lectures were made available online by capturing them in class on videotape and by uploading a compressed digital video file to a server where they could be accessed by means of streaming video in realplayer format. Pilot research has demonstrated that students find the quality of the video image and of the sound satisfactory (Bassili & Joordens, 2003).

2.1.3 Procedure and measures

Students viewed the lectures using the free version of realplayer. Like most media players, realplayer offers the ability to pause the media, and to navigate forward and backward through it via a seek bar. Our research will consider how often students choose to watch lectures via this medium, which features they used and how often, why they used the features, and whether using the features lead to a performance advantage. We obtained this data via an online survey containing 50 questions, a subset of questions used by Bassili and Joordens (2008) augmented by some questions especially related to mathematics. In this paper we focus primarily on the questions highlighted by Bassili and Joordens in order to compare findings across the Psychology versus Mathematics contexts.

2.2 Results

Table 1 provides a breakdown of students’ responses with respect to how many lectures they attended, viewed online, attended and viewed online, or missed completely. Across 4 questions they were asked to estimate the number of lectures they experienced in each format using the categories indicated in Table 1. There were 24 lectures in total during the fall term. As the data suggest, over 50% of the students attended over half of the lectures even when the online lecture option is available. The online lectures are also being heavily utilized with over 40% of the students watching at least half of the lectures online. Students sometimes attend and watch lectures online, but most do so for only a small percentage of classes. Less that 10% of students both attend and watch more than half of the lectures online. These patterns seem relatively stable across the two math courses.

Table 1: Breakdown of number of lectures attended, viewed online, both, or neither expressed as the percentage of students within each response category

<table>
<thead>
<tr>
<th></th>
<th>Attended</th>
<th>Online</th>
<th>Both</th>
<th>Neither</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATA30</strong></td>
<td>n = 196</td>
<td>196</td>
<td>196</td>
<td>196</td>
</tr>
<tr>
<td>None</td>
<td>6.1</td>
<td>2.6</td>
<td>49.0</td>
<td>71.9</td>
</tr>
<tr>
<td>1-5</td>
<td>17.9</td>
<td>32.1</td>
<td>32.1</td>
<td>25.0</td>
</tr>
<tr>
<td>6-10</td>
<td>10.7</td>
<td>13.3</td>
<td>9.7</td>
<td>2.0</td>
</tr>
<tr>
<td>11-15</td>
<td>14.3</td>
<td>13.3</td>
<td>5.6</td>
<td>0.0</td>
</tr>
<tr>
<td>16-20</td>
<td>17.3</td>
<td>15.3</td>
<td>2.0</td>
<td>0.5</td>
</tr>
<tr>
<td>21-24</td>
<td>1809</td>
<td>11.7</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>All</td>
<td>14.8</td>
<td>11.7</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>MATA32</strong></td>
<td>n = 292</td>
<td>292</td>
<td>292</td>
<td>292</td>
</tr>
<tr>
<td>None</td>
<td>1.4</td>
<td>4.8</td>
<td>46.8</td>
<td>76.7</td>
</tr>
<tr>
<td>1-5</td>
<td>8.6</td>
<td>4.06</td>
<td>33.1</td>
<td>20.2</td>
</tr>
<tr>
<td>6-10</td>
<td>10.3</td>
<td>17.1</td>
<td>7.2</td>
<td>1.0</td>
</tr>
<tr>
<td>11-15</td>
<td>13.0</td>
<td>15.7</td>
<td>5.8</td>
<td>0.7</td>
</tr>
</tbody>
</table>
As presented in Table 2, there were also some expected correlations with respect to how students viewed the lectures. Those students more likely to attend lectures were less likely to watch online, $r(490) = -.64$, $p < .001$, but were more likely to both attend and watch online, $r(490) = .31$, $p < .001$. Those more likely to watch lectures online were also more likely to both attend and watch online, $r(490) = .26$, $p < .001$. Given that doing both requires one to both attend and watch online, these last two correlations are hardly surprising. However, the relatively strong negative correlation between attending versus watching online does suggest that most students prefer doing one or the other.

Table 2: Correlations with among responses, and with final grade

<table>
<thead>
<tr>
<th>Pause</th>
<th>Seek</th>
<th>Attended</th>
<th>Online</th>
<th>Both</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>MGTA30</td>
<td>.24**</td>
<td>-.06</td>
<td>.15*</td>
<td>.13</td>
<td>-.17*</td>
</tr>
<tr>
<td>MGTA32</td>
<td>.45**</td>
<td>-.01</td>
<td>.07</td>
<td>.13*</td>
<td>-.08</td>
</tr>
<tr>
<td>Combined</td>
<td>.38**</td>
<td>-.03</td>
<td>.10*</td>
<td>.13*</td>
<td>-.11*</td>
</tr>
<tr>
<td>Seek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGTA30</td>
<td></td>
<td>-.05</td>
<td>.07</td>
<td>.06</td>
<td>.00</td>
</tr>
<tr>
<td>MGTA32</td>
<td></td>
<td>-.07</td>
<td>.11</td>
<td>.08</td>
<td>.07</td>
</tr>
<tr>
<td>Combined</td>
<td></td>
<td>-.04</td>
<td>.08</td>
<td>.08</td>
<td>.05</td>
</tr>
<tr>
<td>Attended</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGTA30</td>
<td></td>
<td></td>
<td>-.74**</td>
<td>.35**</td>
<td>-.03</td>
</tr>
<tr>
<td>MGTA32</td>
<td></td>
<td></td>
<td>-.53**</td>
<td>.29**</td>
<td>-.09</td>
</tr>
<tr>
<td>Combined</td>
<td></td>
<td></td>
<td>-.64**</td>
<td>.31**</td>
<td>-.04</td>
</tr>
<tr>
<td>Online</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGTA30</td>
<td></td>
<td></td>
<td>.08</td>
<td></td>
<td>-.08</td>
</tr>
<tr>
<td>MGTA32</td>
<td></td>
<td></td>
<td>.40**</td>
<td></td>
<td>-.04</td>
</tr>
<tr>
<td>Combined</td>
<td></td>
<td></td>
<td>.26**</td>
<td></td>
<td>-.07</td>
</tr>
<tr>
<td>Both</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGTA30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.33**</td>
</tr>
<tr>
<td>MGTA32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.19**</td>
</tr>
<tr>
<td>Combined</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.22**</td>
</tr>
</tbody>
</table>

When students watch online they utilize the features provided by the media player. Descriptive statistics concerning mediaplayer usage are presented in Table 3, alongside previously published findings for Introductory Psychology (PSYA01). Students clearly use the pause and seek features extensively; even more so in the mathematics courses than they did in the psychology course. Approximately 77% of the students in the mathematics courses would pause lectures at least once per lecture, and over 52% would use the seek bar at least once per lecture. Pausing was used primarily to take notes, or to consult the instructor’s notes, whereas the seek function was used primarily to revisit parts of the lecture. This high level of feature usage suggests that students perceive them to be valuable in terms of allowing control over the information flow from lectures.

Table 3: Percentage of students (total responses in parentheses) who indicated the specified reason for using the specified mediaplayer function

<table>
<thead>
<tr>
<th>Overall use of Pause</th>
<th>MATA30</th>
<th>MATA32</th>
<th>PSYA01</th>
</tr>
</thead>
<tbody>
<tr>
<td>To write notes</td>
<td>76.5</td>
<td>71.2</td>
<td>46.7</td>
</tr>
<tr>
<td>Consult the textbook</td>
<td>31.6</td>
<td>27.7</td>
<td></td>
</tr>
<tr>
<td>Consult classmates</td>
<td>1.0</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Take a break</td>
<td>63.3</td>
<td>52.7</td>
<td>43.0</td>
</tr>
<tr>
<td>Read instructor</td>
<td>50.5</td>
<td>59.6</td>
<td></td>
</tr>
</tbody>
</table>
Use of the pause and seek functions was positively correlated for both MATA30, \( r(196) = .24, p < .001 \), and MATA32, \( r(292) = .45, p < .001 \). Thus, as was observed in PSYA01 \( r = .28 \), those who utilize one of the features are also more likely to utilize the other. That said, the correlations remain relatively modest, suggesting that some students use one of the features more heavily than the other. In addition, use of the pause features was positively correlated with a tendency to either watch lectures online, \( r(490) = .10, p < .001 \), or to both attend and watch online, \( r(490) = .13, p < .001 \). Given that these features are only provided in the online environment, these correlations are expected. All of the above suggests that students are utilizing the online lectures when they are made available, and that they also utilize the unique features provided within the media player.

This leads us to the primary issue: do students who use the online lectures and the features of the interface achieve better performance? As an initial analysis we correlated the various indicators described above with students’ final grade in the class. Recall that our previous research in the context of Introductory Psychology produced a modest positive correlation between use of the pause and seek features and performance on a high stakes exam, and we expected perhaps stronger correlations here. The relevant correlations are presented in the rightmost column of Table 2.

The surprising result is that while final grades in the course were unrelated to most variables, they were negatively related to use of the pause feature, \( r(490) = -.11, p < .001 \), and also to the tendency to both attend and watch lectures online, \( r(490) = -.22, p < .001 \). That is, opposite to our previous findings in Introductory Psychology, reliance on the media-player functions, and the tendency to both attend and watch lectures online, was associated with worse performance in the course.

One possible explanation of this surprising result revolves around what might be called student-specific characteristics. Most students find mathematics challenging, but some find it downright impossible. Perhaps there are students who simply cannot grasp concepts, and hence end up with low final marks, but their performance does not reflect a lack of trying. That is, perhaps these students know how challenging they find mathematical concepts and thus they show the highest tendency to both attend classes and watch online, and the highest tendency to pause lectures often to take it in slowly, and yet still they do not get the concepts. If this possibility is correct, we would expect the negative correlations we observed to become less negative as we consider only higher performing students.

While plausible, subsequent analyses do not support this student-specific characteristics explanation. We examined three subsets of the data related to students who scored better than 50%, better than 60% and better than 70% respectively. The negative correlations observed in the data set were present for all subsets, and showed no indication of systematically changing in strength. In addition, all students had completed a diagnostic test of ability prior to taking these courses. When we partialed diagnostic test performance out of the correlations, the negative correlations between final performance and use of the pause button, \( r(476) = -.09, p < .06 \), and the tendency to both attend class and watch online, \( r(476) = -.19, p < .001 \), remained. Thus, these correlations do not arise from differences among students in terms of their general math abilities.

