Editorial

This conference edition of the EJEL contain a selection of papers which were presented at Glasgow Caledonian University in November 2003.

The keynote address of Gilly Salmon, from the Open University in the UK, spoke to a variety of possibilities as to how the future of e-Learning might unfold. The main thrust of this message was that it is important is to remember the very old adage from instructional technology - learning is first of all about interaction between people, and the technology must serve that interaction, and not try to drive the process in a different direction.

On the other hand the power of the technology should to be fully utilised, as it does offer unprecedented opportunities for interaction and for linking people, ideas, texts and resources. This leads to the notion of e-publishing. This new idea requires the reconceptualisation of the term 'e-paper' which will mean something different to simply publishing "conventional papers" on the Web.

What does that mean, and how can it be done? First of all, a new emphasis on connected texts is required. Wherever it is appropriate, include links to Internet resources and sites: websites, blogs, discussion forums etc. These papers of course still need to retain academic substance in their own right, but they should also link into the much larger virtual conversation, which is out there on the other side of the web browser.

Of course much of the detail of how this will be achieved is yet to be determined but the idea is certainly in interesting one and it offers a clear challenge to the academic community.

It is clear that there is much work to be done in developing a new e-Learning world and that we have only just begun to have a glimpse of the new and exciting ways in which learning will eventually be transformed.

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Combining Traditional And Virtual Teaching Techniques In Cross-Border Higher Education

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Abstract: Our paper describes the important role of virtual education in the process of building a unique cross-border educational environment between Finland and Russia. Against a background of the latest trends in international virtual education, we propose a realistic solution for equal collaboration between two different systems. The final model strives at combining the directly applicable features of both academic sectors into an innovative educational structure that offers attractive study programs and provides a wide range of educational services worldwide.

Keywords: cross-border education, equal partnership, common study programs, semi-virtual course

1. Introduction

The challenging idea of sharing students and courses on a virtual basis through international partnership networks is of widespread interest nowadays (International Institute for Educational Planning 2003, Commonwealth of Learning 2002, Hawkridge 2003b). A recent literature survey (International Association of Universities 2003) shows that the amount of titles published in this area is continuously increasing and that authors are widening the scope from rather technical topics to the institutional or qualitative aspects of these processes. One can find various features of virtual education (in this paper we consider the term virtual education as being a synonym to e-Learning) at many educational levels, starting from individual virtual teaching units, such as lectures, through fully virtual courses and study programs to specialized virtual institutions that deal with education on a commercial basis.


Many universities have their own educational technology centres that cooperate with national coordinators. For example, the Finnish Virtual University (2003) offers and maintains virtual courses provided by local universities. In January 2004, the Finnish Virtual University offered 73 active courses.

Starr (1998) has studied the current trends and future directions in virtual education. For example, she describes the Western Governors University, which is a regional virtual university that was piloted in 1997. She also introduces some design issues for virtual courses and discusses the institutional aspects of future virtual universities. Kullenberg (2002) presents a working model for an international virtual university. The Virtual University of the International Ocean Institute offers a Master’s Degree program for students who already hold bachelor-level degrees. Thiriet et al. (2002) describe a European-wide effort to define the core curriculum for electrical and information engineering. Their article also includes student assessments for two experimental courses for students in Denmark or France and Morocco, respectively. A summary, published by the Commonwealth of Learning (2001), collects comprehensive data and case studies concerning the institutional, international and networking aspects of future virtual education.

There are also working cross-border projects, like an "open higher education space" between the border regions of the Netherlands and Germany (Huisman 1998) and the Baltic Sea Virtual Campus (2003) around the Baltic
countries, or a model used at the University of Adelaide (Field 1999).

The Department of Clinical Nursing at the University of Adelaide takes advantage of multimodal learning at their international education project. The students have Internet access to the university library, regular e-mail contact with their coordinator, a chat capability and material on CD-ROM and on the Web. In addition, students have periods of intensive contact teaching. The University of Adelaide sees two major limitations in this kind of cooperation. The first one is students’ access to Internet in areas where the telecommunication infrastructure is not up-to-date and the second is the cultural background of the students.

Finland and Russia are countries with different cultural backgrounds, which must, naturally, also influence joint educational activities (O’Loughlin 1992). Numerous related practical findings from other cross-cultural educational projects are already available. The University of North Carolina at Wilmington and the Digital Communities of Japan initiated a virtual university experiment in 1997 (Thompson 2000). Its pilot phase, implemented in 1999, included three courses, four seminars, and a professorial symposium. The whole experiment ended in 2001 and revealed four facts. Firstly, the researchers found collaborative learning to be an efficient technique for virtual education. Secondly, the national differences in semester scheduling caused problems. Thirdly, the Japanese students requested face-to-face interaction with the teacher. Fourthly and finally, these students requested the course material in their native language instead of in English.

Vogel et al. (2001) studied virtual groups from the perspective of the socio-cultural learning theory. The City University of Hong Kong and the Eindhoven University of Technology, Netherlands organized a common course with 73 participants who were divided into 10 multicultural (international) groups. The group members had seven weeks to finish assigned projects and communicated via email, videoconferencing and a Group Support System. The students involved found this kind of collaborative, experimental learning to be a meaningful method. This study, however, identified several cultural-dependent features concerning time management, the establishment of virtual trust and team communication.

Azadegan et al. (2001) also deals with academic international virtual teams. Students from the Towson University (Maryland, USA) and the Evry University (France), formed cross-cultural virtual teams and carried out a software development project. Interaction took place via websites, Internet Relay Chat and email. Although the students were acquainted with collaborative learning and group dynamics, it was finally discovered that the interaction between the team members, as well as their English skills, was not sufficient. Also, Last et al. (2000) reported communication and time-management difficulties in a virtual international study environment, established between Sweden and US universities.

Systematic cooperation with Russia in the area of higher education is one of the priorities of the Ministry of Education of Finland (Ministry of Education of Finland 2001, 2003). Since Lappeenranta University of Technology (LUT) is close to St.Petersburg and has traditionally enjoyed good contacts with universities in St. Petersburg, it was a natural choice to implement this governmental strategy between LUT and universities in St. Petersburg and, subsequently, also in other neighbouring Finnish universities. Our aim was to find a model of mutual virtual cooperation that would be convenient for both Finnish and Russian partners, applicable in the short-term and that would allow Russian teachers to be involved actively. In the following chapters, we present the experience that has been accumulated so far and propose a feasible local solution.

2. Expertise in cross-border and virtual education

Our know-how in the area of international education is based primarily on extensive personal experience with tens of Russians, who have studied and graduated from the International Masters’ Program in Information Technology (IMPIT) at LUT since 1999. We collected another portion of this significant knowledge during the continuous development of this program while searching for optimal bilateral conditions with several partner universities from Northwest Russia. Finally, our extensive experience with different technologies in virtual education helped us to successfully realize and evaluate a regular semi-virtual course in several universities in Finland and Russia.
2.1 International Masters’ Program in Information Technology

This program was established in 1998 at LUT and is currently being run at the other Eastern Finnish universities of Joensuu and Kuopio. It has the following two main goals:

1. To internationalise education at the host universities,
2. To provide more information technological (IT) experts for the local industry,

and includes several specific features:

- It focuses primarily on Russia but also accepts students from other countries,
- It lasts for two years, and successful students graduate with Finnish Master’s degrees in IT,
- Applicants must already hold a bachelor-level degree,
- If necessary, it provides scholarships that cover the living expenses of Russians in Finland during the first two years of study,
- All IMPIT courses belong to the standard university curriculum,
- IMPIT instruction uses mostly conventional (face-to-face) teaching techniques. Some courses also have virtual features (videolecturing, WebCT), but their scope is limited to Finland only. The involvement of Russian teachers is minimal.
- The program handles students’ employment matters and follows their professional careers also after graduation.

The total intake between 1998 and 2003 was 142 students, and the total number of graduates so far is 92; both numbers are from January 2004. The remaining students are still studying at Lappeenranta, Joensuu and Kuopio as the rejection rate from IMPIT is very low.

Our main experience is related to the study morale and work attitudes of Russians; we also learned a lot about their cultural habits. The current core network of three Finnish and seven Russian universities in two towns, St. Petersburg and Petrozavodsk, is shown in Figure 1.

![IMPIT network](http://www.ejel.org)

2.2 Cultural aspects of international education

We found that during the construction of a firm cross-border educational environment, cultural differences must definitely be taken into account. As a result of extensive qualitative and quantitative research in this domain, we concluded that there are significant behavioural differences between our Finnish and Russian students. The most obvious indications of these differences are their understanding and interpretation of academic honesty, learning and working practices, their communication skills or capabilities to work independently or in teams.

Consequently, it would be a mistake to believe that only the motivation and enthusiasm of foreigners helps them to joining standard processes abroad and accommodating the different nature of these processes. Especially in the initial phases of "becoming international", students need extensive personal guidance and exceptional administrative arrangements. The final solution that guarantees constructive cross-border coexistence, partnership on many platforms and continuously increasing involvement, consists of a bilaterally open and deterministically designed educational structure that equally incorporates the specifics of all the nationalities involved. The details concerning this matter will be published later.
2.3 Virtual education in the St. Petersburg region

One of the significant side-effects of the IMPIT program was the local availability of skilled Russian students and their interest in performing supervised research tasks related to the status of virtual education in the St. Petersburg region. Such collaboration was natural, inexpensive and produced excellent results. Zakharova (2002) and Kuzivanov (2003) summarized the following data concerning the preparedness of Northwest Russia to collaborate in international educational projects:

Advantages:
- A large amount of excellent professionals, who are interested in joining an international environment and capable of producing virtual courses.
- Existing experience from local forms of virtual and international education (Ministry of Education of the Russian Federation, State Institute of Information Technologies and Telecommunications 1999).
- The increasing importance of education in the Russian labour market, the need for lifelong education, specialized vocational training and transfer education there.
- The need to access education, also outside major centres.

Limitations:
- The overall shortage of funds in the educational system.
- A general lack of computers and advanced networking technologies.
- Unreliable and expensive Internet connections.
- Educational conservativeness, a lack of motivation, and distrust towards modern teaching technologies in the older school of academic society.
- Overall language problems.
- Institutional and legal limitations (the certification of courses, the internal status of virtual students, military service issues, the local approach to academic honesty etc.).
- A lack of general standards, coordination and quality control mechanisms for virtual education.

Before designing the first prototype of the cross-border virtual educational unit, we performed a related risk analysis. To identify possible future bottlenecks, the following three main components were identified and separately analysed from the functional and financial standpoints:

- I: the Institutional component that incorporates legal and institutional limitations, the current status of internationalisation or educational and cultural differences.
- T: the Teaching component, incorporating the content, presentation and language issues of the delivered courses.
- V: the Virtual component, connected mostly with teaching technologies and the technical aspects of distant education.

In our opinion, in a properly working system all the components should be equally important and mutually balanced, i.e. $I = T = V$.

We found, however, that the current situation in Russia is different. Concerning the overall process risks, it holds that $T > I > V$, which means the following:

a) The highest risk is connected with the teaching component, $T$, particularly because of the language skills of local teachers, their minimal experience in the application of computers in education, their difficulties in giving presentations if there is no audience and other personal and social limitations. It is evident that in the case of a teacher’s unclear message, the whole concept fails even if the remaining two components are properly established.

b) The influence of the institutional component, $I$, is significant, especially in the later stages of building common programs, where a strong legal background (double-degree issues, exchange of credits, the mutual recognition of courses or certification and recognition of certification) is needed.

c) We assigned the lowest weight of the risk to the virtual component, $V$, as it includes mainly concrete, deterministic and easily verifiable entities (course material) and related technical arrangements (methods of transferring the course material to distant learners).

From the financial point of view, the relationship among $T$, $V$ and $I$ is rather different, particularly $T > V > I$. This finding can be justified as follows:

a) In the initial stages of implementation, it is not so important to invest in the institutions ($I$), but rather to concentrate on content production and the
motivation of the course designers (T), because only they are able to produce immediate results and influence the subsequent stages.

b) Investments in the technical infrastructure of Russian universities (V) are also crucial, although for the prototype building stage, we do not consider them to be important as direct investments in human resources.

2.4 Semi-virtual education on a cross-border platform

A semi-virtual course on Artificial Intelligence, which corresponded to 6 ECTS credits, was lectured by a single teacher for students from two Finnish and two Russian universities during the autumn semester of the academic year 2002-03. By the term “semi-virtual”, we want to emphasize the regular personal contacts between teachers and students, which were carefully maintained throughout the whole teaching period.

Our experimental course was divided into five blocks that included audiovisual lectures, numerical exercises, Web-based homework and quizzes, as illustrated in Figure 2.

![Figure 2: The internal structure of our semi-virtual course.](image)

Students had to make notes of all the tasks they completed in their own study records by given deadlines. Only those students, who completed all the tasks in the current block, could move onto the next one. There was also a single course project, and the course ended with a written examination. In the final classification, we strived to suppress the importance (leading role) of the examination and to award students for continuous learning, creativity and teamwork.

The lecturer visited the students at the end of each block and discussed all the matters of interest. Moreover, by talking to the students, he could immediately assess the level of some particular knowledge for a certain group and correct the original schedule or content, if necessary. The meetings were necessary also because the Russian students are used to being guided by the teacher. These sessions were theoretically time-unlimited but, in practice, took between three and five hours per group per block.