If the correlations do not reflect attributes of the students’ abilities, perhaps they reflect differences in learning strategies (Biggs et. al, 2001) that interact with course content. That is, it may be the case that some students approach learning by attempting to memorize concepts. Such students might be more likely to rely on the online lectures, pausing them often to take notes or remind themselves of concepts. Such a “surface” strategy might work well in the contexts where students are primarily learning definitions, theories, etc. as is more the case for courses like Introductory Psychology. But it could actually be a counterproductive in courses where one truly learns by working through novel

<table>
<thead>
<tr>
<th></th>
<th>MATA30</th>
<th>MATA32</th>
<th>PSYA01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall use of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seek</td>
<td>50.5 (196)</td>
<td>53.9 (293)</td>
<td>42.0 (205)</td>
</tr>
<tr>
<td>Rewatch lecture</td>
<td>78.1</td>
<td>73.0</td>
<td>62.9</td>
</tr>
<tr>
<td>Skip to future</td>
<td>36.2</td>
<td>42.3</td>
<td>10.8</td>
</tr>
<tr>
<td>location</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skip to future</td>
<td>36.2</td>
<td>42.3</td>
<td>10.8</td>
</tr>
<tr>
<td>location</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
problems, generalizing the examples in class to new situations. The students who attempt to memorize may feel like they are learning the class content, and they may be, but if the assessment focuses on deep learning and the ability to transfer cognitive skills, then knowing the lecture content may be insufficient.

2.3 General discussion
The current paper examined usage of online lectures, and the features they provide, in the context of two math courses. Of primary interest was the relation between feature usage and performance in the class. To our surprise, and in contrast with previous findings in the context of Introductory Psychology, students who both attended and watched lectures online, and those who pause online lectures frequently, actually performed worse in the course. We cannot be sure of the reason for these contrasting results, but we believe it is due to different learning strategies and the manner in which they interact with course content. In courses where students are primarily learning relatively shallow concepts and definitions, the ability to pause lectures may facilitate memorization strategies and result in better performance. However, in courses were students must learn, and learn to transfer, cognitive skills those who rely on memorization strategies may actually perform worse.

It would be a mistake, however, to view these findings as a reason to not provide access to online lectures in mathematics contexts. Many students did indeed utilize the online lectures, some watching over half of their lectures online. Clearly the presence of online lectures provides a great convenience to students and thereby enhances their satisfaction with the learning experience (Bassili & Joordens, 2008). In addition, it is not the case that those who watched lectures online performed generally more poorly; mode of lecture viewing (Online vs. Traditional) was unrelated to performance.

Instead, the primary message of this paper is that if left on their own devices, some students may utilize online lectures in a manner that is not beneficial to their learning. Specifically, they may be attempting to “understand” calculus by memorizing what occurred within the classes, a tendency that can be detected in the variables measured here (i.e., the tendency to both attend and watch online lectures, and the tendency to pause the online lectures often while viewing). In the absence of online lectures these students may nonetheless attempt such a surface learning strategy, but this tendency would remain unnoticed. The presence of online lectures may have provided a new tool to support the non-effective strategy, but it is the chosen strategy, not the tool, that is the primary problem.

This all leads us to the following recommendation. Providing access to online lectures in skills-based courses like calculus can provide flexibility and convenience, but students should instructed on how to use the online lectures to their benefit. They should not be pausing lectures in order to better memorize what happened in the class but, rather, they should be pausing with the intent of gaining a deeper understanding by applying what happened in the lecture to novel problems. Pausing should be used to go beyond the lecture, not further within it.

References


When Knowing More Means Knowing Less: Understanding the Impact of Computer Experience on e-Learning and e-Learning Outcomes

Lena Paulo Kushnir
University of Toronto, Canada
lena.paulo.kushnir@utoronto.ca

Abstract: Students often report feeling more overloaded in courses that use e-learning environments compared to traditional face-to-face courses that do not use such environments. Discussions here consider online design and organizational factors that might contribute to students' reports of information overload. It was predicted that certain online factors might contribute to stimulus overload and possibly students' perceived overload, rather than information overload per se. User characteristics and a range of design and organizational factors that might contribute to perceived overload are discussed and hypotheses of how such factors might affect learning outcomes are also discussed. An experiment was conducted to test predictions that (i) students’ past online experience, (ii) the organization and relevance of online information, and (iii) the level of task difficulty affect (i) learning outcomes, (ii) students’ perceptions of information overload, and (iii) students’ perceptions of having enough time to complete experimental tasks. A total of 187 participants were tested in four experimental conditions that manipulated the organization and relevance of online material that students had to learn (i.e., (i) a stimulus-low environment, where the material to be learned was presented as scrolling text, with no other stimuli present; (ii) a familiar environment, where the material to be learned was set within the borders of a familiar course Web site; (iii) a stimulus-rich or stimulus-noisy environment, where the material to be learned was set within the borders of an Amazon.com Web page (a Web site where you can search for, and buy books, videos and other products online); (iv) a PDF file environment, where the material to be learned was presented as a PDF file that resembled an online duplicate of the same material in the course textbook). Findings suggested that overly busy online environments that contain irrelevant information (i.e., stimulus-rich or stimulus-noisy online environment) had a negative impact on learning for students ranked “high” on experience with e-learning technologies, but no impact on learning for other students (as measured by a knowledge test of material studied during experimental sessions). There is no doubt that online environments contain vast amounts of information and stimuli; often some of which are irrelevant and distracting. How one handles irrelevant or distracting information and stimuli can have a significant impact on learning. Surprisingly, results here suggest that overload affected only experienced students. Perceptual load hypotheses are discussed to explain what initially seemed to be counterintuitive results. This paper examines literature that considers factors that can affect learning online, strategies for how teachers can ensure positive outcomes for the technology-based classroom, and strategies for avoiding online pitfalls that might leave students frustrated or burdened with feelings of overload.

Keywords: learning outcomes; overload; perceptual load; design and organizational factors of e-learning; interface design; instructional design; user experience; task difficulty

1. Introduction

A serious complaint often reported by students registered in courses using e-learning environments is that they are overloaded with vast amounts of information, and that they often feel more burdened in those courses compared to traditional face-to-face courses that do not use such environments (Harasim, 1987; Hiltz and Turoff, 1985; Hiltz and Wellman, 1997; Kushnir 2004). There is a substantial body of education research that describes a range of factors that can influence one’s perception of overload and educational outcomes for students using e-learning environments (for example, Carey & Kacmar, 1997; Carver et al., 1999; DeStefano & LeFevre, 2005; Franz, 1999; Hiltz, 1986; Hiltz & Turoff, 1985; Khalifa & Lam, 2002; Lee & Tedder, 2003; Reed & Giessler, 1995; Stanton & Barber, 1992; Yang, 2000; Zumbach, 2006.). Three factors considered in this paper to be “major component parts” of e-learning are (i) user characteristics, (ii) interface design, and (iii) instructional design. These three factors are viewed to be interacting components that make up e-learning environments and they can have many associated variables that likely interact with one another, and likely impact learners in many ways.

Figure 1 illustrates a model of sample variables associated with the three component parts of e-learning technologies discussed here. These components and associated variables are not viewed as a comprehensive model, rather the model simply represents a sample (of a wide-ranging list of variables that one could possibly generate) that might be particularly important for e-learning.
Discussions here focus on only three variables associated with the three component parts of e-learning technologies: (i) student’s experience with e-learning technologies, (ii) the organization and relevance of online information, and (iii) level of task difficulty. While each of the variables in Figure 1 was considered important for understanding e-learning, and while one could make an argument for a different set of equally important variables, these particular three were chosen because of their implications for understanding notions of overload as discussed here. Also, a review of the literature showed that these three variables had yet to be investigated empirically and systematically.

1.1 User characteristics

Certain user characteristics that are associated with using online education technologies might affect student performance in some online situations. For example, lacking certain skills or experience might put one at a disadvantage compared to students who do not lack those skills or experience. It is important to understand who the users of a particular system are and understand how their motivation (Stanton & Baber, 1992), individual learning styles (Kraus et al., 2001; Reed et al., 2000; Weller et al., 1995) and personalities (Hiltz, 1988) might affect successful e-learning.

1.1.1 Student’s online experience

It seems obvious that the incidence of overload in online education environments can be exacerbated if students lack certain characteristics and online behaviours. Consequently, learning might be adversely affected. For example, if students lack the technical skills required to participate, then they might be more susceptible to experiencing overload than those who do not lack such skills (Althaus, 1997; Hiltz & Turoff, 1985). Students’ level of experience can impact their ability to manage information, and as Reed et al. (2000) and Kraus et al. (2001) suggest, impact the way students approach and work with online material.

As with most other learned behaviours, practice probably “makes perfect” in online situations, and how students feel about working in online environments will likely change as their level of experience changes. Burge (1994) and Hiltz (1986) pointed out that novice users likely experience overload more often than experienced users because novices have to learn, simultaneously, the course material plus how to use the technology. The experienced user needs to focus only on the material to be learned.

1.2 Interface design

There are also variables related to the interface design of online environments that might affect one’s performance (variables such as the organization of information and the relevance of the information to learning). For example, Weller et al. (1995) demonstrated that hypermedia helped users with the
organization of information, while Dalal et al. (2000) suggested that many hypermedia systems lack coherence and, as a result, users feel disoriented. Brewster (1997) demonstrated that presenting information in such a way that it is processed by more than one sensory modality increased one’s capacity to process that information.

1.2.1 Organization and relevance of online information

The organization of e-learning environments can have a tremendous impact on learning. It might be that some online environments are unnecessarily cluttered with irrelevant stimuli and information, or it might be that the way in which relevant information is organized affects some learners. Kushnir (2004) suggested that overly busy e-learning environments that contain irrelevant information, are over-stimulating, distracting and can “clog up” valuable (cognitive) processing resources. This is consistent with what Hiltz and Turoff (1985) suggested, that when e-learning environments contain unorganized information, students find it difficult to decipher the relevance of information, and thus feel overloaded. If students cannot decipher relevant information, then maybe irrelevant information contributes to a misconception about the amount of information with which they are presented; perhaps it contributes to “perceived overload”.

How relevant the information is for successfully completing a task, and the effects of irrelevant information on learning can play an important role in students’ perceptions of overload. Systematic investigation of this issue could provide insight to the types of information that are essential for effective learning in online environments. For example, Stanton and Baber (1992) suggested that students’ levels of motivation might be affected by how much students believe that online material available to them was relevant and would help them reach their goal of completing a task. If users encounter irrelevant information, the goal of completing the task might be hindered. These authors also pointed out that students’ motivation might be impaired if they become overwhelmed by the freedom to move around in such environments (due to not knowing how to move from one place to another and, thus, feeling helpless).

1.3 Instructional design

Finally, variables related to the instructional design of courses using online technologies might also affect one’s performance in such environments, for example, facilitator skills, course expectations, types of tasks completed online, and the level of task difficulty. As Althaus (1997) and Kimball (1995) indicate, a well designed instructional strategy with clear goals and expectations for participation will reduce the likelihood of users becoming confused and frustrated. It is important that good instructor facilitation be available so that users do not feel unnecessarily burdened (Hiltz & Turoff, 1985; Kimball, 1995).

1.3.1 Level of task difficulty

From an instructional design perspective, it is important to understand under which conditions users of e-learning technologies become so overwhelmed that they are unable to perform effectively. Carey and Kacmar (1997) investigated the effects of task complexity on group satisfaction and group performance. They suggested that people are more satisfied with such technologies during simple tasks than during complex tasks, and that when compared to face-to-face groups, online groups produced less correct problem solutions during complex tasks. Hiltz, et al. (1986) also found an effect of task type, and consistent with other research, complex tasks were considered more difficult to complete in online learning systems.

There is evidence that the variable of “task difficulty” interacts with other online variables. Perceptual selection and attention theories shed light on the relation between “task difficulty” and the variables of the organization and relevance of online information. The importance of attention in perception is well known in the attention literature and research focusing on divided and selective attention shows that there are some tasks that one can perform well (and others poorly) when one tries to process multiple stimuli.

A widely known and unresolved debate (since the mid-1950s) involves visual selection tasks, that is, tasks in which one has to attend to specific stimuli from an array of stimuli in one’s visual field. The debate is over whether one selectively attends to specific stimuli early in one’s visual search of target stimuli, or whether one selectively attends late in the visual search of target stimuli. The first view, known as the “early selection” view, argues that perception is a limited process, and that to successfully proceed in this process, one must selectively attend to specific stimuli early in one’s visual search of relevant stimuli (or information) and ignore (or not fully perceive) irrelevant or non-selected stimuli. This view is also known as...
a “bottleneck” model of attention and it was first put forth by Broadbent (1958) and later more fully developed by Treisman (1969).

A second and competing view, known as the “late selection” view, argues that perception is an unlimited process, such that it is an automatic process where by selection is unnecessary until after an entire visual space has been searched, and thus after an overall perception has taken place. According to this view, late in the perception process, one would selectively attend only to specific and relevant stimuli. This view was put forth by Deutch and Deutch (1963).

The early versus late selection debate has empirical support for both sides. In an attempt to resolve this debate, Lavie (1995) put forth a perceptual load hypothesis of selective attention, where she argued that perceptual load is a major determinant of early or late selection. Specifically, she argued that the extent to which one employs early or late selection depends on task difficulty (or perceptual load), such that a difficult task is considered to be higher in perceptual load than an easy task (and thus, one is overloaded). On the other hand, an easy task is considered to be lower in perceptual load than a difficult task (and thus, one is not overloaded). Lavie also argued that irrelevant stimuli in a visual selection task have no impact when a task is difficult (so when perceptual load is high, or again, when one is overloaded), whereas irrelevant stimuli influence performance when the task is easy and thus, when there is less processing (so when perceptual load is low, or again, when one is not overloaded). Lavie’s model is a resource model that suggests that, on easy tasks, you have excess resources that spill over and process automatically other irrelevant, non-target items in your visual field, whereas on difficult tasks, you have no extra resources to process irrelevant information and you focus only on the goal relevant stimuli or target information.

2. Research question, hypotheses and rationale

This study investigated the following question: Does student online experience, the organization and relevance of online information, and the level of task difficulty, affect e-learning and students’ perception of overload? It was hypothesized that the organization of the online environment in which students learn, and the relevance of the information in that environment, would affect students’ learning such that those who worked in stimulus-rich (or stimulus-noisy) environments would (i) perform significantly worse on a knowledge test of material studied during an experimental session, (ii) report perceived overload most often, and (iii) report most often that they did not have enough time to complete the experimental task compared to those who worked in stimulus-low online environments. It was also hypothesized that students with more e-learning experience would (iv) perform better than students with less experience.

In a preliminary study (Kushnir, 2004), it was discovered that in spite of students’ perceptions, the online components of various courses contained far less information than the face-to-face components. Yet students reported that they felt overloaded and believed that they were presented with significantly more information than was actually presented in the online course components. It was suggested that students had misconceptions about the amount of information they had received in the online environments and that students might not have experienced information overload per se, rather they might have experienced stimulus overload. It might be that the organization of e-learning environments makes it difficult for students to decipher the relevance of information and thus they feel overloaded. It is argued here that, perhaps, it contributes to “perceived overload”. For the purpose of this study, the following distinctions between information overload and stimulus overload were made:

- **Information overload**: the presentation of too much information relative to the time one has to cognitively process the information (Kushnir, 2004)

- **Stimulus overload**: the presentation of too many environmental stimuli such that one is unable to process them, or the presentation of successive stimuli which are presented too quickly for one to manage (Milgram, 1970)

A further distinction to consider is the distinction between “distraction” and “over-stimulation”. It might be that in any particular instance, students might not be over-stimulated by too much information or too many stimuli, but perhaps just distracted by unnecessary or irrelevant information. Nonetheless, distracting information gets added to the information processing queue and possibly takes up valuable cognitive processing resources which, ultimately, may contribute to students feeling over-stimulated or overloaded. So, in some cases, distracting information or distracting stimuli may lead to overload, while in others, too many stimuli (that are not necessarily distracting but rather relevant and necessary for learning) may lead to overload.
Perhaps there are variables inherent in online environments that confound students' perceptions of information and that negatively impact their learning (variables such as experience, organization and relevance of information, and level of task difficulty). It might be that some online environments are unnecessarily cluttered with irrelevant stimuli and information, or it might be that the way in which relevant information is organized affects how some students learn. This study was designed to establish whether the organization and relevance of information in an online environment impacts learning for experienced and inexperienced online users.

While past studies have investigated students' perceptions of learning in online environments (eg, Carey & Kacmar, 1997; Carver et al, 1999; DeStefano & LeFevre, 2005; Franz, 1999; Hiltz, 1986; Hiltz & Turoff, 1985; Khalifa & Lam, 2002; Kushnir, 2004; Lee & Tedder, 2003; Reed & Giessler, 1995; Stanton & Barber, 1992; Yang, 2000; Zumbach, 2006), few studies have empirically and systematically investigated explicit measures of learning (Chen, 2005; Dalal, 2000; Lee & Tedder, 2003). The current literature base is rich with qualitative analyses of e-learning; the quantitative analyses presented in this study add to this literature base and offer new and interesting findings about e-learning.

3. Design of study

3.1 Participants

Participants were one hundred and eighty-seven undergraduate students enrolled in an Introductory Psychology course of a large urban centre university. The sample included 135 females (72%) and 50 males (27%), and there were no-responses for 2 participants (1%). Participants ranged from 17 to 50 years of age; the majority of the sample was between the ages of 17 and 25 (n=175; 94%) with the remainder of the sample between the ages of 26 and 50 (n=10; 5%), and there were no-responses for 2 participants (1%).

3.2 Procedure

All participants were given 30 minutes to read and learn five specific pages from an Introductory Psychology text used in their course. Keeping screen size and resolution constant, the five pages of text were embedded within four differently organized online environments. Participants were randomly assigned to one of four conditions: (i) a stimulus-low environment, where the material to be learned was presented as scrolling text, with no other stimuli present (ie, Scrolling condition; n=49; 26%); (ii) a familiar environment, where the material to be learned was set within the borders of a familiar course Web site (ie, Psy100 condition; n=43; 23%); (iii) a stimulus-noisy environment, where the material to be learned was set within the borders of an Amazon.com Web page (a Web site where you can search for, and buy books, videos and other products online, ie, Amazon condition; n=51; 27%); and (iv) a PDF file environment, where the material to be learned was presented as a PDF file that resembled an online duplicate of the material in the course textbook (ie, PDF condition; n=44; 24%).

Figure 2 provides a sample screen shot of the Amazon condition (ie, the Introductory Psychology material contained within the boarders of an Amazon.com Web page). The other conditions consisted of the same material contained within the online environments described above.

The Amazon condition represented a stimulus-noisy condition where participants encountered both relevant material (ie, material to be learned) and irrelevant, and possibly, distracting material (ie, hyperlinks and advertisements on the Amazon.com Web Site that would not necessarily help students learn the required material). The PDF condition served as a baseline measure for the outcome variables since it was like reading the actual textbook (as it appears in paper format) but online.

After reading the online text, all participants were asked whether they had enough time to complete the experimental task, if they felt overloaded, plus demographic-type information such as age and gender. They were also asked how they ranked themselves with regards to their computer experience (ie, beginner (just starting to use computers); intermediate; experienced; advanced (working in a professional/computer based career), and questions about their experience using e-learning systems (eg, if they had used/participated in the e-learning system that was available to them in this particular course; if they did use it, then how often; how many of their other undergraduate courses offered similar e-learning systems, etc.). The distribution of participants in each of the groups was approximately equal in number of participants, gender and age. Table 1 presents the distribution of participants in each of the groups.
Finally, all participants were given up to 15 minutes to complete a short pencil-and-paper multiple-choice test of 15 questions related to the material that they read and learned online.