The majority of the course material was available off-line on CD. Students could access their personal study record over the Internet, and all impersonal communication took place via email. These technical arrangements were acceptable for both Russian and Finnish students. More information on the course structure can be found in (Alaoutinen et al., 2003a). All the materials and teaching was in English.

The significant differences between the Finnish and Russian educational systems required, however, special technical and administrative arrangements for the smooth implementation of shared courses in the both countries to keep the quality of education and the level of achieved knowledge on the highest possible level. For our research, this meant that we
developed, tested and optimized the expected semi-virtual technology initially only with the Finnish students and just after the local satisfaction extended its scope internationally. Details about these experiments will be published elsewhere.

In principle, our final model is similar to an old method called the Keller Plan (Keller 1968). The Keller Plan also divided the course material into smaller units and the students had to study the material by themselves. There were no meetings with the teacher. When a student felt that (s)he mastered the subject, (s)he took a unit test. After passing the test, (s)he could start the next unit. What we have done differently is that we have deadlines for the blocks but no unit tests and the teacher meets the students in every block. This method is in use in contact teaching, for example, at the University of Texas, Austin, and the Australasian Legal Information Institute.

At the end of the course, we asked the students to answer a Web questionnaire, where we asked about their opinions about the realisation of the course. We got 90 answers, which is about two thirds of the number of the active participants.

Over half of the students felt that the use of blocks and deadlines helped them. One student made the following comment:

"I liked ... increased number of deadlines ... applies sufficient pressure evenly across the whole course timespan ".

They also liked the combination of audio files and printable lecture notes:

"The best learning situation for me is when I have written material (slides like here are enough) with me when I listen to the lectures so that I can add my own notes to them ".

Russians felt that the contact sessions were of some help. 60 % of the Russian students replied that it helped a lot and 10 % could not have managed without it. Half of them did not have enough personal contact with the teacher and were not willing either to move the meetings onto the Web or have the meetings more seldom. 75 % of the Russian students did have technical problems while listening to the material. Their biggest problem was access to the Internet. They got the CDs only at the end of the course. At the beginning, they had an access to the material only via the Internet.

At least some of the students have noticed that they need to change their learning styles and to take responsibility for their own learning.

"It was actually more demanding for a student to make his own time for listening to the lectures ".

The same teacher had lectured the course also the two previous times and the final exam has been of the same type; therefore, we could compare the exam results to those of the previous exams to see if there was any differences in the results. Table 1 lists the exam results. LUT ’98 and LUT ’00 are the two old courses we used for comparison. The numbers show a clear improvement in the averages and according to a t-test, the difference is significant (95 %). These results are also in accordance with those obtained by Tyree on the Keller Plan (Tyree 1997). According to Tyree, the Keller Plan had been studied a lot and the results showed that it improved the learning results.

The majority of the students who quit the course (the difference between the registered and passed columns) did this during the first teaching block in reaction to the unusual teaching system, because they had overestimated their own language skills or due to conflicts in their schedules. For the Russians, the course was a demanding extra effort on top of their already fixed timetable, while at our university, students can enrol onto a course without being obliged to actually take it the same year.
3. Conclusions

We found, that currently there is a real possibility to establish a new type of international educational institution on the Finnish-Russian border. The IMPIT program helped us to establish an international, motivating and positively competitive environment in IT department of LUT. Through this, more or less traditionally oriented study program, we established relationships with several leading universities from St. Petersburg region, accommodated cultural background and working habits of Russian students. Another important IMPIT consequence is that we succeeded to include our international students to Finnish industry and found that, if managed properly, Russians are not only successful students and talented researchers, but also good employees.

IMPIT students did also a significant work as our research assistants in various Russia-oriented projects; especially when discovering the overall level of local virtual education. Based on these conclusions we implemented the first international semi-virtual course and learned numerous specifics of Russian higher education.

As the result of the continuous development of IMPIT, we succeeded in moving from a set of courses, taught in a conventional manner for foreign students in a host country, to the prototype of a semi-virtual international course, accepted by participants and recognized by the academic authorities in two countries. It is important to realize that the proposed prototype is something more than a heterogeneous package of audio files and lecturing materials distributed among students. It is a course with flexible study arrangements and improved level of internal communication. Such course can be delivered in a defined quality, when single teacher can serve many students in different places.

In this way, we also proved that it is possible to replace student mobility with the exchange of teachers. Such a model is less expensive and overcomes the multiple legal and administrative limitations between Russia and Finland. The students also felt that the meetings with the teacher were important and supported their learning. Students should not be dependent on the Internet connections and have all the study material available offline from the beginning of the course. Also the timetable and study arrangements were fixed, which made the studies deterministic and students were able to plan their activities in advance.

The exam results just support the statements above showing, that a group of good Russian students managed better than the average Finnish students and also that the exam results of the Finnish students, participating in the semi-virtual course, have improved.

In the future experiments with cross-border education we are planning to include also
shorter but intensive events such as summer or winter schools. Distant students, knowing each other only from the web newsgroup or through the teacher’s interpretation, would meet there and learn how to practically cooperate in the international environment.

Because of the short geographical distances, the best students from both sides of the border could join research or industrial projects instantly on demand. Such a system is motivating, emphasizes quality over quantity and minimizes cultural shocks and brain drain.

The region of St. Petersburg area has all the basic prerequisites for the successful implementation of virtual international education. In accordance with our investigation in several Russian universities, we believe that the design of a future cross-border educational environment should start from the bottom, i.e. with the main investments being made in designers and semi-virtual courses. Once several such courses are properly underway, there will be more reliable evidence on the technical and institutional background needed in the future.

Although the cross-border education between Finland and Russian has many specific features, we believe that our results include also generally applicable conclusions, useful for every academic institution, interested in an immediate cooperation with Russian partners.

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The Use of Templates to Manage On-line Discussion Forums

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Abstract: In higher education, online discussions are an integral part of collaborative based e-Learning systems. However, there can be problems associated with current online discussion models. For example, it can be easy to set open-ended discussions which attract little participation and assessing contributions can be difficult or time-consuming. Students may not achieve the expected learning outcomes without proper structure and management in online discussions. This paper proposes a web-based environment for online discussions where the facilitator can structure each discussion according to its nature and learning requirements using already designed templates. Features include setting mandatory sections to address, assessment weighting, release dates and archiving options. Students can prepare and post their messages and responses using the discussion forum interface. The facilitator may assess students’ messages, mark them and release them to other responders for review. The discussion can be automatically archived for further discussion or reference. Students should find the proposed structured online discussion model easier to follow, while the facilitator will have more control over the activity and find it easier to assess and re-use. Templates can help in structuring this process.

Keywords: Collaboration, Discussion Forum, CMC, Asynchronous Communication, e-Learning, Higher Education, Templates, Collaborative Learning

1. Introduction

e-Learning is rapidly becoming mainstream in higher education. Computer-mediated communication is a key element of e-Learning systems and strategies. Online discussions are one of the most important applications of computer-mediated communication in e-Learning environments (Kearsley 2000). They provide an asynchronous collaborative learning environment where interaction takes place between group members (Dillenbourg 1999) and have been included in almost all courses or learning management systems.

Online discussions offer a number of potential benefits that can help engage students in activities that contribute to their intellectual growth (MacKnight 2000). For example, composing a response in online discussions often requires greater reflection than in face-to-face discussions (Harasim 1995). Other benefits include promotion of team building, promotion of critical thinking (Muilenburg & Berge 2002) and support for collaborative work (Salter 2000).

The facilitator may actively control the discussion through means such as selectively releasing responses, limiting who can view them or by active participation in the forum. On the other hand, the facilitator may take a more hands off approach and leave the students to themselves after posting a question or task. Unfortunately, simply asking students to respond to an instructor’s given topic or question is not likely to generate an effective collaborative learning environment. It may help students to interact with information but not with the instructor or other students.

This paper will examine some of the problems associated with current discussion models and then propose a model that aims to encourage greater collaboration and makes it easier to structure, manage and assess online discussion activities.

2. Limitations in existing online forum models

There are only a few models for online discussions with limited variation. The discussion area provides a platform where participants can share ideas by posting a message to initiate a discussion or to respond to already posted questions or messages of ongoing discussion. One variation is whether the messages can be viewed in a linear or threaded fashion.

In a learning environment, the facilitator that moderates the process may be a tutor, instructor or teacher. The facilitator explains the purpose and sets up the protocols such as discussion cycle, duration and assessment weight. The facilitator often starts the discussion by posting a question. Students answer the question in the form of a discussion posting and may be required to comment on other responders posting as well (Rossman 1999, Laurillard 2002).
The following problems can be associated with such model(s).

2.1 Open-ended discussion topics

Open-ended discussions may result in non-productive learning activity. Students are likely to lose interest where there is an overload of information that doesn’t have direct application or use (Harasim 1995).

If there is assessment associated with the discussion question students may be tempted to copy text from different sources to perform the activity rather than engage with the question. This does not help students to enhance their analytical and critical thinking. At the same time long unstructured responses can result in a greater information burden for other responders.

2.2 Low participation or problem of “lurking”

Lurking is another big problem that is often a lack of participation by students particularly where it is a new communication medium (Harasim 1995). Another common observation is that active students take an interest in discussion based learning whereas passive students tend to find it less attractive. This may be because it is a text-based, self-initiated learning environment.

Research proposes a number of strategies to hold students interest and to enhance their critical thinking (Muilenburg & Berge 2002) but current technologies and models do not necessarily support them. Students become confused or lose their interest when a discussion is ill-structured or there is no process designed to enhance their critical thinking (MacKnight 2000).

Low participation in discussion forums may also be linked with students’ own learning styles. Some students strongly believe in individual learning. In that case, the existing discussion forum model, based on a collaborative approach, may not be appropriate. (Sae-Chin & Resta 2003).

2.3 Ill-described discussions

Students find it hard to initiate their response to them where the task is not well described. In contrast, it has been observed that students find those learning activities more interesting where the task is specifically well defined and easier to follow (Mullenburg & Berge 2002).

Similarly, the job of assessing the student responses is more time consuming and subjective when the task is not well defined (Burford & Cooper 2003).

2.4 Discussion management

Current discussion models do not include many management features that can assist in an educational setting. Features useful in educational settings include access control, discussion availability duration, assessment weight, and archive options.

For example, a facilitator may want to release discussion responses only after he or she has added feedback and the last student has responded. After this the activity may continue where the students are required to compare their responses. This can be a difficult process with current available software and tools.

Typically there are no start or stop controls available and the facilitator does this by informing the students or closing the discussion topic manually. The H2O project (H2OProject 2003) allows facilitators to set some deadlines for submission of posting but it does not have the other features discussed in this paper. It is freely available at http://h2o.law.harvard.edu.

2.5 Discussion assessment

A continuing research problem is how to assess discussion contributions (Mochizuki et al 2003). Assessment was not included in most of earlier discussion models. Typically, they have been used to share ideas and helping out each other. Many were not formally linked to learning activities, outcomes and finally to assessment. However, messages in discussion forums can be useful for assessing collaborative learning (Mochizuki et al 2003).

Assessing a contributor is very hard and time consuming (Laurillard 2002) as there are few techniques available. A common one is to count the number of postings (Salter 2000). This strictly quantitative approach does not necessarily correlate with learning or effort. Indeed, it may encourage students to simply post frequent and/or large messages but without making a serious attempt.

In fully online courses, the volume of posting may be huge to read and assess. In this case assessment may be done by the contributors themselves or by peers. The ‘Peer and Self Assessment System (PSAS), suggests ways in which this might be done (Resta 2003) see http://dl.aace.org/14156. However, this kind of system may have some problems such as it
can be biased, time consuming and difficult to integrate into the main assessment system. Peer grading can provide strong motivation to do quality work, but students are often uncomfortable grading one another (Salter, 2000). A simple rating system (eg. excellent, good, fair, poor) can be used or students may be required to make only positive critiques (leaving the negative comments to the instructor).

Another assessment technique is text mining (Fujitani & et al 2003). However this example is used for self assessment and only to see overall discussion patterns but it is not linked to actual student assessment. Other assessment methods are provided in Salter (2000).

However, whichever technique is chosen, greater management by the discussion model can make marking easier, particularly given the volume of responses generated by most discussions.

3. Template based discussion system

The structure of online discussions is an important aspect involved with encouraging collaborative learning. It requires planning and management (Mason 1998, Laurillard 2002). To assist in this the following web-based online discussion model (Figure 1) is proposed.

![Diagram of online discussion model](http://www.ejel.org)

**Figure 1:** Proposed online discussion model

3.1 System: Actors & components

1. Facilitator: the instructor or moderator who controls the online discussion as controller.
2. Responders: students who responds to facilitator’s question/task or other students’ postings.
3. Discussion Template: discussion questions and stored settings from the control panel.
4. Control Panel: allows the facilitator to configure each discussion.
5. Discussion Forum: a password protected web interface where responders post their messages. On submission each message is automatically saved.
6. Assessment: allows the facilitator to access different responses and mark them.

[Diagram of online discussion model]

http://www.ejel.org
3.2 Process

![Application homepage](http://www.ejel.org)

A facilitator starts the activity by either creating or choosing an online discussion template stored in the Discussion Model Templates database.