![Figure 2: Stimulus-rich (noisy) environment; Amazon condition](image)

<table>
<thead>
<tr>
<th>Table 1: Distribution of participants in each group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Scrolling text (no background or hyperlinks,</td>
</tr>
<tr>
<td>stimulus-low environment)</td>
</tr>
<tr>
<td>PDF document (duplicate of print version of course</td>
</tr>
<tr>
<td>textbook)</td>
</tr>
<tr>
<td>Amazon environment (text embedded in stimulus-rich/</td>
</tr>
<tr>
<td>stimulus-noisy environment)</td>
</tr>
<tr>
<td>Psy100 environment (text embedded in familiar course</td>
</tr>
<tr>
<td>Web site environment)</td>
</tr>
<tr>
<td>Totals:</td>
</tr>
</tbody>
</table>

The classical antipsychotics (such as Thorazine and Haloperidol) reduce the major positive symptoms of schizophrenia (such as thought disorder and hallucination—see Chapter 10) apparently by blocking dopamine receptors in certain key brain pathways. But they are insufficient in up to 20 percent of patients with negative symptoms (see Chapter 18). The **atypical antipsychotics** (such as Clozaril and Risperdal) not only
3.3 Analyses

3.3.1 Statistical tests

Univariate Analyses of Variance (ANOVAs) were computed to test for significant “group” differences and to test the effects of “experience” on “test scores” and the total number of reported “pages”. Tukey’s-B post hoc analyses and independent samples t-tests were computed to further clarify significant tests. Logistic regressions were computed to test for significant “group” differences and to test for the effects of “experience” (ie, high/low) on the report of “overload” (ie, yes/no) and report of “enough time” to complete the experimental task (ie, yes/no). The Wald statistic was computed to determine whether the independent variables of “group” and “experience” had significant effects on the dependent variables of report of “overload” and “enough time” (Agresti, 1996; Wald, 1943).

3.3.2 Measurement of computer experience

Originally a four-item scale variable (ie, 1= beginner [just starting to use computers], 2= intermediate, 3= experienced, 4=advanced [professional/computer-based career]), the measurement of computer “experience” was collapsed to form a dichotomous variable, that is, “low” computer experience and “high” computer experience. This was accomplished by combining “beginner” with “intermediate” to form the new level of “low” computer experience, and by combining “experienced” with “advanced” to form the new level of “high” computer experience. This technique was necessary due to the fact that the categories of “beginner” and “advanced” were rarely selected.

The variable “experience” was used as a factor in the ANOVAs to test the hypothesis that prior computer experience interacts with the experimental manipulation in determining performance. Since the lowest option, “beginner”, and the highest option, “advanced”, were rarely selected, this would result in small sample (n) sizes for each of those cells. This would also result in unnecessarily inflated (high) variance for the small n cells, thus producing unreliable point estimates for population inferences. Similarly, “experience” was used as a covariate in the logistic regression analyses, and low frequencies of the lowest and highest response options would be problematic; again, these would produce unreliable estimates of values for the population parameters.

4. Results and discussion

The predictions that students’ experience and the organization of the environment they used to learn the material were important in determining their test scores were supported. There was a significant interaction between “group” and “experience” on “test scores”, F (3, 179) = 3.821, p # .011. Table 2 and Figure 3 suggest that the source of this interaction was the poor performance of students with “high” experience within the “Amazon” condition. Although significant, this is contrary to the hypothesis that students with “high” experience would perform better than students with “low” experience, but this is consistent with the overall “group” difference predicted (ie, poorer performance in the Amazon, stimulus-noisy condition).

Table 2: Descriptive analyses for the interaction between the factors “group” and “experience” on “test” performance

<table>
<thead>
<tr>
<th>Group</th>
<th>Computer Experience</th>
<th>N</th>
<th>Mean Test Score</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon Low</td>
<td>28</td>
<td>11.07</td>
<td>2.054</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>23</td>
<td>8.74</td>
<td>2.508</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
<td>10.02</td>
<td>2.534</td>
<td></td>
</tr>
<tr>
<td>Psy 100 Low</td>
<td>17</td>
<td>10.47</td>
<td>2.375</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>26</td>
<td>11.19</td>
<td>2.173</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>10.91</td>
<td>2.255</td>
<td></td>
</tr>
</tbody>
</table>

www.ejel.org 295 ISSN 1479-4403
Due to the significant interaction between "group", "experience", and "test scores", each level of "experience" was analyzed and there was a significant main effect of "group" for "test scores" for the "high" experience group, $F (3, 92) = 4.644, p < .005$, but not for the "low" experience group, $F (3, 87) = .979, p = .406$. To confirm this difference, an independent samples t-test was conducted within the Amazon group and it was confirmed that students with "high" experience performed significantly more poorly on "test scores" than students with "low" experience, $t (49) = 3.65, p < .001$. As expected, contrasts and post hoc tests revealed that the Amazon group had significantly the poorest "test scores".

Figure 3: Mean "test" scores for each level of "group" by "experience"

The results seem counterintuitive because it was hypothesized that more computer experience would make students less vulnerable to overload, such that they would perform better than less experienced
students in a stimulus-noisy environment like the Amazon condition. Presumably, more experienced students would be more efficient and find it easier to work in online environments than less experienced students. This had been suggested by others also: Burge (1994) and Hiltz (1986) argued that experienced students are likely to fare better in online environments compared to less experienced students primarily because experienced students need to attend only to the material to be learned, whereas less experienced students have to attend to both the material to be learned and how to use the technology.

The unresolved debate (“early” versus “late” selection of information), and specifically, the sequence of selection (Broadbent, 1958; Deutch & Deutch, 1963; Treisman, 1969), plus Lavie’s (1995) perceptual load model of attention help explain the seemingly counterintuitive results found here. This experiment was designed like a visual search task, that is, a task in which students had to attend to specific stimuli (in this experiment, the material to be learned) from an array of stimuli in their visual field (in this experiment, the background environment within which the material to be learned was embedded and organized). Students in the Amazon condition encountered a busy environment (containing irrelevant information) within which the relevant information was embedded. Their task was to learn the material in spite of the distracting environment. Consistent with what Burge (1994) and Hiltz (1986) suggest, one might consider the Amazon condition to be an overall difficult task for the less experienced student and yet a comparatively less difficult task for the more experienced student. Following Lavie’s model, the irrelevant stimuli found in the noisy, Amazon environment had no impact on the “low” experienced students since this was likely a difficult task for them, and thus perceptual load was high (i.e., they likely were overloaded). According to Lavie’s model, these “low” experienced students would have no extra resources to process irrelevant or distracting information because they focused on the goal and processed only the relevant information due to early selection, as first suggested by Broadbent (1958). On the other hand, for the “high” experienced students, the irrelevant stimuli negatively impacted their performance since the task was likely a comparatively less difficult one for them and thus perceptual load was low (i.e., they likely were not overloaded). According to Lavie’s model, it would follow then that the “high” experienced students had excess resources that spilled over, and therefore they processed more irrelevant stimuli due to late selection, as first suggested by Deutch and Deutch (1963). The early versus late selection debate and Lavie’s perceptual load model of attention (suggesting when one is likely overloaded) together offer a convincing explanation for the otherwise counterintuitive results found in this study.

The prediction that the “group” in which students participated would have an effect on their report of “overload” and “enough time” to complete the experimental task was not supported, although there was a significant main effect of “experience” on reporting “enough time”. Table 3 shows logistic regression results for the predictor “experience”. According to the Wald criterion, the independent variable “experience” reliably predicted the report of “enough time”.

Table 3: Logistic regression results for the predictor “experience”

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPERIENCE</td>
<td>-.639</td>
<td>.318</td>
<td>4.039</td>
<td>1</td>
<td>.044</td>
<td>.528</td>
</tr>
</tbody>
</table>

Students with more “experience” were more likely to report that, “yes”, they had enough time to complete the experimental task, but students “low” on “experience” were more likely to report not having had “enough time”.

5. Conclusions and recommendations

This study contributes significantly to our understanding of e-learning outcomes. Where other studies have measured students’ perceptions of learning, this study explicitly and empirically measured online learning. As Chen (2005), Dalal (2000), and Lee and Tedder (2003) suggest, few studies have done this. From the results here, we learned that certain user characteristics (in this study, student’s experience) interacts with important e-learning factors, specifically, interface design (in this study, the organization and relevance of information) and instructional design (in this study, level of task difficulty). Interestingly, in this study, it was the experienced students that were most likely affected by stimulus overload than the inexperienced students, possibly due to issues around selective attention and perceptual load (which in turn, was associated with either being overloaded or not overloaded). We also learned that experience impacts some students’ ability to complete tasks within a specific amount of time. The experienced students were also the ones most likely to report having had enough time to complete the experimental tasks even though they were most affected by stimulus overload in the Amazon condition. It was the
inexperienced students that most often reported not having enough time to complete the experimental task within the specified time frame (a task-in-time model familiar to most undergraduate students).

This study aimed to understand, link and apply existing theoretical frameworks to data that add to our understanding of the design and use of instructional technologies. This type of research linking theories to e-learning is too often absent in the education literature, and Chalmers (2000) and Kraus et al (2001) suggest that more of this type of linking is necessary so that educators can make informed, data-based decisions about the most effective implementation of technology.

Practical tips that designers and teachers can take away from this research include the need to consider the impact that training can have when creating and using educational technologies. Familiar, stimulus-low environments result in the best learning outcomes. Training can increase a sense of familiarity with the learning environment, decreasing the possibility of distraction, and creating opportunities for learners to increase experience (which, as found in this study, helps with feelings of having had enough time for task completion). Also, designers and teachers should consider the impact that irrelevant and possibly distracting information can have on students, especially (and surprisingly) for those who have experience with e-learning environments. For students, this study suggests that keeping focused and goal oriented is very important, especially in online environments where one can easily stray beyond the relevant and necessary information that facilitates learning. It seems that, at least for e-learning, more (information, experience, etc.) does not necessarily mean better or more effective learning.

E-learning research should continue to link theories to online learning, so that future developments of educational technologies are empirically supported and based in proven and appropriate pedagogical methods. It would be interesting to consider a “Universal System” that could accommodate both novice and experienced users. Such a system might allow individual users to have some control over the organization and format in which stimuli are presented. For example, it might be that an environment where users can engage (or disengage) high or low stimuli conditions, can better accommodate learners of varying levels of experience, different needs, learning styles, or preferences. While future research might consider such factors, it is important to remember that, as Shneiderman (1998: p. 150) notes, “...each small experimental result acts like a tile in the mosaic of human performance with computer-based information systems”, and as a good friend and colleague once told me: “...beware the experts who claim they have the final answer. The nature of scientific progress is slow but deliberate and self-corrective. No single study of complicated behaviour tells us exactly what to do” (Walters, G.C., personal communication, October 4, 2003).