![Discussion template builder](http://www.ejel.org)

**Figure 2:** Application homepage

**Figure 3:** Discussion template builder

The Discussion Template Building environment allows the facilitator to specify the elements required for a particular online discussion and then save it as an online discussion template.
Figure 4: Discussion control panel

The control panel component allows the facilitator to set parameters for the discussion such as release and finish time, anonymity, assessment weight, public/private, attachment options, archive options and whether the discussion is threaded or unthreaded.

Figure 5: Discussion forum for students

Responses in the forum follow the structure set by the facilitator.
If there is an assessment weighting associated with that particular discussion activity the facilitator is able to grade the response.

If requested the discussion will automatically be saved in the Discussion Archive. For example, suppose a lecturer wants the students to explore some free web resources available for automatic website testing. The work needs to meet a deadline and will be marked. The postings should be available to other students to avoid repetition of the same testing tools. Finally, the work will be reused in another activity where students will rate and categorise the web site testing tools listed.

Using existing discussion models, the lecturer would have to put in considerable effort moderating the discussion to check the deadline, manually marking the students’ postings and creating a usable discussion archive at the end.

Using the proposed system (Discussion Corner) a template is created:

Web Site Testing Tool
- Name: (mandatory)
- URL : (mandatory)
- Features: [maximum 250 words] (mandatory)
- Comments

After that, other options are set using the Control Panel:
- Archive: Yes (the work will be re-used)
- Selective Release to: None (discussion is for whole class)
- Available Date: 30-11-03 12:00 (when student can see it)
- Due Date: 07-12-03 00:00 (student submission date)
- Release Date: 07-12-03 (student only can see others' posting after release date, as the lecturer does not want students to see others postings before this.)
- Anonymous: No (Students posting will be personalised)
- Comments: Allowed (After release date students can annotate comments to others postings)
- Threaded: No (Students can not respond to students postings, as this is not on-going threaded discussion)

4. Expected benefits
The proposed system should provide the following benefits -

4.1 Structured discussion objectives
In online discussions, the nature and structure of discussion questions is very important
(Muilenburg & Berge 2002). The proposed model will help enforce this by providing a template-building environment for the facilitator. Rather than settle for questions that concentrate on recall (eg. give a definition of X?), more creative examples can be built into the templates. These might include -

- Rating alternative information sources
- Evaluating a list of alternatives based on multiple criteria.
- Electronic Brainstorming for a specific question or issue. (Salter, 2002)
- Group outlining to generate or group ideas into a familiar hierarchical structure. (GroupSystems.com, 2002)
- Providing an annotated bibliography
- Voting and survey questions

In particular, this will assist those teachers who are new to online discussions to set meaningful discussion questions that encourage evaluation and/or deep learning.

4.2 Students’ interest and reusability of their work

Specific and well-structured discussions questions are more likely to hold students’ interest especially when there is some assessment weighting attached to it. Student work is not necessarily discarded when the semester is over. With permission, this work can be analysed or built upon by students in future semesters. By supplying samples of good quality previous work the authors have noted anecdotally that the standard for subsequent semesters continues to increase. In other cases, students have analysed the previous work in a new manner. For example, student ratings on an issue from a previous discussion can be collated and graphed.

4.3 Well managed discussions

Discussion management is a challenging aspect of online discussions, especially in an educational environment (Burford & Cooper, 2003). It is also a very time consuming job (Laurillard, 2002). For example, without a set ending date, discussions can be viewed as ‘never-ending’ and the purpose can be lost. Having set opening and closing times for a discussion helps avoid information overload and keeps students focused on the task (Salter, 2000). The proposed system allows the facilitator to have much more control over the management of the discussion.

4.4 Assessment

Assessment in discussion forums is gaining importance (Mochizuki, 2003). In educational environments, assessment is linked to learning outcomes which in turn are linked to learning activities (Burford & Cooper, 2003). The proposed system assists teachers if they want to include assessment weightings and provides a facility for marking. Rather than simply using a quantitative system for marking (eg. number of posts) a more qualitative approach can be taken. For example, students may have to submit a draft version for others to critique before producing a final version (Salter, 2000). Using the system both the final version and the critiques could easily be marked.

5. Future research

This paper focuses on a work in progress. The real test will come when the proposed model is applied in a higher education environment. Using an action research model, the following questions will be answered -

- Do students find the forum easier to use and follow? Does it support and enhance their level of collaboration? Does it improve the quality of their work?
- Do staff prefer the forum to create and manage online discussions? Does it minimize their effort in managing online discussions?
- Is reusability of discussion templates good idea in practical sense? Will it save time and effort?
- What is the best framework to reuse the outcomes of students’ postings?

6. Conclusion

There are some problems associated with the current models of online discussions in higher education. Discussions can end up as an open-ended, non-productive learning activity, there may be a lack of students’ participation, discussions may not be well structured or easy to initiate and assess by staff. The proposed system has been designed to help overcome these problems. This may lead to better outcomes for both students and staff. These expectations are going to be tested through action research where the proposed system will be tested by faculty and students.

References

Burford, S., & Cooper (Accessed on 28th August, 2003), L "FAQs: Collaborative Learning Online", [online],

http://www.ejel.org


Navigation and Ownership for Learning in Electronic Texts: An Experimental Study

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Abstract: Feelings of ownership for learning are an important part of the learning process and should be encouraged in e-Learning environments. This paper presents two experimental studies investigating the effects of navigation aids on ownership for learning with electronic texts. Experimental findings revealed that designers should not assume that allowing learners greater control over their navigation through higher navigational freedom, or the ability to create their own navigation aids, will increase feelings of ownership for learning with electronic texts. The results of these studies have implications for those designing navigation in educational electronic texts.

Keywords: ownership for learning, navigation aids, electronic text.

1. Introduction

Electronic texts are an essential component of any e-Learning environment. The way that the user interface is designed to support navigation in electronic texts is critical since it determines the way that the texts can be traversed and it is vital that navigation problems, such as ‘feelings of lostness’ (e.g. Conklin 1987), are avoided. In e-Learning environments, a key question is how navigation affects learning, and one important aspect of the learning process is that learners feel ownership for their learning (e.g. Cunningham et al 1993).

Previous research has demonstrated that navigation aids affect the way users interact with educational electronic texts and this, in turn, influences the achievement of learning outcomes (e.g. McDonald and Stevenson 1999). We extend this by hypothesising that different navigation aids will also impact upon users’ feelings of ownership for learning and we present two experiments designed to investigate these effects. The first experiment examined the effects of the level of navigational freedom offered by a navigation aid on feelings of ownership for learning. The second experiment examined the effects of allowing learners the opportunity to create their own navigation aids on feelings of ownership for learning.

‘Electronic text’ is used here as a generic term to refer to any text presented in an electronic medium. These texts may be presented in a variety of ways including WWW and stand-alone CD-ROMs. Examples include hypertext documents (nodes of text connected by embedded links), text organised in menu structures, or linear text organised as a set of sequential nodes or as a single scrollable document. We define ‘navigation aids’ as elements of an interface that allow the user to access and traverse electronic texts; examples include embedded links, menus, interactive maps, and bookmarks.

1.1 What is ownership for learning?
Milner-Bolotin’s (2001) working definition of ownership is employed in this research. In this definition, learner ownership is broken down into three interacting components of the learning process: finding personal value, feeling in control, and taking responsibility (see figure 1). Finding personal value is about understanding how the knowledge and skills developed during learning might be useful in situations outside the original learning environment. High feelings of control occur when the learner makes decisions and is a proactive rather than reactive learner. Responsibility in learning, on the other hand, refers to the learner taking responsibility, or feeling accountable, for the process of learning as well as the results of learning. The highest levels of ownership occur when all three components overlap. Situations where only one or two components overlap result in lower feelings of overall ownership.
In terms of ownership, Milner-Bolotin (2001) proposed that learning environments that allow students higher control over their learning, allow them to choose topics of investigation which are more relevant for them, and allow them to be more responsible for their learning, provide more opportunities for students to develop a sense of ownership. In digital technology many authors have interpreted this learner control as control over pace and sequencing (Dillon and Gabbard 1998; for a detailed review see Lunts 2002). We propose that one way this control and choice is realised in electronic texts is as the extent to which learners are able to explore the texts in a way they see fit.

In order to investigate control and choice in electronic texts we define ‘navigational freedom’ as the degree of choice a user has when deciding which page to visit. This equates to the number of outgoing links a learner has to choose between on any one page of the texts. The type of navigation aid(s) employed determines the level of navigational freedom offered. For example, an A-Z index, that allows the learner to choose between every page in an electronic text, represents a navigation aid with higher navigational freedom than paging buttons where the learner only has the choice of going to the next or previous page in a predefined sequence. We hypothesise that navigation aids that offer higher navigational freedom will lead to higher feelings of ownership for learning than navigation aids that offer lower navigational freedom. Experiment 1 was designed to measure these predicted effects.

1.2 Why is ownership important in learning?
Learner ownership is promoted as illustrating the student-centredness of constructivist learning (Honebein 1996) and has been proposed to be important in terms of motivation to learn (e.g. Biggs 1999). Gross (1997) reported that attempts to encourage ownership in a classroom setting had positive effects on learning. By stressing student input, students came to feel responsible for their learning and in turn it was found that they grasped material more firmly, exhibited higher levels of inquiry and pursued tasks independently.

1.3 Background and experimental hypotheses
1.3.1 Learner control and navigational freedom
Supporters of constructivism propose that learners should be given responsibility and control over their learning (Honebein 1996; Duffy and Cunningham 1996), and educationalists have argued for some time that providing appropriate levels of learner control benefits learning (Eveland and Dunwoody 2001). In the context of e-Learning, learner control can be used to refer the extent to which learners are able to make choices and decisions when they use a piece of educational technology. It should also be noted that learner control is distinct from feelings of control, because even if control is offered to the learner, it is not always the case that they will feel and recognise this control.

Recent developments in navigation aids allow the user to adapt the aid and use it to represent ideas in the electronic text. For example, Nestor Navigator (e.g. Zeiliger et al 1997; Zeiliger et al 1999; Nestor is available at http://www.ejel.org)
for download here) is a web browser add-on that creates a graphical trace of visited web pages as the user navigates. This trace can be rearranged and edited, allowing users to create their own navigable structures such as maps (click here for an example map on Nestor related websites), contents lists and alphabetical indexes which they can use as navigation aids.

Due to the proposed benefits of learner control in encouraging ownership we hypothesise that creating navigation aids will lead to higher feelings of ownership for learning with electronic texts, than simply using navigation aids. Experiment 2 investigates the effects of creating navigation aids as compared to using navigation aids in Nestor.

The next section presents the methods employed in experiments 1 and 2.

2. Method

2.1 Experiment 1

Experiment 1 aimed to investigate the effects of the level of navigational freedom offered by navigation aids on feelings of ownership for learning. Participants used either paging buttons, hypertext, an A-Z index or a map to navigate educational electronic texts. They were then asked to rate their feelings of ownership for their learning with the electronic texts on a questionnaire.

2.1.1 Participants

Twenty-eight undergraduates and postgraduates on an introductory Human Computer Interaction (HCI) course took part in the study. Sixteen were female and twelve male. Ages ranged from 18-39 years. All had a similar level of background knowledge of the topic presented in the electronic text.

2.1.2 Materials

Participants were given electronic text on the subject of usability evaluation, compiled from teaching materials. The text consisted of twenty-three nodes and was approximately 3100 words in length. The materials were created and accessed using the Nestor Navigator browser.

2.1.3 Design

A between-subjects design was employed and participants were randomly assigned to experimental conditions, giving a total of seven participants in each condition. The independent variable was the type of navigation aid. The four conditions and associated levels of navigational freedom were:

- Condition 1: Paging buttons (lower navigational freedom).
- Condition 2: Hypertext (medium navigational freedom).
- Condition 3: A-Z index (higher navigational freedom).
- Condition 4: Map (higher navigational freedom).

See figures 2-5 for illustration.

Condition 1 (paging buttons) consisted of 'Next' and 'Previous' buttons that allowed the user to access pages in a sequential order. In condition 2 (hypertext) each page consisted of hypertext and a back button, and the pages in the text were arranged as a network of cross-referential links. Condition 3 (A-Z index) consisted of a left-hand frame containing an interactive alphabetical list of page titles, and a right hand frame showing the content of pages. Similarly, condition 4 (map) consisted of a left-hand frame containing an interactive graphical map of page titles, and a right hand frame showing the page content.

The A-Z and map conditions were both included in this experiment to represent high levels of navigational freedom in order to assess the effects of the different structures they depict. The graphical map shows one possible conceptual structure of the text. The index, in contrast, shows an alphabetical structure.

The dependent variable was the level of feelings of ownership for learning. An ownership measurement questionnaire (Milner-Bolotin 2001), designed for measuring ownership in a classroom setting, was adapted for use in the context of educational electronic texts. The original questionnaire was worded in terms of ownership for learning in a group project. The process of adapting the questionnaire involved rewording the questions in terms of issues specific to the use of electronic texts in learning. The adapted questionnaire consisted of sixteen questions on feelings of control for learning, feelings of responsibility for learning and feelings of value for learning. Questions were rated on a five-point Likert scale from strongly disagree (1) to strongly agree (5). The results of a reliability analysis and factor analysis of the
questionnaire will be discussed further in the results section.

2.1.4 Procedure

Participants were tested individually. Initially participants were given a pre-test questionnaire on their knowledge of usability evaluations, followed by a ten-minute training task in using the navigation aids with sample materials on the American Museum in Britain. For the main task, participants used electronic texts on usability evaluation in a realistic educational task. They were given a setting for a usability evaluation including details of a budget, timescales and access to users. They were then given up to forty-five minutes to use the task materials on usability evaluation to choose a usability evaluation technique for the given setting. After they had finished, they were asked to complete the questionnaire regarding their feelings of ownership for learning with the electronic texts.

2.2 Experiment 2

Experiment 2 aimed to investigate the effects of creating navigation aids on feelings of ownership for learning. The experiment had two parts, each carried out by different participants. Participants in part A of the experiment used electronic texts with an existing map or facilities to create their own map as navigation aids. Participants in part B used electronic texts with an existing A-Z index or the facilities to create an A-Z index as navigation aids. They were then asked to rate their feelings of ownership for learning on a questionnaire. Data collected from the hypertext condition in experiment 1 was also used as a comparison condition in parts A and B of this experiment.

2.2.1 Participants

Twenty-six undergraduates and postgraduates on an introductory HCI course took part in parts A and B. Thirteen took part in part A and thirteen took part in part B. Of the twenty-six, thirteen were female and fourteen male. Ages ranged from 18-49 years. All had a similar level of background knowledge of the topic presented in the electronic text.
2.2.2 Materials
The same text content was used as in experiment 1. Again the materials were developed and accessed using the Nestor Navigator browser.

2.2.3 Design
A between-subjects design was employed for both parts A and B of this experiment and participants were randomly assigned to experimental conditions.

The independent variable was the type of navigation aid. For part A the experimental conditions were:
- Condition 1: Using a Map (+ Hypertext)
- Condition 2: Creating a Map (+ Hypertext)

For part B the experimental conditions were:
- Condition 3: Using an A-Z (+ Hypertext)
- Condition 4: Creating an A-Z (+ Hypertext)

Six participants took part in conditions 2 and 3, and seven participants took part in conditions 1 and 4.

Condition 1 (using map + hypertext) consisted of hypertext and a back button, and a graphical map of page titles in a left-hand frame. In condition 2 (creating map + hypertext), initially the participants accessed pages using hypertext. When the participants visited a page, the page title and the visited link were represented as a graphical trace in a left hand window. The page titles were interactive and could be used to access pages in the electronic texts. The participants were asked to arrange the map according to their own preferences by re-arranging the shape of the map, adding new links and deleting links.

Condition 3 (using A-Z + hypertext) consisted of hypertext and a back button, as well as an interactive alphabetical index of page titles in a left-hand frame. For condition 4 (creating A-Z + hypertext) the participants could access pages using hypertext. When the participants visited a page the page title was represented in a window on the left hand side of the screen. These titles were interactive and could be used to access pages in the electronic text. Participants were asked to arrange page titles into alphabetical order by clicking and dragging them into position.

As with experiment 1, the creating and using A-Z and map conditions were both included in order to assess the effects of the different structures that they depict. The map shows one possible conceptual structure of the text, where as the A-Z shows an alphabetical structure.

Finally, the following condition was also added as comparison condition in both parts A and B, since it forms a baseline for the conditions in both parts A and B:
- Condition 5: Hypertext

The data collected from the seven hypertext participants in experiment 1 was used here as condition 5. The use of this data as a comparison condition is valid since the procedures and measures used in experiment 2 are the same as experiment 1. As such, data from the hypertext condition can be compared against conditions 1 and 2, as well as against conditions 3 and 4.

The dependent variable was the level of feelings of ownership for learning as measured by the ownership questionnaire detailed in section 2.1.3.

2.2.4 Procedure
The procedure was the same as that used in experiment 1, except that the participants in the creating navigation aids conditions were asked to create the respective navigation aid as they used the electronic texts.

3. Results

3.1 Reliability analysis and confirmatory factor analysis
In order to assess the quality of our ownership questionnaire, we performed an analysis of its internal reliability. This process led to the removal of three questions due to low-item total correlations, indicating that these questions were measuring a different construct to the rest of the questionnaire. The final questionnaire, used in the following analyses had thirteen questions, and was found to have a Cronbach’s alpha of 0.8, indicating good internal reliability.

In addition we performed a confirmatory factor analysis to identify factors in the final questionnaire. Three factors were revealed relating to: control over use of the electronic texts; responsibility for learning with the electronic texts; and value for learning with the electronic texts. See box 1 for the questions that fell under each factor, and the questions that were removed.
Factor 1 – Control
I felt I could not access the pages I wanted to in the electronic texts.
I felt I was free to choose the way I progressed through the electronic text materials.
I felt I had control over the use of the electronic text.
I think I had control over my progression through the electronic text materials.
I felt responsible for the exploration of the materials on usability evaluation.

Factor 2 – Responsibility
I felt responsible for my final choice of evaluation techniques(s).
I felt ownership for my final choice of usability evaluation technique(s).
I do not feel a personal responsibility for the decisions I made when using the electronic texts to choose a usability evaluation technique.
I feel responsible for the usability evaluation decisions I made when using the electronic text.
I had a sense of ownership for my use of the electronic text materials to choose a usability evaluation technique(s).

Factor 3 – Value
I found no personal value in the information in the electronic texts.
I found personal value in the use of the electronic texts.
I think I will be able to use what I have learned from the electronic text materials in other courses, and/or in everyday life.

Removed Items
I felt that my progression through the electronic text materials was guided.
I think that the skills that I have learned when using these materials will help me to succeed in the future.
I think freedom to decide the way you use electronic text materials is very important to learning with these materials.

Box 1: Questions that fell under each factor and removed questions.

3.2 Experiment 1
This section reports on results from participants in the paging buttons, hypertext, A-Z and map conditions in experiment 1.

Total ownership scores were calculated by reversing the ratings for negatively worded questions and adding together ratings for all questions on the questionnaire. All thirteen questions were weighted equally so the total ownership scores were rated out of 65. The questionnaire responses were then examined in terms of average ratings for each factor.

Average ratings for the control factor were calculated by pooling all the participants’ ratings for the control questions and calculating an average for each condition. The same method was used to obtain average ratings for the responsibility and value factors.

Due to the non-parametric nature of the data, Kruskal-Wallis one-way analyses of variance (ANOVA) by ranks were employed to assess differences between conditions, and where appropriate non-parametric tests for post-hoc pair-wise comparisons according to the Siegal and Castellan (1988) method were also used (see table 1). Note that graphs are only given where there are significant differences between conditions.

![Figure 6: Average ratings on the control factor for conditions in experiment 1](http://www.ejel.org)
Table 1: Results of analyses performed on questionnaire ratings for the paging buttons, hypertext, A-Z and map conditions in experiment 1

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Average for each condition</th>
<th>Kruskal-Wallis ANOVA</th>
<th>Significant post-hoc tests (p&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ownership scores (out of 65)</td>
<td>paging buttons – 49.71; hypertext – 49.14; A-Z index – 52.86; map – 50.57.</td>
<td>Non-significant.</td>
<td>N/A.</td>
</tr>
<tr>
<td>Control factor (out of 5)</td>
<td>paging buttons – 3.34; hypertext – 3.54; A-Z index – 4.40; map – 4.17. (see figure 6).</td>
<td>Significant (H(3,140)=20.82,p&lt;0.000)</td>
<td>paging buttons vs A-Z; paging buttons vs map; hypertext vs A-Z; hypertext vs map.</td>
</tr>
<tr>
<td>Responsibility factor (out of 5)</td>
<td>paging buttons – 3.91; hypertext – 3.97; A-Z index – 3.57; map – 3.54.</td>
<td>Non-significant.</td>
<td>N/A.</td>
</tr>
<tr>
<td>Value factor (out of 5)</td>
<td>paging buttons – 3.91; hypertext – 3.97; A-Z index – 3.57; map – 3.54.</td>
<td>Non-significant.</td>
<td>N/A.</td>
</tr>
</tbody>
</table>

3.3 Experiment 2

Firstly we present the results of the analysis of data collected from the using map and creating map conditions in part A of experiment 2, compared with data from the hypertext condition in experiment 1. We then present the results of analyses conducted on the data from the using A-Z and creating A-Z conditions in part B of experiment 2, again as compared with the data from the hypertext condition in experiment 1. As discussed earlier the comparisons with the hypertext condition are valid since the procedures and measures of experiments 1 and 2 are the same.

Total ownership scores out of 65 were calculated in the same way as in experiment 1. The questionnaire responses were also examined in terms of ratings for each factor, and averages were again calculated in the same was as in experiment 1. Kruskal-Wallis ANOVAs were then employed to assess the effects of the different navigation aids, and where appropriate non-parametric tests for post-hoc pair-wise comparisons according to the Siegal and Castellan (1988) method were also used. The results for parts A and B of experiment 2 are presented in tables 2 and 3 respectively. Graphs are only shown for significant results.

Table 2: Results of analyses performed on questionnaire ratings for the using map and creating map conditions in part A of experiment 2, including comparisons against the hypertext condition from experiment 1.

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Average for each condition</th>
<th>Kruskal-Wallis ANOVA</th>
<th>Significant post-hoc tests (p&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ownership scores (out of 65)</td>
<td>using map – 59.29; creating map – 46.33; hypertext – 49.14. (see figure 7).</td>
<td>Significant (H(2,20)=8.226,p&lt;0.050).</td>
<td>using map vs. creating map; using map vs. hypertext.</td>
</tr>
<tr>
<td>Control factor (out of 5)</td>
<td>using map – 4.69; creating map – 3.70; hypertext – 3.54. (see figure 8)</td>
<td>Significant (H(2,100)=26.19,p&lt;0.000)</td>
<td>using map vs. creating map; using map vs. hypertext.</td>
</tr>
<tr>
<td>Responsibility factor (out of 5)</td>
<td>using map – 4.51; creating map – 3.63; hypertext – 3.97. (see figure 8)</td>
<td>Significant (H(2,100)=16.70,p&lt;0.000)</td>
<td>using map vs. creating map; using map vs. hypertext.</td>
</tr>
<tr>
<td>Value factor (out of 5)</td>
<td>using map – 4.43; creating map – 3.22; hypertext – 3.86. (see figure 8)</td>
<td>Significant (H(2,60)=9.64,p&lt;0.01)</td>
<td>using map vs. creating map.</td>
</tr>
</tbody>
</table>
Table 3: Results of analyses performed on questionnaire ratings for the using A-Z and creating A-Z conditions in part B of experiment 2, including comparisons against the hypertext condition from experiment 1.

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Average for each condition</th>
<th>Kruskal-Wallis ANOVA</th>
<th>Significant post-hoc tests (p&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ownership scores</td>
<td>using A-Z – 52.00;</td>
<td>Non-significant.</td>
<td>N/A.</td>
</tr>
<tr>
<td></td>
<td>creating A-Z – 49.43;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>hypertext – 49.14.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control factor</td>
<td>using A-Z – 3.57;</td>
<td>Non-significant.</td>
<td>N/A.</td>
</tr>
<tr>
<td></td>
<td>creating A-Z – 3.97;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>hypertext – 3.54.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibility factor</td>
<td>using A-Z – 4.20;</td>
<td>Non-significant.</td>
<td>N/A.</td>
</tr>
<tr>
<td></td>
<td>creating A-Z – 3.94;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>hypertext – 3.97.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value factor</td>
<td>using A-Z – 4.39;</td>
<td>Non-significant.</td>
<td>N/A.</td>
</tr>
<tr>
<td></td>
<td>creating A-Z – 3.90;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>hypertext – 3.86.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7: Average total ownership scores for analyses of part A in experiment 2.

Figure 8: Average ratings on the control, responsibility and value factors for analyses of part A in experiment 2.

4. Discussion

The two experiments presented here aimed to assess the effects of navigational freedom and creating navigation aids on ownership for learning with electronic texts. Overall the results of these experiments indicate that navigation aids influence ownership for learning.
4.1 Summary and explanation for findings

4.1.1 Experiment 1

Experiment 1 examined the effects of the level of navigational freedom offered by a navigation aid, on feelings of ownership for learning. It was found that navigational freedom had significant impact upon feelings of control for learning with electronic texts, but did not affect overall ownership, or the component feelings of responsibility and value as measured by the questionnaire. In particular A-Zs and maps led to significantly higher feelings of control than paging buttons and hypertext. This suggests that the higher level of navigational freedom offered by the A-Z and map encourages higher feelings of control in the learner than the lower levels of navigational freedom offered by the paging buttons and hypertext. The learner control offered through higher navigational freedom has a positive influence on feelings of control, but findings indicate that it does not affect high feelings of responsibility or value in learning with electronic texts.

4.1.2 Experiment 2

Experiment 2 investigated the effects of creating navigation aids on ownership for learning with electronic texts. For part A, analyses showed that there were significant differences for overall feelings of ownership between the using map, creating map and hypertext conditions, but these results were not as predicted. It was found that participants who used maps reported significantly higher feelings of ownership than those that created their own maps. Furthermore, participants who used maps also reported significantly higher feelings of ownership on the questionnaire than participants that used hypertext. However, for part B there were no significant differences in the level of ownership reported by participants in the using A-Z, creating A-Z and hypertext conditions.