References


www.ejel.org 298 ©Academic Conferences Ltd


A Novel Interactive Online Module in a Traditional Curriculum through a Blended Learning Approach

Leslie Laing Gibbard and Florin Salajan
University of Toronto, Canada
leslie.lainggibbard@dentistry.utoronto.ca
florin.salajan@dentistry.utoronto.ca

Abstract: A unique approach was planned and implemented for undergraduate dental students that would reinforce the principles of removable partial denture (RPD) design. 162 students were grouped according to their year of dental studies (66 second-year students and 96 third-year students) within the Discipline of Prosthodontics at the Faculty of Dentistry, University of Toronto. Previous training for the students consisted of the traditional Socratic approach, including lectures, seminars, and laboratory pre-clinical hands-on exercises. During the testing session, all the students were given the case history of a particular patient. One half of each of the classes was instructed to design an RPD using the traditional, clinically-related approach, with a dental model that could be touched and seen, dental surveyors, and writing instruments. When finished, various treatment options were discussed. The other half of the classes was given the same instructions but saw the dental model only in animated form via a computer-based e-learning scenario. The RPD was virtually fabricated with student choices of drop-down design features made in a particular orderly sequence as the students worked step-by-step through the computer simulation. A pre-test questionnaire was given to all students concerning their design choices, the order in which they chose the denture components, and their learning experiences. All students were then asked to design an RPD for a different but similar case using dental models in the traditional clinical manner. Post-test questionnaires were given to assess the effectiveness of the method of their pre-test technique, in addition to their enjoyment of the approach. A cross-over situation followed one week later, whereby each group of students went through the alternate approach from the previous session. The results from the third-year student data and implications of this blended approach for teaching and learning RPD design are analyzed and discussed.

Keywords: e-learning, dental education, computer-aided learning, computer simulation, removable partial denture design

1. Introduction

As is often the case in undergraduate university settings, a course coordinator has the responsibility not only to design the overall outline of the course but also to solely present or invite other instructors to present various sub-topics pertaining to their area of expertise. Teaching within dental faculties has followed a similar venue and has traditionally taken the approach of the Socratic style, i.e., that of lectures, seminars, and laboratory pre-clinical hands-on exercises. One topic in the area of prosthodontic education that has had a tradition of being difficult for students to master has been that of Removable Partial Denture (RPD) design. Although there are a number of computer software programs available that feature various aspects of RPD design (Beaumont, 1989; Beaumont and Bianco, 1989; Hammond et al., 1993; Wicks and Pennell, 1990; Lindquist et al., 1997; Lechner et al., 1998; Lechner et al., 1999), interactive online modules have neither been designed nor formally tested at the pre-doctoral level. With this in mind, a unique approach was planned and implemented for incorporation into the undergraduate dental curriculum to enhance students’ mastery of RPD design. Assessment of the application was performed by summative means.

1.1 Prosthodontic training

During their traditional pre-clinical prosthodontic training, the students are introduced to the various terms used within the discipline of Prosthodontics, and are taught the fundamental concepts of RPD design including features of support, stability, and retention. Traditional (Kennedy-Applegate (Kennedy, 1923; Applegate, 1960)) and contemporary (Prosthodontic Diagnostic Index (McGarry et al., 2002)) classification systems of denture designs are presented as well as the types of clasps and materials used in the fabrication of the RPDs. Techniques on how to make accurate impressions of patients’ oral structures including teeth, gums, and surrounding soft tissues are presented as well as how to pour up such impressions in various dental stone materials. Once the stone models or casts have been made, methods on how to survey the casts and how to design appropriate RPDs using various denture components are presented. During this process, the students learn the importance of the angulations of the models and the proposed paths of insertion of the prosthodontic appliances
such that the final RPDs are not only easy for the patients to insert and remove, but are also sufficiently retentive during the chewing of sticky foods, without causing undue stress on either the remaining teeth or underlying soft tissues. Other considerations include the aesthetic aspects of denture design such as whether or not to incorporate visible retentive clasps, stress-relief components, technically-complex precision attachments, or functional features for enhanced speech articulation.

1.2 e-Learning module

For this computer-based e-learning scenario, a novel approach was planned and tested based on the traditional and logical planning steps of RPD design principles. A decision-tree logic involving predetermined choices was employed in developing the module, so that the students would be guided through a series of choices leading, in the end, to a correct version of an RPD. Thirty possible valid prosthodontic designs were retained as acceptable outcomes of the steps followed in the simulated design in which the student engaged. The e-learning module was developed in-house at the Faculty of Dentistry, University of Toronto, with the contribution of:

- two dental students, who worked out the logic and sequence of the decisional steps to be included in the RPD design;
- a web programmer, who converted the decisional logic generated by the students into a functional algorithm in the module;
- a biomedical animator, who created the three-dimensional casts presented to the student at key points during the course of the design; and
- a web developer, who created the overall graphic design of the module as well as the navigational commands allowing the user to advance from step to step in the application.

The RPD e-learning module was built using Adobe Flash CS3 and ActionScript 2 for the design and programming of the dynamic and interactive elements involved in the decisional tree. Autodesk Maya 8.5 was used for the generation of both the static and the animated three-dimensional images of the RPD casts. Adobe Dreamweaver CS3 was used to assemble the web-based components of the e-learning module. Once the module was completed, it was hosted for web access on an internal server at the Faculty and subsequently made available to the students in the course via the Blackboard learning management system. The program was designed for use by dental students who were familiar with the terms and functional elements associated with RPD design. The module included a brief medical and dental history as introduction to the virtual patient as well as an animated, three-dimensional image of a cast of the patient’s maxillary (upper) arch as illustrated in Figures 1 and 2 below.

Figure 1: The initial screen of the e-learning module, showing the patient’s dental history
Based on the number and location of missing teeth, students were asked to categorize the patient’s maxillary arch with respect to the Kennedy-Applegate Classification System (Kennedy, 1923; Applegate, 1960). The animated cast was portrayed from all appropriate angles and could be rotated 360°. In order to emphasize the concept of retention of an RPD, the cast was also displayed with various tilts. Five views were illustrated, as shown in Figure 3: no tilt (where the base of the cast was parallel to a tabletop), with an anterior up-tilt (with the front teeth raised higher than the back teeth), an anterior down-tilt (with the back teeth raised higher than the front teeth), or with the left or right side raised higher than the right or left side, respectively.
Each student was required: to choose abutment teeth, i.e., those requiring clasps; to design the clasps for those abutment teeth; and to select the materials used for clasp fabrication. If a clinically-unacceptable choice was made anywhere during the step-by-step design activity, the student was informed, was asked to reconsider his/her choice, and could not proceed further until a clinically-acceptable choice had been made. In essence, the student was guided through the scenario by visual cues alerting him/her to the appropriateness of selections made (correct or incorrect) from a series of drop-down menus containing a certain number of choices representing particular elements or components of the RPD. Consequently, the student was “forced” to complete the program successfully by designing one of the thirty possible scenarios contained in the module. Upon completion, the program provided a method of formative evaluation. In addition, at the end of the simulation, the cumulative, clinically-acceptable RPD design appeared in animation for the student’s inspection (see Figure 4).

![Figure 4](image)

**Figure 4:** Completion screen in the e-learning module, showing an animation of the designed cast and an actual photo of the case-study individual.

Future revisions of the e-learning module will entail the incorporation of built-in tracking tools in order to capture real-time data about the interaction of the students with the content. This will enable the authors to evaluate objectively the effectiveness of the module in ways that are not possible at the present time.

2. Experimental design

2.1 Students involved

162 students were grouped according to their year of dental studies (66 second-year students and 96 third-year students) within the discipline of Prosthodontics at the Faculty of Dentistry, University of Toronto. Previous training for the students consisted of the traditional Socratic approach, including lectures, seminars, and laboratory pre-clinical hands-on exercises. At the time of testing, the only difference between the second- and third-year students was that the third-year students had an additional year of dental training in comparison with the second year students, but had no additional Prosthodontic training. As a result, this exercise acted as a review of RPD design principles for the third-year students prior to their continued Prosthodontic training involving clinical cases with greater complexity than those encountered in their second year of training. In addition, approximately one-quarter of the third-year students (28) had previously been trained to be dentists in countries remote...
from Canada and the United States of America. They were pursuing the Canadian dental program in order to become licensed to practise in Canada. English was not their mother-tongue.

2.2 Case presentation

All the students were given a case history of the same individual patient. One half of the class (designated P1P2 or Group A) was instructed to design an RPD using the traditional approach with dental models that could be touched and seen. The models consisted of actual representations of a patient’s maxillary arch, including teeth, gums, and palate. The students were asked to survey the casts to determine the most appropriate tilt, a necessary step for the appropriate path of insertion of the final RPD. When finished, various treatment options, designs, and choices of materials were discussed. The other half of the class (designated C1P2 or Group B) saw the same model in animation via the computer-based online interactive e-learning scenario. Choices of design features and materials were made in a particular orderly sequence as outlined above in the section describing the e-learning module. All the students, whether in the P1P2 group or the C1P2 group, were given a pre-test questionnaire to complete which concerned their design choices, order of design, and learning experiences. For the subsequent and formal exercise which tested for competency with respect to RPD design, all the students were asked to design an RPD for a different but similar case using dental models in the traditional, clinically-related manner. Their work was graded by two independent Prosthodontic examiners who had previously been given guidelines of correct responses to ensure calibration. Post-test questionnaires were given to the students to assess the effectiveness of the method of their pre-test technique, in addition to their enjoyment of the approach. In order to allow all students to have the same experience using the e-learning approach, a cross-over situation followed one week later, whereby each group of students went through the alternate approach from the previous session. In other words, those originally in the C1P2 group became the P3P4 group, and those in the P1P2 group became the C3P4 group.

2.3 Pre- and post-test questionnaires

The questionnaires were designed to assist in the development and use of technology in teaching and learning in the Prosthodontic discipline in the Faculty of Dentistry, University of Toronto. Of particular interest, were the students’ thoughts, feelings, and actions as well as their expectations regarding the use of technology in teaching and learning. The questionnaires were intended to be confidential. The students were asked to provide their student numbers in order to merge the pre-test questionnaire data with their post-test questionnaire data. The results were summarized reflecting the group and not any individuals. Students were instructed to circle the appropriate number from 1 to 5 where 1 represented “not at all” and 5 represented “very much so”.

2.4 Objectives

The module was designed to reinforce the students’ basic knowledge of RPD design principles such that they would be able to adapt these concepts to their individual patient needs. In doing so, the students would not only be able to implement fundamental guidelines when designing RPDs but also to identify individual clinical situations where guideline modifications would be necessitated. In addition, the exercise provided a review of RPD design principles for the third year students.