The results of experiment 2 were also examined in more detail by looking at participants’ ratings on each factor of the questionnaire. The analyses of part A revealed that participants who used maps reported significantly higher feelings of control, responsibility and value for their learning than participants who created their own maps. In addition, the participants who used maps also reported significantly higher feelings of control and responsibility than participants who used hypertext. For the analyses of part B, there were no significant differences in the levels of control, responsibility and value reported by participants who used A-Zs, created A-Zs or used hypertext.

Our findings indicate that creating maps leads to lower feelings of overall ownership, and each of its component factors of control, responsibility and value, than using maps. However, the fact that no significant differences were found between using A-Zs, creating A-Zs and using plain hypertext for overall ownership, or the control, responsibility and value factors, suggests that it is not simply the act of creating a navigation aid that negatively leads to lower feelings of ownership. The effect is specific to differences between the using and creating map conditions in our experiment.

A potential explanation for this is that the activity of creating a map, in itself, requires certain skills that the user may not have unless they have used mind mapping software previously. In this experiment, although the participants were given functional training in map creation, they were not given any additional guidance about the best techniques to apply when creating maps. This was intentionally left open in this experiment so that participants could make their own decisions about creating the map.

4.2 Scope of findings

The type of electronic texts and the type of tasks employed in our experiments define the scope of our findings. The electronic texts used in these experiments were on the subject of usability evaluation, a topic that is central to HCI education, and has little pre-defined structure. As such, the findings presented here are of particular relevance to the use of educational electronic texts in topics with similar inexact structures such as those in Art and History. However, findings on ownership may differ for educational electronic texts with natural pre-defined structures, such as biological classification systems.

Our findings are also particularly relevant in short-term educational tasks, such as those used in a single tutorial session. However, findings on ownership may differ in long-term educational tasks or projects. This may be particularly relevant to the creation of navigation aids. Navigation aids that are created and refined over time may have different effects on ownership to the findings reported here.
The findings presented here focus on the effects of navigation aids on feelings of ownership for learning. We have not addressed other aspects of the learning process such as knowledge development.

4.3 Implications of findings

There are three major implications of our findings. Firstly, navigation aids affect feelings of ownership for learning with electronic texts. This indicates that designers of these texts should consider the employment of navigation aids carefully if they want to promote feelings of ownership.

Secondly, higher navigational freedom leads to higher feelings of control, but not higher overall ownership or the component feelings of responsibility and value. Consequently, we suggest that the designer of educational electronic texts should not simply look at navigational freedom to encourage feelings of ownership for learning. They should also address issues related to encouraging the user’s feelings of responsibility and value in their learning. We can speculate that aspects of the learning environment that might influence these feelings include the relevancy of the task to the learner and the learner’s involvement in decision making about the task.

The third implication of our experiments is that creating navigation aids has little or negative effects on feelings of ownership for learning, but that using maps to navigate is particularly beneficial to ownership. As such, if they want to promote ownership designers of educational electronic texts should be careful in the way that they employ tools that allow users to create their own navigation aids.

4.4 Conclusions and future research

Overall, our findings suggest that designers of educational electronic texts should not assume that by increasing navigational freedom, or offering learners the ability to create their own navigation aids, they will increase the learner’s feelings of ownership. Results presented here indicate that the effects of these types of navigation aids are not clear-cut in terms of ownership, and further investigation is needed.

Three key areas for future research have been identified. Firstly, the results presented here only examine the consequences of navigational freedom, and using and creating navigation aids in terms of feelings of ownership for learning. In order to get a complete picture of the effects of these activities further investigation will look at how they influence users’ understandings of the text content as well as how efficient they are to use. Secondly, since it was thought that potential difficulties could have arisen with the creation of maps due to learners’ inexperience in mind mapping skills, another area for future investigation is to examine the effects of additional training in mind-mapping skills and specific training in the use of creating-map software, on feelings of ownership for learning. Finally, this research should be extended by looking at the effects of navigation aids on ownership for learning in the context of different types of electronic texts and educational tasks.

References


The Need for a Strategic Foundation for Digital Learning and Knowledge Management Solutions

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Abstract: This paper elaborates on the importance of a strategic foundation when digital learning or knowledge management (KM) solutions are planned and developed. It looks at some key issues of e-Learning and knowledge management (KM) through discussing the various stages (technologies) and potential benefits of e-Learning; the state of the e-Learning industry; the concept and hierarchy (components) of KM; digital divide; and the implications of KM on e-Learning. It emphasizes the importance of a strategic approach to introducing e-Learning and KM through reviewing some of the potential causes of failure and proposing a framework for developing a strategic foundation for e-Learning and KM.

Keywords: Digital Learning, Knowledge Management, e-Learning, Strategic Foundation, Digital Divide

1. Introduction

Educators and educational technologists (e.g. Baynton 2001, Rosenberg 2001, Higgins 2002, Burns et al 2001, and Dobbs 2000) argue that learning practices are on the verge of a major change. Today, the knowledge and skills that we acquire are in danger of becoming increasingly obsolete, which in turn requires us to learn on an ongoing basis. Most traditional approaches (to learning) seem to be no longer adequate in responding to the new challenges with regards to the need for increased efficiency (and effectiveness) in developing, acquiring or disseminating knowledge. The solution (in most cases) seems to have been provided through the application of Information and Communications Technology (ICT).

Over the past few years rapid advancements in ICT have contributed towards a staggering growth in global computer networking and the emergence of a globally connected world. The Internet has evolved from being a network for researchers and academics into a platform that has enabled new businesses to find alternative ways in which to offer their products and services. We have witnessed a paradigm shift in the ways in which the transfer and management of knowledge is handled. The Internet and Web-based technologies have both had a profound effect on the way(s) in which educational and training institutions now operate - in that it has made it possible for many innovative educators/trainers (within ICT enabled nations) to think of new ways in which to use the Internet in order to provide Web-based knowledge management and training opportunities.

There appears to be significant optimism amongst technologists and strategic planners for knowledge management. They view global networking and Web-based solutions as catalysts for addressing today's challenges of knowledge management and digital learning. This has become evident with an increasing number of tertiary educational institutions and industry based training organisations attempting to offer a wide variety of Web-based (online) learning solutions. These institutions have adopted a variety of strategies - some have considered Web-assisted solutions as a supplement to face-to-face communication between students and educators/trainers, whilst others have used Web-based learning through the Internet as the sole medium for delivery.

A review of e-Learning and KM cases (e.g. various cases in online learning in the Training Magazine, Asgarkhani 2003, Kiser 2001, Montandon 2002 and Rossett 2002) suggests that most tertiary educational institutions and professional training organizations (within ICT enabled and globally networked countries) acknowledge (to some extent) the strategic importance of using technology-based education and learning through Web-based applications. They seem to view e-Learning as being a fundamental and positive shift in the academic and professional knowledge management world. Yet there is also a danger. If we focus too much on the technology aspect of e-Learning and less on broader issues and/or strategies, we are unlikely to be able to deliver futuristic solutions of a high quality. On the whole, some electronically delivered programs/courses appear to have been developed and implemented in a somewhat reactive manner, and in isolation - more specifically, without much thought being given as to strategic implications; global developments; cultural issues; digital divide and the complexity of today's knowledge management systems. As a result, some of
these solutions have proved incapable of meeting the expectations of their potential markets (students/trainees). Considering the significance of knowledge management and ongoing learning in today’s environment, the development of knowledge management systems and electronic learning solutions needs to be based upon a strategic foundation.

2. The evolution of digital or electronic learning

2.1 e-Learning - The concept

e-Learning has been defined in many different ways. The historical background of e-Learning can be observed over three decades of development in ICT based education (and training).

Various technologies (including ICT) that have been introduced throughout the past few decades (in order to facilitate learning) include:
- Film
- Advanced TV technologies and video tapes
- Mainframe computer based “teaching machines”
- Early microcomputers as a basis for Computer Based Training (CBT)
- Touch screens and interactive videodisks based on “InfoWindows” hardware technology
- Power PCs, CDs and VCDs
- Global networking advancements and web-based solutions

Overall, universities in the US and the army appear to have played a pioneering role in the application of technology and developments which has eventually led to digital delivery of learning solutions.

Today, the e-Learning industry is diverse. Numerous universities have developed profit orientated e-universities offering courses and degree programs.

It should be noted that the e-Learning industry also includes organizations that support the establishment of learning infrastructures and networks for higher education institutions and corporations – such as course management and delivery tools from Blackboard and WebCT that allow customers to create learning programs directly on the Web without investing in their own tools or infrastructure.

In this paper, digital learning (or e-Learning) refers to the use of Web-based technologies (and applications) in order to deliver a broad range of learning solutions - whereby learning materials can be accessed from the web or intranet via a computer and educators/trainers can communicate with each other using e-mail, chat or discussion forums. e-Learning can be used as the main method of delivery of education/training or as a combined approach with face-to-face classroom-based teaching.

Some of the key characteristics of e-Learning solutions (Rosenberg 2001) can include:
- Relying on computer networking technologies – so as to make it capable of instant updating, storage/retrieval, distribution and sharing of instruction or information.
- Delivering to the learner via a computer that is connected to standard Internet technologies. However, there is much debate over the interpretation of the term “computer” and what it actually refers to.
- Focussing on the broadest view of learning. That is to say, it considers learning solutions that go beyond the traditional paradigms of training. E-Learning moves beyond training to include the delivery of information and tools that improve performance and competitiveness within the job market.

2.2 Change of attitudes in the transfer and management of knowledge

Training Magazine’s 1999 statistics (Industry Report 1999) demonstrate that companies are shifting some of their training investments away from on-site classrooms. There appears to be growing evidence that in the future, changes to business, society, general attitudes towards learning and the application of technology will limit the effectiveness of traditional learning/training. Providing effective futuristic learning solutions requires a shift in attitudes and perceptions – including:
- Focussing on outcomes – Learning solutions need to make a positive impact on learners’ performance and work-readiness.
- Providing flexible access (anytime/anywhere) – Knowledge solutions must meet the diverse needs of learners concerning time frames and locations.
- Placing emphasis on online rather than paper-based delivery.
Shifting the focus from physical facilities to networked facilities – Networked solutions for knowledge delivery (Internet or Intranet) play a significant role in information sharing, communications, and flexible access to learning material from any location in real time.

Facilitating real time rather than cyclic learning – Today, the pace of change is extraordinary and the cycle time concerning knowledge is short. There is a need for improved learning efficiency and pace.

It has to be emphasised once more, that there is an enduring and important role for traditional classroom instruction (Asgarkhani 2003).

### 2.3 Potential benefits and drawbacks of e-Learning

There has been much debate over the potential benefits and drawbacks where web-assisted learning is concerned (Asgarkhani 2003, Rosenberg 2001, Kruse 2002b, Kruse 2002c, Sitze 2001 and Burns et al 2001). Some of the more obvious advantages and disadvantages are outlined in Table 1.

#### Table 1: Benefits and Drawbacks of e-Learning

<table>
<thead>
<tr>
<th>Potential Benefits (Solution Provider)</th>
<th>Potential Benefits (Learner)</th>
<th>Potential Drawbacks (Solution Provider)</th>
<th>Potential Drawbacks (Learner)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced overall costs</td>
<td>On-demand availability</td>
<td>The need for up-front investment</td>
<td>The need for access to technology</td>
</tr>
<tr>
<td>Reduced learning time</td>
<td>Self-pacing</td>
<td>Technology</td>
<td>The need for printed workbooks or reference material</td>
</tr>
<tr>
<td>Consistent delivery of materials</td>
<td>Interactivity</td>
<td>complexities and design</td>
<td>Reduced social and cultural interaction</td>
</tr>
<tr>
<td>Expert knowledge can be communicated and captured with effective e-Learning and knowledge management systems</td>
<td>Availability of newly updated material in a timely fashion</td>
<td>Educators’ workload</td>
<td></td>
</tr>
<tr>
<td>Proof of completion and certification</td>
<td></td>
<td>The need for selecting appropriate content and effective instructional design</td>
<td>Cultural acceptance</td>
</tr>
</tbody>
</table>

### 2.4 Digital learning and KM - General trends

Over the past few years, there has been much debate over the effectiveness of e-Learning. Many people (e.g. Rosenberg 2001) consider technology-based learning disappointing at its best - as they argue that its impact has been relatively minimal. Others (Kiser 2001, Dobbs 2000, and Kruse 2002a) argue that the benefits of e-Learning outweigh its drawbacks.

The perceived importance of digital learning has motivated some governments to develop national guidelines and strategies for introducing e-Learning solutions (e.g. New Zealand e-Learning Advisory Group 2002).

Recently, there has been much debate with regards to the state of the e-Learning industry (e.g. Dobbs 2000, Industry Report 1999, Kaeter 2000, and Kiser 2001). Overall, e-Learning appears to be taking root in organisations of all sizes - even though there are often different views concerning the ways in which e-Learning can benefit individuals or organisations.

Those who believe technology will eventually replace highly skilled teachers within classrooms of highly motivated learners are as misguided as those who consider the Internet as a phenomenon that can be overlooked as its impact will diminish over time.

The International Data Corporation (IDC) and Online Learning Magazine (OLM) recently examined the general attitudes towards e-Learning - as expressed by a group of OLM readers about training within organisations (Kiser 2001). According to this research, those people who have been responsible for the implementation of e-Learning solutions seem to be pleased with the results (80% of the respondents used some form of e-Learning and there were indications that this percentage will increase - as more than 40 percent of the respondents whose employers had not yet adopted e-Learning were apparently planning to do so within the next two years). Research by the IDC has shown convenience as being one of the most important reasons for employees for using e-Learning.

Furthermore, recent studies of learners’ attitudes towards e-Learning within tertiary educational institutions (e.g. Burns et al 2001, Asgarkhani 2003) indicated that there is an increasing demand for web-assisted courses. A recent pilot study of trends and attitudes within the CPIT in Christchurch, New Zealand (Asgarkhani 2003) suggested that in general,
there is an increasing interest in the application of e-Learning (despite the fact that most of their learning still happens in the classroom). Even though the results of this study are not considered as being final, it appears that the demand for quality web-assisted courses with multifaceted person-to-person interaction will increase rapidly in the near future.

3. Knowledge management – An overview

3.1 The Concept of Knowledge Management

Within the information society, the world of knowledge management and learning seems to be focussed on two concepts: Knowledge Management (henceforth abbreviated as KM) and Digital (Electronic) Learning. KM is not easy to define. However, it can be viewed as a methodology for the acquisition, retention, storage, distribution and use of knowledge. Rosenberg (Rosenberg 2001) describes KM as a tool for supporting the creation, archiving, and sharing of valued information, expertise, and insight within and across communities of people and organizations with similar interests and needs. Today, numerous KM systems are facilitated by web-based solutions and technologies. However, it should be noted that KM is as much about people, working relationships, and communication. KM is best represented as a cross-disciplinary domain (Putzhuber 2003) which can relate to a wide range of disciplines and technologies – some of which can include:

- Cognitive Science
- Artificial Intelligence and Expert Systems and knowledge based management systems (KBMS)
- Groupware
- Library and Information Science
- Technical Writing
- Document Management
- Semantic Networks
- Relational and Object-Oriented Databases
- Simulation
- Management of Information
- Management of People

3.2 A definition for knowledge

There often seems to be confusion with reference to the terms information and knowledge – which obscures the fact that while it can be extremely easy and quick to transfer information from one place to another, it is often very difficult and slow to transfer knowledge from one person to another. In attempting to understand knowledge it would be beneficial to consider that the human mind often deals with two kinds of knowledge: the rational and the intuitive. The way in which we view knowledge today has been significantly transformed – largely due to the extended accessibility of know-how through advanced ICT solutions.

Knowledge is more than what someone knows. It's also what the organization knows-gathered from internal and external sources throughout years and decades. Knowledge can be:

- Explicit – can be easily described and specific enough to be documented and applied in educating/training.
- Tacit - harder to record and difficult to document or teach to others (heuristics often embedded in people's experiences and life's work). This is often the most elusive and most valuable type of knowledge.

Different types of knowledge require different approaches to KM. Each presents unique challenges and opportunities.

3.3 The hierarchy of knowledge management

Rosenberg's (Rosenberg 2001) review of some KM systems/solutions and a review of other studies (Hsieh et al 2003, Zyngier 2003, and Asgarkhani 2003a) indicate that KM can be divided into three layers:

- Layer 1: Document management – The earliest form of KM has been the use of technology in order to retrieve and access documentation. Today, it is common for organizations to provide access to documents, reports, and forms online.
- Layer 2: Information creation, sharing, and management - This is where people contribute information to the system, creating new content and growing the knowledge base. That is to say, users are encouraged to read documents, fill forms, and submit forms online. This would allow for the information to be continually updated.
- Layer 3: Organization or enterprise intelligence – The ultimate in KM is the development of a robust and interactive KM system so as to accurately represent the organizational “know-how.”
As KM solutions are introduced, it is inevitable that we observe changes in the ways in which people learn and work together.

4. Common characteristics of e-Learning and knowledge management

Web-assisted course management tools are often viewed as KM tools (Asgarkhani 2003). However, the concept of KM is different from e-Learning. Even though e-Learning could potentially be a cornerstone of KM, there is little evidence that e-Learning organizations have identified the need for and mastered the theory and practice of KM.

e-Learning and KM seem to focus on different goals (Putzhuber 2003, Asgarkhani 2003a). E-Learning systems appear to help learners in expanding their knowledge through providing structured learning content and intercommunication facilities to specific topics. In contrast, most KM systems provide knowledge by using content management systems with search and sort facilities.

Common characteristics of e-Learning and KM can include:

- Both e-Learning and KM systems provide knowledge in different forms to the users.
- The system architecture (client-server-architecture with high complexity in the server-part) is almost the same for both systems.
- Both e-Learning and KM need to provide communication and cooperation facilities.
- Personalization (role-based or person oriented) plays an important role in both e-Learning and KM.
- Both approaches need to consider access regulation (group or person specific).

Today, there is an increasing interest to bridge the gap (differences) that currently exists between e-Learning and KM.

The potential implications of KM for e-Learning can be significant. For instance, rather than relying on instruction, we can use well structured information (as well as productivity enhancing tools) to help people learn and improve their performance. We can differentiate between skills that must be performed automatically from information that can be accessed or referenced when needed. We may not have to teach people the steps in for example a sales process; we may only have to teach people where to find the steps.

It is fair to say that developing strategies for e-Learning cannot be carried out in isolation. Any strategic framework for introducing digital learning needs to address KM alongside that of developing e-Learning solutions (see section 6).
5. Digital divide and e-Learning

Today, access to information and communication technologies (ICTs) is critical for economic and social development. Developing effective digital learning and KM solutions depend on the state of the ICT industry and electronic readiness (e-readiness) where it concerns countries, organizations, societies and so on (e.g. Information Society Index 2001, OECD Workshop 2000, META Group 2000 and Asgarkhani 2002b).

Overall, differences in diffusion and use of ICTs and electronic networks can lead to:

- Divides between countries
- Social divides within countries
- Divides within countries related to income, education, age, family type, and location
- Business divides related to sector, region, and firm size

There has been much debate over the implications of digital divide on e-Learning and KM. In November 2001, the global communications company Marconi (Marconi 2001) called on government and private stakeholders in South Africa to accelerate the introduction of e-Learning centres in remote, rural and disadvantaged areas - suggesting that economic and educational benefits would have an immediate and measurable impact on poverty in South Africa. Higgins (Higgins 2002) views e-learning as a tool that can play a significant role in bridging the digital divide in the APEC region. However, the digital divide can also be considered as a barrier to successful rollout of e-Learning and KM solutions.

Some of the causes of digital divide that can also limit successful implementation of e-Learning and KM solutions can include:

- Lack of telecommunications and network infrastructure
- Limited PC access
- Lack of financial resources for developing an infrastructure
- Lack of ICT literacy
- Limited Internet access
- Cultural resistance
- High access costs to global networks and the Internet
- High cost of business investment
- Strategic business impediments – applicability; the need to reorganise; the need for skills, security and privacy considerations

6. The need for a strategic foundation

6.1 Assessing the effectiveness/success

While the impact of e-Learning within the academic and the professional world can be widespread, it is essential to monitor and assess the success/effectiveness of e-Learning projects.

e-Learning success can be measured with reference to either financial indicators or academic achievements. Some of the parameters that can be taken into consideration when measuring the success and effectiveness of e-Learning include:

- financial indicators such as return on investment (ROI), increased revenue, cost savings and total cost of ownership
- learners’ achievements including comparison with other learning tools.
- functionality and best practice
- scalability and support resources

6.2 Potential causes of problems

While there are many case studies and success stories (with regards to e-Learning and KM), there are equally examples and cases where e-Learning and KM solutions have proved inadequate (e.g. Rosenberg 2001).

Typical causes of failure (Rosenberg 2001, Sun 2003, Asgarkhani 2003a and Galloway et al 2002) can include:

- lack of familiarity with proper applications and requirements of digital learning
- underestimating the resources and expertise that are required
- overestimating what can be accomplished through digital learning
- lack of understanding of the functionality and the tools that are available
- overlooking the potential problems of self-learning
- overemphasizing technological aspects of digital learning
- inappropriate content planning and design
- authenticity of the solutions (programs) that are being offered
- lack of standards for digital learning solutions
- different requirements by different learners – “one size does not fit all”
- lack of support
- learners’ resistance to adopt digital learning culture
- lack of creativity in order to motivate online self-learners

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6.4 The need for strategic thinking

As we can observe (e.g. see sections 6.2 and 6.3), even though technology is a major component of e-Learning and KM, improving technology and infrastructure is not sufficient to produce outcomes of a high quality – as the components and relationships within today’s information society are complex. The development and delivery of quality e-Learning and KM solutions needs to be viewed as a holistic process, whereby a strategic foundation is developed in order to optimize the application of technology by giving consideration to many aspects of the digital delivery of knowledge such as digital divide, culture, social trends and so on. The process for strategic development of digital learning and KM must also consider critical success factors that have been widely discussed over the past few years (Kruse 2002d, Gallagher et al 2002, Hsieh 2003, Rosenberg 2001, and Rossett 2002) – which can include:
- establishing a culture of support for ongoing learning
- ensuring support from management
- deploying a nurturing business model
- sustaining the change throughout the organisation

Today, it is essential that we view learning needs in a much broader context – one that includes:
- learning as the growth of the intellectual capital of corporations and societies
- learning as enabling higher individual and organisational performance

A strategy that is developed for e-Learning and KM needs to be examined, pilot tested and put in practice at a rate that technology develops and the Internet grows.

Any strategic framework for introducing e-Learning and KM solutions needs to be concerned with the overall direction of digital learning and KM whilst providing a foundation for tactical and operational issues. A review of some of the most widely used frameworks for
strategy development (Robson 1997, Asgarkhani 2002a, Boar 2001, Heath 2003, and Rossett 2002) suggests that it (the process) should consist of at least three specific components/phases: Analysis, Choice and Implementation.

The total strategic process for e-Learning/KM is anything but linear. Integrating all the components of the strategic process is cyclic – often circling back to itself. The key elements of this cycle (as outlined in Figure 2) are:

- **Strategic Analysis** – involves establishing an understanding of the current situation, including: aspects of the environment; current technology infrastructure; available resources; expectations; broad objectives; and power bases.
- **Strategic Choice** – involves the formulation of the strategy itself through understanding various options, evaluating options and making a decision on a suitable strategy.
- **Strategy Implementation** – involves tactical issues such as resource assessment and planning, identifying human resources and systems, contents, determining organizational structure and so forth.

The first two stages of the strategy cycle outlined in Figure 2 should ideally result in the formulation of a strategy plan. The strategy plan can often be formulated as a hierarchy that clearly outlines the various stages (components) of the strategy process for e-Learning or KM – Figure 3.

The components of the strategy plan often include (but may not be limited to):

- **Mission** - What are we planning to do with e-Learning and KM solutions?
- **Goal(s)** – What are we trying to achieve?
- **Strategies** - What alternative pathways are available to us – in order to achieve agreed upon goals?
- **Policies** - How should we be guiding our moves within a selected pathway in order to achieve goals?
- **Decisions** - What alternative options for moves should be considered?
- **Action** - This is the way we will implement our decision for introducing e-Learning and/or KM solutions.

Figure 2: The cycle of strategy development and implementation for e-Learning and knowledge management
Alternatively, the strategy cycle can help in establishing a foundation for successful development and delivery of web-assisted learning and KM – as displayed in Figure 4. As you can observe, Figure 4 depicts the critical components for successful e-Learning, including:

- Reviewing/reinventing the position of e-Learning – e.g. determining if Web-assisted solutions are to be introduced as a supplement to face-to-face communication between students and educators/trainers, or whether Web-based learning through the Internet is to be the sole medium for delivery.
- Compiling a sound business case for delivering on-line learning and KM solutions – more specifically, linking e-Learning goals with business goals.
- Fostering an environment that balances learner and business needs in order to guarantee management support.
- Allowing for an effective change management approach.
- Establishing an information vision and architecture that would form the basis of the infrastructure (technological capabilities) needed in order to deliver and manage e-Learning and supporting KM solutions. This would require involvement from ICT technologists in order to develop an understanding of baseline technologies.
- Taking into consideration alternative approaches to e-Learning (and KM) and the ways in which e-Learning can be coordinated with other learning methods – including the enduring and important role for traditional classroom instruction.

There are a number of key questions that can be considered in order to facilitate the strategy development (as outlined in Figures 1, 2 and 3). These can include:

- What are our reasons for pursuing digital learning and KM?
- Are we aware of our limitations and the challenges ahead of us?
- What is our clear vision for digital KM and/or digital learning?
- What are the priorities that we have considered?
What types of e-Learning or KM are we ready for?
What specific KM solutions/strategies suit our choice of digital learning?
Do we have a methodology for selecting, planning and managing e-Learning and/or KM projects?
Did we consider a thorough plan for managing change?
What are the tools and metrics that we have thought of in order to be able to measure progress/success?
What would be a model (methodology) for managing relationships with other institutions when considering potential strategic partnerships?