3. Results

3.1 Pre-test results

A total of 66 second-year and 96 third-year dental students participated in the exercise. The percentage of third-year students from each of the groups responding favourably to individual questions of the pre-test questionnaire is listed in Table 1 below. Similar percentages were obtained from the second-year students (results not shown). Students were asked to what extent they learned something in designing the RPD in the first Case Study (Qu2). For those students who performed the e-learning exercise first (C1P2), 83.7% responded in a positive manner, whereas only 36.9% of the students who performed the test in the traditional manner first (P1P2), responded favourably. Similar results were seen in the cross-over portion of the study, where 71.4% of the students in the C3P4 group responded positively but only 17.7% did in the P3P4 group. When asked to what extent they thought that the method used in the first Case Study would help them in the design of an RPD for a similar second Case Study (Qu3), 95.2% from the C1P2 group responded favourably, whereas only 64.2% of the P1P2 group did. While 77.5% of the C1P2 group and 84.8% of the P1P2 group felt that
the tactile sense of holding a model was important to them in designing an RPD (Qu4), when the cross-over exercise was conducted a week later, 85.7% of the C3P4 group and 77.4% of the P3P4 group felt that the tactile sense was important. For the question Qu6 asking to what extent the students would prefer to design an RPD having a model to hold versus a digitized model, 71.5% of the C1P2 group responded favourably, whereas 91.3% of the P1P2 group did. It is noteworthy that at the cross-over exercise, 100% of the students were in favour of having a model to hold. Questions 9 and 10 assessed the students’ level of comfort with respect to computer technology.

Table 1: Percentage of third-year students with positive responses to pre-test questionnaires (N=96)

<table>
<thead>
<tr>
<th>Group</th>
<th>Qu1</th>
<th>Qu2</th>
<th>Qu3</th>
<th>Qu4</th>
<th>Qu5</th>
<th>Qu6</th>
<th>Qu7</th>
<th>Qu8</th>
<th>Qu9</th>
<th>Qu10</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1P2</td>
<td>83.7</td>
<td>83.7</td>
<td>89.8</td>
<td>77.5</td>
<td>79.5</td>
<td>71.5</td>
<td>63.0</td>
<td>87.6</td>
<td>83.7</td>
<td>85.7</td>
</tr>
<tr>
<td>P1P2</td>
<td>93.4</td>
<td>36.9</td>
<td>93.5</td>
<td>84.8</td>
<td>87.0</td>
<td>91.3</td>
<td>63.0</td>
<td>86.9</td>
<td>93.5</td>
<td>87.0</td>
</tr>
<tr>
<td>P3P4</td>
<td>94.0</td>
<td>17.7</td>
<td>64.7</td>
<td>77.4</td>
<td>94.1</td>
<td>100.0</td>
<td>53.0</td>
<td>64.7</td>
<td>94.1</td>
<td>70.5</td>
</tr>
<tr>
<td>C3P4</td>
<td>85.7</td>
<td>71.4</td>
<td>95.2</td>
<td>85.7</td>
<td>76.2</td>
<td>88.1</td>
<td>71.3</td>
<td>78.6</td>
<td>85.7</td>
<td>73.8</td>
</tr>
</tbody>
</table>

- Qu1: To what extent did you enjoy designing the RPD in the first Case Study?
- Qu2: To what extent did you learn something in designing the RPD in the first Case Study?
- Qu3: To what extent do you think that this first Case Study would help you in the design of an RPD for a similar second Case Study?
- Qu4: To what extent is the tactile sense of holding a model important to you in designing an RPD?
- Qu5: To what extent is the visual sense of seeing a digitized model important to you in designing an RPD?
- Qu6: To what extent would you prefer to design an RPD having a model to hold versus a digitized model?
- Qu7: If a model could be scanned into a program, how likely would you be to design an RPD using an electronic program rather than by the traditional approach, using a model?
- Qu8: To what extent would you prefer a different approach in RPD design to the one used in the first Case Study?
- Qu9: To what extent are you comfortable using a computer?
- Qu10: To what extent are you comfortable studying from a computer screen?

3.2 Post-test results

The percentage of third-year students from each of the groups responding favourably to individual questions of the post-test questionnaire is listed in Table 2 below. Similar percentages were obtained from the second-year students. In response to Qu3 with respect to the method of designing the RPD, almost all of the students (91.9% from the original group and 95.1% from the cross-over group) preferred the e-learning method to the traditional one (78.3% and 76.5%, respectively). The visual sense of seeing a digitized model became very important to the students for their RPD design sequence once they comprehended what a digitized model represented.

Table 2: Percentage of third-year students with positive responses to post-test questionnaires (N=96)

<table>
<thead>
<tr>
<th>Group</th>
<th>Qu1</th>
<th>Qu2</th>
<th>Qu3</th>
<th>Qu4</th>
<th>Qu5</th>
<th>Qu6</th>
<th>Qu7</th>
<th>Qu8</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1P2</td>
<td>89.8</td>
<td>77.5</td>
<td>91.9</td>
<td>81.7</td>
<td>85.7</td>
<td>65.4</td>
<td>100.0</td>
<td>73.4</td>
</tr>
<tr>
<td>P1P2</td>
<td>87.0</td>
<td>86.9</td>
<td>78.3</td>
<td>89.1</td>
<td>71.7</td>
<td>78.3</td>
<td>89.1</td>
<td>70.5</td>
</tr>
<tr>
<td>P3P4</td>
<td>70.6</td>
<td>88.3</td>
<td>76.5</td>
<td>88.2</td>
<td>82.4</td>
<td>82.4</td>
<td>100</td>
<td>88.2</td>
</tr>
<tr>
<td>C3P4</td>
<td>87.8</td>
<td>78.1</td>
<td>95.1</td>
<td>80.4</td>
<td>68.3</td>
<td>87.8</td>
<td>92.7</td>
<td>83.0</td>
</tr>
</tbody>
</table>

- Qu1: To what extent did you enjoy designing the RPD in the second Case Study?
- Qu2: To what extent did you learn something in designing the RPD in the second Case Study?
- Qu3: To what extent did you prefer the method of designing in the first Case Study to the one in the second Case Study?
• Qu4: Did you learn more from the first Case Study than the second one?
• Qu5: Did you learn more from the second Case Study than from the first one?
• Qu6: To what extent is the tactile sense of holding a model important to you in designing an RPD?
• Qu7: To what extent is the visual sense of seeing a digitized model important to you in designing an RPD?
• Qu8: To what extent would you prefer to design an RPD having a model to hold versus a digitized model?

3.3 Competency test results

Grading results from the summative assessment of both the second- and third-year students are included in Tables 3 and 4, respectively. In both cases, higher grades were received by those students who performed the e-learning test prior to the competency test in comparison to those who completed the traditional approach first. Similar results occurred in the crossover session. Also included in Table 4 are the results from the competency test that the current third-year students performed during their second-year of training, without assistance of the e-learning module. Since the group of 28 foreign-trained dentists had not joined the group at that time, the number of students is 68, rather than 96.

Table 3: Summative assessment based on competency results of second-year students (N=66) during the crossover session, group C1P2 (N=33) became P3P4 and group P1P2 (N=33) became C3P4

<table>
<thead>
<tr>
<th>Group</th>
<th>A+</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1P2</td>
<td>14 (21.2%)</td>
<td>12 (18.2%)</td>
<td>7 (10.6%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P1P2</td>
<td>9 (13.6%)</td>
<td>11 (16.7%)</td>
<td>10 (15.2%)</td>
<td>2 (3.0%)</td>
<td>1 (1.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3P4</td>
<td>13 (19.7%)</td>
<td>10 (15.2%)</td>
<td>5 (7.6%)</td>
<td>3 (4.5%)</td>
<td>2 (3.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3P4</td>
<td>14 (21.2%)</td>
<td>11 (16.7%)</td>
<td>3 (4.5%)</td>
<td>5 (7.6%)</td>
<td>0 (0.0%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Summative assessment based on competency results of third-year students (N=96) during the crossover session, group C1P2 (N=48) became P3P4 and group P1P2 (N=48) became C3P4

<table>
<thead>
<tr>
<th>Group</th>
<th>A+</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
<th>C</th>
<th>C-</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1P2</td>
<td>4 (8.3%)</td>
<td>7 (14.6%)</td>
<td>16 (33.3%)</td>
<td>8 (16.7%)</td>
<td>7 (14.6%)</td>
<td>3 (6.3%)</td>
<td>2 (4.2%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>P1P2</td>
<td>1 (1.0%)</td>
<td>1 (1.0%)</td>
<td>2 (4.2%)</td>
<td>18 (37.5%)</td>
<td>12 (25.0%)</td>
<td>4 (8.3%)</td>
<td>3 (6.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>P3P4</td>
<td>0 (0.0%)</td>
<td>18 (37.5%)</td>
<td>13 (27.1%)</td>
<td>7 (14.6%)</td>
<td>8 (16.7%)</td>
<td>2 (4.2%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>C3P4</td>
<td>6 (12.5%)</td>
<td>13 (27.1%)</td>
<td>16 (33.3%)</td>
<td>8 (16.7%)</td>
<td>4 (8.3%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Second-year results (N=68)</td>
<td>4 (18.5%)</td>
<td>4 (5.9%)</td>
<td>4 (5.9%)</td>
<td>5 (7.4%)</td>
<td>14 (20.6%)</td>
<td>3 (4.4%)</td>
<td>12 (17.6%)</td>
<td>24 (35.3%)</td>
</tr>
</tbody>
</table>

4. Discussion

Results from this novel approach to reviewing the concepts of RPD design indicate that the experience obtained from the e-learning sessions was a positive one that was enjoyed by the majority of the students, whether in second- or third-year of their dental training. The students were impressed by the interactive nature of the e-learning approach, particularly the ability to rotate the cast and to visualize the clasp design in a step-by-step manner. At least 83.7% of the students were comfortable using a computer, but only 70.5% of them were comfortable studying from a computer screen. Although only 65.4% of the group of third-year students who were introduced to the e-learning scenario first, did not initially feel that the tactile sense of holding a model was important to them when designing an RPD, in comparison to 78.3% of them who only had a model to hold, touch, and rotate
during the exercise, over 82.4% of the students in the crossover session felt that holding a model enhanced their ability to design an RPD. This would indicate that even though the e-learning approach may provide a valuable teaching tool, that the basic tactile sense is nevertheless important in the design process. The blended approach introduced in this study underscores the inherent value of different teaching presentations of RPD design concepts allowing students to visualize an RPD design more readily. The interactive nature of this blended approach may make the principles of RPD design, so difficult in the past for students to master, not such an onerous task after all, as some students may initially think.

5. Conclusions

A unique blended learning experience was presented to second- and third-year undergraduate dental students at the University of Toronto. The salient features of RPD design, fundamental to the discipline of Prosthodontics, were reviewed and underscored in both the traditional manner using patient models as well as through the advances of computer-assisted learning. As determined by summative evaluation, the study has reinforced the notion that today’s students are technologically-literate, yet are capable of understanding the principles of RPD design traditionally difficult to master. They can design clinically acceptable RPDs using a blended approach of e-learning and traditional methods. The project has shown that the students not only enjoyed but appreciated the opportunity to do so.

Acknowledgements

Funding for this project was made possible by the Bertha Rosenstadt Endowment and the Faculty of Dentistry Endowment. The authors wish to thank the following contributors to the design process: Andrea Cormier, Neil Darbyshire, Sergey Uss, Usama Al-Rhiahi, Matthew Dang, and Greg Mount.

References

Development of the Novel e-Learning System, “SPES NOVA” (Scalable Personality-Adapted Education System with Networking of Views and Activities)

Ken Takeuchi¹, Manabu Murakami¹, Atsushi Kato², Ryuichi Akiyama³, Hirotaka Honda¹, Hajime Nozawa¹ and Ki-ichiro Sato¹
¹Tokyo University of Science, Hokkaido, Japan
²PHD, Inc., Nakamichi-cho, Hokkaido, Japan
³Muroran Institute of Technology, Hokkaido, Japan

Abstract: The Faculty of Industrial Science and Technology at Tokyo University of Science developed a two-campus system to produce well-trained engineers possessing both technical and humanistic traits. In their first year of study, students reside in dormitories in the natural setting of the Oshamambe campus located in Hokkaido, Japan. The education program at Oshamambe instills a rich appreciation/awareness of humanity which especially enables them to empathize with nature. The faculty has been developing a novel e-Learning system called SPES NOVA (Scalable Personality-Adapted Education System with Networking of Views and Activities). SPES NOVA, which is intended to increase competency in communication skills, is based on a remote meeting system that is accessible simultaneously to multiple users via a Flash plug-in on the Internet. To link users in separate locations, each user must have a headset and web cam attached to a personal computer with an Internet connection. At Oshamambe, the SPES NOVA e-Learning system links the students to each other and to the professors. In one of the first applications of SPES NOVA, a student puts on a headset and sits in front of a computer equipped with a camera, and then accesses small-group instruction of a humanity course based mainly on discussion. An electronic whiteboard is displayed at the center of the monitor, and live-action shots of the users are arranged around the computer screen. The voice and picture data of the lecture are stored as educational materials on the server. Consequently, students can review an entire lecture as well as their own speech and behavior. The teacher can easily cut segments from the motion pictures of the lecture and combine them into teaching materials. SPES NOVA includes an e-Learning system that distributes educational materials via a wireless LAN during instruction. The system has also been used effectively in an example of ubiquitous computing in laboratory training courses, which included small group instruction. The students are able to browse the systematic exposition of experimental techniques as well as learn the correct usage of experimental apparatus by using a portable video game player during experiments. The teaching materials contain not only the answers to possible questions, but also the lectures for the day. The e-Learning system can record the laboratory training course lectures and then stream them back in video format. Furthermore, the portable video game player can save images as well as data from the experiments. This e-Learning system is connected to the computer network on campus. Therefore, students can review the learning materials by using a personal computer before and after the laboratory training courses. When used during the small group instruction of the laboratory training course, this unique system effectively helps participants develop lecture note-taking skills, hone communication skills, and learn the correct usage of the experimental apparatus used in liberal arts. Furthermore, with SPES NOVA, we can classify individual students not only according to their academic achievements, but also in relation to their behaviour, temperaments, and lifestyles. Subsequently, we can establish a recursive evaluation system for each student.

Keywords: blended learning, knowledge management, communication skill, small group instruction, laboratory training course

1. Introduction

1.1 Liberal arts in the dormitory

The Faculty of Industrial Science and Technology was established in 1987 at the Tokyo University of Science and it consists of three departments: Applied Electronics, Materials Science and Technology.
and Biological Science and Technology. The faculty developed a two-campus system to produce well-trained engineers who possess both technical skills and humanistic traits. This new educational system is based on interpersonal communication and rich interaction between people and nature. In their first year of study, students reside in dormitories in the natural setting of the Oshamambe campus located in Hokkaido, the northernmost part of Japan, before transferring to the Noda campus near Tokyo for the remainder of their studies. The Oshamambe campus offers a unique curriculum to foster well-rounded individuals. The education program is comprised of a tutoring system run by faculty members to aid students in their campus life. This program consists of small group instruction sessions for the humanities courses taken by the students, all of whom are enrolled in science and engineering, small group instruction sessions for the science courses through laboratory training and exercises, and also on-site training courses that provide farming experiences, nature-based experiences, and social studies field trips. These various elements provide students with a rich appreciation of humanity which especially enable them to empathize with nature (Murakami 2005, Murakami 2007).

1.2 Develop the novel e-learning system

The faculty began development of the novel e-Learning system, “SPES NOVA” (Scalable Personality-Adapted Education System with Networking of Views and Activities), based on the experience gained from 22 years of teaching at Oshamambe. In Latin, ”spes nova” means "new hope," and it is the name of the Oshamambe campus. The goal is to produce well-trained engineers possessing both technical skills and humanistic traits.

One part of the project required development of an e-Learning system that distributed educational materials via a wireless LAN during instruction. The system evolved to help users acquire laboratory skills and to upgrade their communication skills. Both of these skills were used in the classroom and in the dormitory. The e-Learning system is explained briefly here.

Approximately three-hundred students were divided into groups of ten in the laboratory training course and each group worked together on the same experimental subjects. Students of the three departments (Department of Applied Electronics, Department of Materials Science, and Department of Biological Science and Technology) were included in each small group throughout the year. Students participated in a total of twenty-two experiments from all the scientific fields, including physics, chemistry and biology. Students conducted the various experiments so that they could acquire the broad knowledge required of a scientist. With this arrangement, students belonging to the Department of Applied Electronics assumed a leadership role during physics experiments. Likewise, students from the Department of Materials Science led the chemistry experiments. Finally, students belonging to the Department of Biological Science and Technology led the biology experiments. Students learned how to decide who should be responsible for which task according to their specialization, and they assigned part of each experiment to each student.

1.3 Problems of small groups in the laboratory training course

When we started the small group instruction in the laboratory training course, we discovered some problems. First, students who passed the entrance examination with only a physics or biology background had almost never performed a chemistry experiment in high school. They could not smoothly conduct the chemistry experiments because they could not adequately visualize how to use the experimental apparatus from the figures and explanations in the textbook. As a result, some of the students could not finish an experiment within the allotted time. Such students concluded that chemistry experiments were difficult.

Second, students could not understand the outline and hints that the professor explained at the beginning of an experiment. Since they did not even know the names of the experimental apparatuses, it was an unreasonable to expect them to be able to mentally visualize how to use them. Third, students in the dormitory did not share information about the experiments. Many discussions and debates were expected to be initiated between the students who had already finished the experiment during the previous week and the students who would do it at the next week. However, once we started small group instruction, it became clear that students did not discuss and debate as well as we had expected. Though there were additional issues, we tried to solve these problems first by developing a novel e-Learning system and employing it in the small group instruction.
2. Development

Figure 1 shows a diagram of the e-Learning system configuration. A video camcorder (FV-10, Fuji Film Corp.) was connected to the Intel-Mac (Mac mini 1.33 GHz, Mac OS X 10.4.7, Apple Computer Inc.) using IEEE 1394 via a hardware encoder (GV-1394TV, I-O Data Device, Inc.). The recorded images were converted to a portable music player (PMP) format using the Intel-Mac. The PMP format is playable on a portable video game player (PSP; Play Station Portable, Sony Corp.). Movie files were shared using a server (Amphis MT729C2D; Core2Duo 6600@2.40 GHz, Windows XP Professional edition, Aro-system Co. Ltd.) connected to the Intel-Mac. The server had a dual video streaming system. One video streaming system distributed the educational materials using the PiMP Streamer streaming software by DickyDick1969 for the portable video game player via wireless LAN (IEEE 802.11b/g), and the other system used VLC software for general web systems via the campus computer network. On this system, six PiMP Streamer instances ran on the giga-bit Ethernet and were delivered to several PSPs and web systems simultaneously. The PSP users could then play lecture videos on-demand if they wanted to view any missed lectures. The firmware of the PSP had to be downgraded to version 1.5 for the PiMP streamer (2.01 sub) on the PSP to operate correctly. We downgraded from PSP version 2.8 to version 1.5 using the system control software (Device Hook 0.4 launcher for 2.71).

3. Achievement

3.1 Design of the e-learning system for small groups in the laboratory training course

The e-Learning system was applied to the course, “The Quantitative Analysis of Iron (Fe) in Solution Using a Visible Spectrometer.” For this course, twelve students were divided into six pairs. Each pair prepared five kinds of solutions with different concentrations of Fe as the standard to provide a calibration curve. The pairs were then instructed to help each other measure the concentration of Fe in an unknown solution. Through hands-on practice, students learned the correct experimental techniques for instruments such as a pipette, measuring flask, pH meter, and spectrometer.

At the beginning of the experiment, the professor explained the outline of the experiment and gave hints as to how to carry it out smoothly. The explanations and hints were recorded and immediately delivered to the portable video game player. A video showing how to handle the experimental apparatus was prepared and saved on the server in advance. All of the video contents, including the explanation, hints, and method of using the apparatus, were saved. The students could watch the...
videos at any time and any place, even after they had returned to the dormitory. While having access to the video as a reference, they then wrote their research papers in the dormitory.

Currently, it is prevalent for a desktop and/or laptop computer to be used in e-Learning. However, it is difficult for a course involving experiments to make use of a desktop and/or laptop computer, because there are usually many materials on the lab table, such as the apparatus and chemical reagents. The presence of even a single laptop computer on the lab table can disrupt the experiment, and if all students bring their laptop computers and place them on the lab tables, it would be quite difficult to carry out the experiments. In addition, from the viewpoint of safety, it is preferable to avoid putting a computer on a lab desk. Therefore, on the Oshamambe campus, the videos are distributed to the portable video game players using the wireless LAN. With this method, computers no longer competed for valuable lab desk space.