How would our e-Learning and KM model improve the overall process of learning and KM?

To conclude, strategy development and implementation is an ongoing process. A strategy plan is considered to be a living document. It needs to be:
- redefined and adjusted as the environment and requirements change or new technological options become available, and
- examined on an ongoing basis against the mission and vision of your institution (a solution provider or a learners’ institution)

To ignore the iterative nature of any strategy would eventually compromise the quality of the outcome.

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**E-Learning & KM**

- Considering alternative architectures
- Establishing an information vision and architecture
- Fostering an environment for management support
- Compiling a sound business case for delivering e-learning/KM solutions
- Reviewing/reinventing the position of e-learning and/or KM

![Figure 4: A strategic foundation for e-Learning and KM](image)

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### 7. Summary and conclusions

Educators and educational technologists evidently believe that we are witnessing a major shift in attitudes towards learning and knowledge management. The ICT and web-based solutions have fundamentally altered the technological, social and economic landscape so as to make it possible for quantum leaps to be made in the application of technology for learning and KM.

Overall (see section 2.4), it appears that there is an increasing interest in the application of e-Learning within organisations. However the potential benefits of e-Learning (see section 2.3) and KM can only materialize when the solutions are introduced as part of a well-planned and properly supported education/training environment.

Technical innovation on its own is not enough to drive the e-Learning and the KM
development process (as discussed in sections 6.2, 6.3 and 6.4). More specifically, access to the right technology for delivering learning and KM solutions is essential but insufficient. Successful Internet-enabled (or Web-enabled) learning needs to be reliant on the development of a strategy that optimises the application of technology through giving consideration to learning attitudes in potential markets (e.g. tertiary educational market and corporate training market); organisational culture; organisational business strategies and so on. Furthermore, an effective e-Learning/KM strategy must give consideration to critical success factors such as establishing a culture of support for ongoing learning; ensuring support from management; deploying a nurturing business model; and sustaining the change throughout the organisation.

The strategic process for e-Learning/KM is cyclic (as discussed in Section 6.4 – Figure 2). The key elements of this cycle are strategic analysis; strategic choice; and strategy implementation. The strategy process outlined in Figure 2 results in:

- Compiling a strategy plan that is formulated as a hierarchy of mission, goal(s), strategies, policies, decisions and actions (Figure 3).
- Developing a strategic foundation that depicts the critical components for successful e-Learning (Figure 4).

Overall, the introduction of e-Learning and KM solutions needs to be a holistic process – one that addresses fundamental issues in a strategic fashion, taking into consideration:

- Securing management support – through aligning e-Learning and KM goals with business strategies
- Defining an information vision and architecture
- Developing terms of reference and methodologies for project development and management
- Putting together strategic, tactical and operational plans (including a change management plan) for the implementation of the information vision and architecture and the development and delivery of e-Learning and KM solutions.

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Expected and Actual Student Use of an Online Learning Environment: A Critical Analysis

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Abstract: While Online Learning Environments (OLEs) can potentially support learning that is more autonomous and authentic in nature than traditional instructional environments often allow, students do not always use OLEs in the ways expected or desired by their tutors. This paper examines the findings of a recent evaluation of an OLE designed for Masters-level engineering students and, drawing on relevant research, offers possible explanations for the particular ways in which the students used the environment. The paper concludes with a short set of general recommendations for practitioners.

Keywords: Online learning environments, constructivism, student usage, learning facilitation

1. Introduction

Online learning environments (OLEs) can be an extremely effective way of delivering course content to students and supporting them in their studies. By enabling access to a range of materials, learning tools and communication facilities, OLEs can be ideal constructivist learning environments that allow students to become more actively involved in developing their knowledge and understandings. However, this is still a relatively new field of study, and research increasingly shows that students do not always use online environments in the ways designers and tutors expect or desire.

This paper examines the findings of the Computer-Based Learning in Petroleum Engineering (CBLPET) project, which developed online modules for Masters-level, workplace-based students of Petroleum Engineering and evaluated their usage and effectiveness. The students who participated in the research did not use the environment entirely as anticipated, especially in how they progressed through the course materials and in their use of communication facilities. While some of these findings were not particularly surprising, they are certainly worthy of reflection and discussion.

The evaluation of the CBLPET environment described the ways in which students worked online, and is discussed in Beasley et al. (in press). This paper takes the findings of this research a stage further and reflects on the possible reasons why students used the environment in the ways they did by drawing on the formal evaluation, other recent research, and informal discussion with the student participants. A number of limitations in the design and implementation of the course are identified, and the ways in which the online environment could be improved to encourage or enable students to make fuller use of the various online resources are considered.

2. Overview of online learning environments

This section examines the reported benefits of online learning environments, and considers examples of actual student usage from the literature.

2.1 Expected benefits of online learning environments

Taking a constructivist perspective, a learning environment can be defined as ‘a place where people can draw upon resources to make sense out of things and construct meaningful solutions to problems’ (Wilson 1996). Constructivist learning environments emphasise fostering long-term understanding through meaningful contexts and interactions that reflect how knowledge is developed and used in the real world. They are characterised by increased student responsibility, opportunities for reflection, a focus on realistic tasks, purposeful collaboration with peers and tutors, exposure to multiple perspectives, and course materials that go beyond purely abstract descriptions of a subject domain (Grabinger & Dunlap 1995; Jonassen 1999).

OLEs typically combine hypertext-based course materials with asynchronous communication facilities, supportive multimedia, and other interactive features to aid understanding. This provides a single point of access on the web, facilitating ‘one stop shop’ learning, with the obvious advantage over traditional environments that learners can study when and for as long as they want,
utilising whatever resources they require at any particular moment (Hill 2000).

The claims made for the educational value of hypertext generally rest on the increased level of learner control that studying with it involves. Within the navigational parameters of hypertext course material, it is the learner and not the instructor who determines the order and depth of exploration of the content. It has been proposed that this allows for more active and reflective knowledge appropriation, as learners can study according to their own ability levels and requirements. It is because hypertext allows the learner to interpret information and choose paths of enquiry in this way that it is claimed that 'hypertext is necessarily a constructivist environment' (Jonassen 1992).

More specifically, the opportunity to present course material non-linearly means that hypertext may be an ideal medium for enabling learners to develop a critical understanding of a domain. This is the central premise of Cognitive Flexibility Theory (CFT) (Jacobson & Spiro 1995), which advocates designing hypertext course material around case studies and problem scenarios. Through the provision of alternative navigational paths, the subject matter can be explored from different conceptual and thematic perspectives, and always with a focus on completing the task in hand. CFT contends that knowledge developed this way is richer in breadth and depth, and so more readily transferable than that developed 'linearly'.

While asynchronous discussion facilities also offer, through dialogue with peers and tutors, the opportunity for students to appreciate multiple perspectives, their main benefit is in the manner in which dialogue is enabled. The increased opportunity for students to reflect on their own opinions and those of others before contributing to an online discussion has the potential to lead to a deeper, more reasoned exchange of views than is often possible in real-time situations (e.g. Mason 1994; McConnell 2000). Allied with this is the idea that students who are less forthcoming in face-to-face discussions are more likely to participate online where they are relatively anonymous, and have ample time to compose messages and be sure of their communications. There are also obvious advantages for students enrolled in distance courses, as online discussion may provide the only means for social interaction and collaboration.

Often integrated within the hypertext of OLEs are visual representations in the form of static, animated and interactive graphics, which are generally referred to as 'supportive multimedia' as their content is intended to complement or extend the textual information (Najar 1998). Of the many cognitive benefits associated with supportive multimedia, the two most important from a constructivist perspective are the authenticity of the learning environment and the concept of 'distributed cognition'.

Supportive multimedia can contribute to the authenticity of a learning environment by presenting objects and phenomena in forms closer to those encountered in the real world, rather than describing them solely through text or highly abstract images. This enables a qualitatively better comprehension of whatever is being depicted, for example a physical item or process, therefore increasing the likelihood of it being recognised and understood on future occasions (CTGV 1993; Honebein et al. 1993).

The idea of distributed cognition is, in short, that certain tools and artefacts within our environment can enhance our cognitive abilities and 'make individuals smarter...while using them' (Bell & Winn 2000). In relation to supportive multimedia, the concern is whether still or moving images help learners to understand what is being depicted more effectively than would be possible in their absence (Scaife & Rogers 1996). In relation to other types of tools and media, for example interactive glossaries and self-tests, then the concern is similarly with the unique ways in which these respective features might aid recall or help consolidate understanding.

2.2 Actual student use of online learning environments

Despite the claims that can be made regarding the educational potential of OLEs, it is becoming apparent that some students, often including those who value what the learning environment has to offer, do not interact with them in a manner conducive to fully experiencing the benefits.

Many students have a tendency to procrastinate rather than exploiting the opportunity for self-paced learning that exists online, which typically leads to them 'falling behind' (Hiltz 1997). It is also common to find that much studying actually occurs offline, and is largely based around working with printed copies of material (Crook 1997; Ward & Newlands 1998). Furthermore, research into
the influence of learner differences in online contexts tends to indicate that only a minority of more focused or active students will fully utilise the materials and tools at their disposal, while the majority limit themselves to working with core materials and only satisfy the basic requirements for interacting with other features of their environments (Light et. al. 1997; Gibbs 1999; Karuppan 2001). Finally, in relation to online communication, it is widely accepted that students will rarely participate in asynchronous discussion or collaboration simply because a facility for this has been provided (Tolmie & Boyle 2000; Salmon 2002).

2.3 Background to the CBLPET Project

The CBLPET project was a one-year EU-funded research project, completed in March 2003. Using the ASTEP framework (MacKinnon et al. 1998) for designing learning environments according to constructivist principles as a starting point, the aim was to develop an online environment for mature, workplace-based students of Petroleum Engineering, and to evaluate the effectiveness of that environment for the target student group and the ways in which they used it.

The CBLPET environment was designed so that students had access to the complete materials for the modules online, interspersed with activities – particularly real-world worked examples and case studies, and instant-feedback assessment questions. This combination of reading material and activities could be utilised in two ways: each chapter of material could be read and the activities used for testing and consolidating knowledge; or the students could start with the activities and use them in a more problem-based manner, accessing material when required to complete an activity.

As students were remote from academic staff, discussion fora were made available as a means for them to communicate with staff and peers. A search facility, comprehensive hyperlinked glossary, and individual progress reports were also implemented and the environment was rich in colour graphics, although the use of simulation and animation was limited owing to the short development time.

Two distinct student groups took part in the research: a group of 12 distance learning students who were already studying the modules using paper-based materials; and an additional group of four students who agreed to study the modules online and participate in a more in-depth evaluation. The opinions of the former group were evaluated with two questionnaires: a short questionnaire to gather first impressions and a more in-depth questionnaire later on. The latter group were evaluated using a series of interviews and a task walkthrough.

All of the students who participated in the trial had opted to take part in the study and use the online environment, and had a fairly high degree of computer literacy and experience of independent learning. The market analysis showed that the distance version of the programme is usually undertaken by graduate engineering professionals working in aspects of the industry, and who want to move into petroleum engineering specifically. The qualification would be necessary for advancement in this area, which would usually be accompanied by a significant salary rise. It is therefore likely that the learners who participated in the study may be more open to the idea of online learning, but also more strategic in their approaches to studying by having extrinsic motivations focused beyond the course itself (Entwistle 1997).

Interviews were also carried out with the company mentors, academic, managerial, and technical staff, which examined their expectations of the environment and whether or not they had been met.

3. Discussion of the student experience

This section examines the key findings of the evaluation and, drawing upon relevant research, reflects upon the possible reasons behind them and highlights recommendations for future practice in the delivery of the programme.

3.1 Preference for linear learning

As noted previously, the learning environment could be used either with a materials focus or with an activity focus, and despite the opportunity to explore the material in a more active, non-linear fashion, students exclusively studied the material linearly. From the evaluation there was evidence that all students knew that the non-linear option was available but chose not to make use of it.

A straightforward explanation for this could be that the students were used to working in a linear fashion, and that it was lack of
experience at working in a non-linear fashion that led to a lack of use. The idea that some students do not possess the necessary skills or mindset to learn online effectively, and when presented with online materials will rely on the tried-and-tested methods of studying they developed in conventional courses, is an established proposition (Bostock 1998; Ward & Newlands 1998).

Another possible explanation is that although students were aware of the functionality that enabled them to access the materials in an activity-based manner, they were not given any specific information on how to study in this way. Previous research has found that learners who are provided with clear navigational guidance embedded within the content of educational hypertexts are much more likely to explore in a more active manner (Veenman et al. 1994; Relan & Smith 1996). The likelihood is that this form of support would be required to ensure the students are not just aware of the non-linear functionality, but actually know how to use it effectively. Therefore a key future recommendation would be to provide explicit instructional guidance on the purpose of these aspects of the OLE, how to operate them, and the expected benefits of using them.

The individual progress reports were not used at all, as essentially the students saw no need for a system that told them what they had yet to study. When studying linearly they could simply start from where they last left off to ensure that all material was covered – something that was not so easily guaranteed if the students were working via the non-linear hyperlinks. It would be interesting to discover whether the reporting functionality would be of greater perceived value had a non-linear approach been used, and how the students have used the site if they had access to the online materials only.