Figure 2: The portable video game player

3.2 Use of the e-learning system during experiments

When students conduct several experiments throughout a course, important new information can emerge almost weekly. However, anticipating student mistakes is difficult. For example, students may ingest an acid solution through a pipette, break a glass apparatus in an unexpected way, or throw away the compounds they have synthesized. Therefore, the materials recorded on video at the beginning of the fiscal year are not always useful; instead, the video materials for experiments should be recorded weekly.

On the Oshamambe campus, preliminary explanations by the professors in the laboratory training courses were recorded every week. The e-Learning system automatically recorded these explanations and then converted them into a video format for immediate streaming to the portable game players. The students were thus able to watch the preliminary lecture on a portable video game player repeatedly, or whenever they had questions — even in the middle of an experiment, as shown in Figure 3. They could also watch the same videos with their laptop computers at any time and any place via the wireless LAN, even after they had returned to their dormitory.

There were several advantages to recoding and streaming the explanations weekly. First, an instructor was able to give a different lecture customized for each small group. Second, instructors...
could point out the problems from the previous week and explain how the students could avoid repeating them in their experiments.

Figure 3: Small groups for laboratory training course with using the portable video game player

3.3 After the experiments

Students who finished an experiment could return to their dormitory and begin writing their research papers while watching the videos on the web. Other students, who would carry out the same experiment the following week, could see the students writing their papers with the aid of the information on the web. The students could then ask questions, such as "What is this instrument?", "How do you use this apparatus?", and "What are the key points of this experiment?". The Oshamambe campus took full advantage of its family-like residential status to implement this blended learning approach.

Students who carried out the experiment the following week could have face-to-face discussions about the outline and receive hints and guidance from students who had already performed that experiment. In other words, students who had finished the experiment became the teachers of the students who would conduct the experiment the following week. This blended learning functions as a chain reaction.

Within this series of blended learning chain reactions, the students could experience both the teaching side and the learning side of the experiments every other week. They could naturally learn how to give and receive correct information about the experiments. If the student’s communication skills improved, they could be informed about the key points of the experiments without using the videos. It is expected that the students would gain the ability to correctly inform others about how to do procedures that they were unable to do themselves before.

3.4 Material production

As stated above, the preliminary explanations by professors were recorded and distributed immediately to the portable video game players on a weekly basis. However, the handling procedure for the basic experimental apparatus did not change every week. Thus, videos that covered how to handle apparatus such as a pipette and measuring flask were prepared in advance. We let volunteer students produce the videos in FY 2006 and FY 2007. The students were entrusted with all of the operations, from the video shoot to the editing of the contents.

To create accurate video materials, the students had to study how to use every apparatus correctly by using books or web sites. The students worked diligently in this respect every day until the dormitory’s curfew at 10:00 P.M. Otherwise, younger students were likely to adopt incorrect ways of using each apparatus. The students produced excellent videos by learning the operation of the apparatuses by themselves, as shown in Table 1. From one to four students focused on one subject, and they spent several months to produce one content. These students learned many facts in the process of preparing the content. The students of FY2008 did experiments in laboratory training by watching the content that elder students had produced in FY2006 and FY2007. Some of the students of FY2008 said, “The contents that the seniors produced is incomprehensible,” and “I want to polish the senior’s contents.” Therefore, we let the students of FY2008 produce new content, as shown in Table 1. Although all the Oshamambe campus students are freshmen, it is expected that such chain reactions
between younger and elder students will be established through watching and producing video contents.

**Table 1**: Videos that the students produced for these three years

| Fiscal Year | Students | Subjects | Pipette | Separatory funnel | Glasswork | Measuring flask | FT-IR | Pipette | pH meter | HPLC | Burette | Spectrophotometer | SEM | Dimroth condenser | Tube furnace | Liebig condenser | Box furnace | Centrifugal separator | TLC | Rectifier circuit | Glasswork | Oscilloscope | Stopwatch | Prepared specimen | DNA (sampling) | DNA (PCR) | Electrophoresis | PSP |
|-------------|----------|----------|---------|-------------------|-----------|----------------|-------|---------|----------|------|---------|-------------------|------|-------------------|-------------|-------------------|------------|----------------------|------|-------------------|-----------|-----------------|-----------|----------------------|--------|-------------------|-----------|-----------------|---------|
| 2006        | 13       |          |         |                   |           |                |       |        |          |      |         |                   |      |                   |             |                   |            |                   |        |                   |         |                   |          |                   |         |
| 2007        | 17       |          |         |                   |           |                |       |        |          |      |         |                   |      |                   |             |                   |            |                   |        |                   |         |                   |          |                   |         |
| 2008        | 23       |          |         |                   |           |                |       |        |          |      |         |                   |      |                   |             |                   |            |                   |        |                   |         |                   |          |                   |         |

4. Evaluation

One of the key issues regarding the use of SPES NOVA is the extent to which it can provide a higher level of experimental skill. We carried out a survey about e-Learning in the small group instruction. A range of questions was asked to determine the students’ opinions of their learning experience and the use and value of the SPES NOVA for preparation, experiments and writing research papers. The questionnaire was administered near the end of the semester, when students had completed the series of laboratory training. It included both general and specific questions on the students’ experiences during the course, and questions requiring reflection on the experience. The questionnaire was distributed to 401 students who attended the small group instruction in the laboratory training course within the Faculty of Industrial Science and Technology, and 370 completed questionnaires were returned (92.3%).

The students were asked to rate SPES NOVA at the stage of preparation for the weekly laboratory training. The total percentage of “very useful” and “relatively useful” responses was 55.4%. These responses suggested that, while slightly more than half the number of students felt that preparation was useful, students did not take full advantage of the web site of SPES NOVA before they came to the chemistry laboratory and attended the laboratory training.

A professor explained the outline of the experiment and gave hints at the beginning of each experiment. The explanations and hints were recorded and immediately delivered to the portable video game player by SPES NOVA. When we asked students to rate the explanations recorded in the portable video game player at the stage of laboratory training in the chemistry laboratory, 68.1% of the students stated it was useful. In contrast, we asked students to rate the video showing how to handle the experimental apparatus in the portable video game player at the stage of laboratory training in the chemistry laboratory: 78.7% students ranked it as having usefulness. Many students set a high value on using the portable video game player.

The students were asked to rate SPES NOVA at the stage of writing the research paper after laboratory training. The total percentage of “very useful” and “relatively useful” responses was 35.1%.

(a) Very useful, (b) Relatively useful, (c) Relatively useless, (d) Very useless

How did you feel about SPES NOVA at the stage of preparation for every week’s laboratory training?

(ii) How did you feel about the explanations recorded in the portable video game player at the stage of laboratory training?

(iii) How did you feel about the video showing how to handle the experimental apparatus in the portable video game player at the stage of laboratory training?
(iv) How did you feel about SPES NOVA at the stage of writing the research paper after laboratory training?

(v) How did you feel about the total e-Learning system in the small group instruction?

![Figure 4: The answers for the questionnaire](image)

In other words, only one-third of the students felt that it was useful; therefore, students did not seem to use the web site of SPES NOVA when they wrote their research papers after they returned to their dormitory from the chemistry laboratory.

Finally, 50.5% students felt that the total e-Learning system in the small group instruction was useful. In response to being asked what they considered to be the main benefits of the portable video game player, students most frequently stated that they particularly liked being able to access the learning materials anytime from anywhere. The professor who had responsibility for the small group instruction thought that one of the main benefits was the ability to use the SPES NOVA as a depository of information, providing lecture notes and exercises, and making announcements. In all, SPES NOVA provided video content of the initial lecture in the laboratory training course and facilitated distribution of all learning and support materials to the portable video game player through the wireless LAN.

It is hard to understand the proper handling of the experimental apparatus even if students watch a video about its usage on the web site for laboratory training. However, if students watch the video contents on the portable video game player before actually touching the actual experimental apparatus, they more effectively acquire the skill to handle it. This could be the reason why they felt the portable video game player was useful.

When we read and corrected the research papers, we could see evidence of discussions in the dormitory by the sentences written. The reason why only one-third of students felt the usefulness of the web site of SPES NOVA at the time of writing their research papers is that their reports were written with reference only to the students' discussion and not the SPES NOVA web site. We assume that at the beginning of the semester, the student might write a paper while referring to the contents on the web site, but they gradually began to exchange information with each other more actively in the dormitory, then finally stopped using web site during the last period of the semester. It will be necessary to analyze the access log of the SPES NOVA web site in detail to confirm whether our assumption is correct.

5. Conclusion

We developed an e-Learning system using a portable video game player and applied it in small group instruction. Approximately one-half of the students thought the web site of SPES NOVA was useful at the stage of preparation for laboratory training. Approximately one-third thought the web site was useful at the stage of writing the research papers. According to both the survey answers and the actual content of the research papers submitted after laboratory training, some of the students...
referred to the SPES NOVA web site at the stage of preparation of laboratory training, but they then tended to write their research papers by exchanging information among the students in the dormitory. However, almost 80% of the students recognized the usefulness of the portable video game player in the chemistry laboratory. The professor in charge of the laboratory training course acknowledged that the number of students who asked questions about using the experimental apparatus was much less than the number before e-Learning was established.

In the six years before using SPES NOVA, only one group finished experiments of “The Quantitative Analysis of Iron (Fe) in Solution Using a Visible Spectrometer” within the time limit of 3 hours 30 minutes. However, more than ten groups finished that experiment within the time allotted by using e-Learning. This result could be the reason why the professor realized that the experiments proceeded more smoothly.

We achieved one of our intended purposes: students who had no experience of chemistry experiments more effectively performed the laboratory training. However, it is hard to say that we achieved the other purpose: students who finished chemical experiments wrote their research papers using the SPES NOVA web site. In the future, more improvement of the contents of SPES NOVA is necessary to increase the number of students who prepare for the experiments and write their research papers by using the web site. We also need to continue to improve SPES NOVA to enhance the information exchange among students, and to consider how to create a strategy to encourage student discussions about the experimental data in the dormitory. We would like to set up a peer review system where the students mark each other’s contributions, particularly in providing a suitable framework and structure that gives students the opportunity to engage in meaningful discussions.

Acknowledgements

References