The students placed a high value on the self-tests provided at the end of each unit and it is possible that the students worked linearly in order to take full advantage of these tests, because if students worked through the material non-linearly it would be more difficult to ensure that they had covered all the relevant material for the tests.

One factor students mentioned that could have increased the non-linear use of the materials would be if they were structured into timed lessons, because workplace-based students often had distinct blocks of free time to spend studying. If the materials were structured into timed units then more effective workplace study could be facilitated, and adequate time ensured to follow the alternative paths through the materials. Although the idea of tightly timed units of online instruction is counter to the idea of self-paced, needs-based learning via hypertext (Jonassen 1992), on a practical level it may have been beneficial to the students on this particular course.

Two features of the environment that were used in a non-linear manner were the hyperlinked glossary, which in particular was cited as extremely useful, and also the search facility. A possible explanation for this is that these features provided functionality not available or easily accessible in the book version, as there is some evidence to suggest that simple-to-use, immediately responsive hypertext navigational tools of this kind can encourage more direct interrogation of content (Najjar 1996).

3.2 Requirement for paper-based materials

The students who were only given access to the online materials quickly requested an additional paper version and for all students there was a preference for the paper-based material, used in conjunction with elements of the online environment. Students appreciated the flexibility of working in any place that the paper materials allowed, with most learners studying predominantly on paper at home using the online materials at work.

Although both mediums were used, the two formats were not used in conjunction. This is perhaps a failure of the design of the online site, which largely mirrors the content of the paper-based version and was not significantly re-written to go online. The heavy use of the paper materials, which are linear by their very nature, may have even encouraged linear usage of the online site, as this would have enabled the students to transfer easily between paper-based and online modes of studying.

An improvement to the online environment would be to add visual, interactive elements that would also not be possible in print form, such as animation and simulation, which could have two potential benefits. The students reported going online to study the supportive graphics, which they found easier to understand than the print versions because they were in colour and allowed better differentiation between aspects of the images. Some form of ‘distributed cognition’ (Bell &
Sellen preferring to work on paper, and material was also cited as a reason for the inability to annotate the web-based working at home or in the office out of hours. The time spent away from the desk, and favoured to noise, interruptions, and large amounts of shifts the other way.

A preference for working with paper has been found in similar studies (Crook 1997; Ward & Newlands 1998) and, consistent with these findings, this investigation showed that most learners found studying at work difficult owing to noise, interruptions, and large amounts of time spent away from the desk, and favoured working at home or in the office out of hours. The inability to annotate the web-based material was also cited as a reason for preferring to work on paper, and O’Hara & Sellen (1997) provide evidence that students may be reluctant to make separate, paper-based notes while reading online.

This use of paper-based materials may well indicate a reliance on ‘traditional’ studying strategies, but equally it could be seen as learners being active in working around some of the disadvantages of studying online – the unsuitability of the access environment, and the reduced scope for making sense of materials through personal annotations.

Overall, it is apparent that online materials provision should not be seen as a replacement for the printed materials currently used on the MSc programme, as the students valued and made use of the flexibility that having both resources allowed them in fitting their studying around their work.

3.3 Limited use of communication facilities

During the requirements analysis, the students expressed a clear desire for online discussion facilities to communicate with peers and academic staff, which was seen as particularly important because they were often physically remote. An asynchronous discussion forum was provided for students to ask subject-specific questions of academic staff, and the purpose of the discussion boards was communicated to the students via a guide to studying online that was available on the website. However, the students indicated that – despite being aware the guide was available – most had never actually looked at it. In practice, no use was made of the discussion facility for either peer or tutor interaction, although it was used sparingly for technical information and support.

The main reason given was that the students genuinely saw no need for such a feature as they could gain all the support required from the company mentor, and preferred to get that support face-to-face. However some did report being discouraged by the lack of activity in the forum, and so were presumably open to the possibility of using it. Another key reason for the low usage levels is possibly that the academic staff were not trained in how to use the forum effectively to encourage worthwhile discussion, and were of the opinion that students would use the facility if they needed it.

Although the students did not feel disadvantaged in relation to the non-use of the discussion forum, it is arguable that the opportunities this offered for interaction could have enriched the learning experience, and in this respect the non-use of the facility can be attributed to shortcomings in course design. The main failing was that no tasks or activities were associated with using the discussion board. Tasks for facilitating online discussion can take many forms, from online seminars to more sophisticated collaborative projects, but it is generally accepted that without there being a reason or purpose to participate in online discussion, very few students will (Tolmie & Boyle 2000; Salmon 2002). To make online discussion purposeful, it is essential that students are provided with a clear understanding about the task or activity to be undertaken, and also what is expected of them as participants. Although usage scenarios were provided in the training materials, students were not overtly encouraged to make use of these materials and, in addition, student
use of the discussion boards was not mandatory, which would have at least ensured some level of participation.

The course could be improved by developing specific learning activities based around the discussion forum to encourage peer and tutor interaction and foster a sense of community, and by providing explicit instructions and indication of purpose.

3.4 Use of self-assessment activities and worked examples

As regards the more active ways in which the students interacted with the environment, the vast majority studied all of the core reading material, using a combination of paper-based and online learning, and also used extensively the self-assessment exercises and worked examples that were embedded throughout the materials. The activities were used predominantly to test and consolidate understanding of what had just been studied.

The reflective activities, worked-examples and quick quizzes were all perceived as useful aids to enhancing and, where applicable, testing understanding. Peat (2000) observes how in online and other independent learning contexts, students often find self-assessment opportunities invaluable as they provide for the kind of responsive support for evaluating understanding that is often readily available in conventional courses but which would otherwise be missing in online equivalents.

This seems to be the likely reason why the self-assessment tools and activities in the course where so heavily used, and why the students were forthcoming in their requests for more interactive online elements to support various aspects of their learning.

For future developments it is important that the online environment be used strategically to integrate added-value interactive elements that complement and enhance the paper-based materials. The evaluation brought forward several ideas for interactivities that would aid understanding and learning. These included glossary word-matching quick quizzes to test knowledge of the complex terminology within the subject area; animated graphics of geological and time-dependent processes where appropriate; the ability to isolate separate data segments on complex graphs to simplify the data representation; and the provision of hints, such as bringing up a solution to a problem a line at a time so that keen learners can pick up the problem from where they understand it to increase learner control over how much relevant support they wish to receive.

4. Conclusions

Although the students in this study did not use the online learning environment in all the ways intended they did perceive the environment to be a valuable resource. Yet from an instructional perspective they were arguably not using it in the most effective ways, and in part this can be explained by the lack of explicit guidance provided to the students, many of whom were new to learning online. However, while it is likely this would have helped to improve the ways in which the environment was used, ultimately it should be recognised that the expectations of tutors are often different from the requirements of the students.

It is felt that the lessons learned from reflecting on the evaluation of this programme may have some practical worth for those involved in the delivery of online courses, and who wish to increase the likelihood of all students in a course utilising an online environment as effectively as possible.

When developing an online learning environment, it is important to:

- consider the likely educational experiences of students, particularly in relation to online learning, to identify the kinds of online learning support required;
- give explicit instructional guidance, within the environment itself, on the purpose of aspects of the environment and how to operate them, including specific guidance on how to study course material via non-linear hypertexts;
- include appropriate supportive visual and interactive multimedia to increase potential opportunities for enhanced learning and transferable knowledge;
- provide self-assessment tools and materials to allow students to test their understanding and reflect on the effectiveness of their learning;
- ensure there is a purpose, in the form of clearly communicated tasks or activities, for students to participate in online discussion.

References


http://www.ejel.org

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Abstract: This paper outlines the development of a generic Business Research Methods course from a simple name in a box to a full e-Learning web based module. It highlights particular issues surrounding the nature of the discipline and the integration of a large number of cross faculty subject specific research methods courses into a single generic module. The design philosophy of the e-Learning course is then outlined and the rapid development task force event that was central to the final development is described. The paper concludes with five key reflections on the whole development process.

Keywords: e-Learning, module development, research methods

1. Introduction and background

This paper is concerned with the development of a general business research methods course, with particular emphasis on the later stages with the move to an e-Learning variant of the module. Some pre-amble is necessary however regarding the earlier developmental stages. The paper is unapologetically written from a beginner’s perspective of e-Learning and specifically examines three issues that were central to this venture:

1. The generally difficulties associated with teaching business research methods to undergraduate students and the extent to which these may act as a barrier to ‘e-Learning’ research methods.

2. The need and difficulties associated with integrating a large number of subject specific research methods modules into a single Caledonian Business School (CBS) research methods module. This was a prerequisite before the module could be developed for e-Learning.

3. The move from a face-to-face on campus environment to a web-based off campus approach, and how this was actually developed for the web.

The background to this development was the decision by the School Board of the Caledonian Business School (CBS) in 1999 to move to a framework undergraduate degree programme. Consequently, within individual degree programmes framework modules now represent 100 credits at level one and 40 credits in the following 2 years. In the honours year (level 4 in Scotland), there is a 40 credit generic module descriptor for the final year dissertation. The full framework is illustrated in figure 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester A</th>
<th>Semester B</th>
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<tbody>
<tr>
<td>1</td>
<td>Organisations &amp; the Business Environment</td>
<td>Programme Specified Module</td>
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<tr>
<td></td>
<td>Perspectives on People at Work</td>
<td>Programme Specified Module (Option)</td>
</tr>
<tr>
<td></td>
<td>Management &amp; Organisations</td>
<td>Programme Specified Module</td>
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<tr>
<td>2</td>
<td>Programme Specified Module</td>
<td>Programme Specified Module</td>
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<td>Programme Specified Module</td>
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<td>Programme Specified Module</td>
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<tr>
<td>3</td>
<td>Strategic Management</td>
<td>Programme Specified Module</td>
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<tr>
<td></td>
<td>Honours Dissertation</td>
<td>Programme Specified Module</td>
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<tr>
<td>4</td>
<td>Programme Specified Module</td>
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Figure 1: CBS framework structure (Source: CBS website - how the undergraduate framework works)

The framework was introduced on a ‘roll-out’ basis from academic year 2001/2 onwards, hence level 3 modules roll out in academic year 2003/4. Eight of the framework modules neatly fit into six of the academic divisions of CBS e.g. Management and Organisations and Strategic Management are the responsibility of the Division of Management. Two modules however are academic ‘orphans’ – Business Research Methods and the Dissertation module. This following sections outline how the first of these modules was developed from a simple name in a box to a fully operational e-Learning module.
2. Business research methods - Early module development

Early development took the form of a short life working party under the leadership of the CBS Director of Research. This consisted of five members including the author. The broad remit of the group was to write a module descriptor for validation for a single RM course that would replace all existing RM courses within CBS. The descriptor therefore had to satisfy the 'research training' needs of each academic division within CBS. The biggest problem for the group was to produce a module that would provide an appropriate balance between generic research issues, quantitative research methods and qualitative research methods.

The broad philosophy taken was to offer mini units in basic research principles as 'core' and more method driven specialisms as 'electives'. The final module descriptor therefore split the subject into eight mini units with two being core and programme boards asked to nominated three from six electives. The original units were:

- **Core elements** –
  - Philosophies of understanding and research
  - The research process

- **Elective units** –
  - Data gathering and secondary analysis
  - Interacting with people
  - Advanced qualitative techniques
  - Surveys and the survey process
  - Identifying differences
  - Identifying effects

The module was to be assessed through a written examination and a research project proposal. This latter assessment element was viewed as particularly important as it would be carried through into the dissertation at level 4.

On reflection, the module was considerably under developed at this stage, particularly in two areas. Firstly, it had been designed in an ideal world situation, and little thought given to how it would actually be delivered. Secondly, the third year of the BA Business Studies constituted an industrial placement. In order to incorporate this degree into the framework, the 'value' of this placement had been reduced from 120 credits to 80 credits. The other level three framework module, Strategic Management, had 'easily' been incorporated by requiring students to submit a 3000 word report on strategic management issues arising on their industrial placement. As regards Research Methods, this was to be done 'On the Web'. This was sufficient to resolve this particular problem and the module was subsequently validated.

As a consequence of this underdevelopment, the author submitted a proposal to one of the general CBS funds for a grant to develop the module into a fully fledged course. This was approved with the proviso that an off-campus version of the module be developed for the BA Business Studies students on placement.

The first part of the development was to redraft the original module descriptor into something that could be delivered to students, particularly in an e-Learning format. This was achieved by merging the two core mini modules into a single core element, and merging the six optional units into three elective streams – quantitative, qualitative and mixed. The author's considerable experience of undergraduate project proposal development had shown that most students undertook honours projects that were a mix of quantitative methods (particularly surveys) and qualitative methods (mainly focus groups and in-depth one-to-one interviews). This revised structure was passed by the Research Methods Subject Quality Group and is shown in Figure 2.

![Figure 2: Revised Module Structure](http://www.ejel.org)
This revision only required some minor tweaking of the original descriptor. Importantly however, this gave some initial thoughts on how the module would actually be delivered and thus a basis from which the on-line module could be developed. Decisively however, the module was due to be delivered to campus based students from February 2004, but from October 2003 to off-campus students. It was therefore decided to develop the off-campus version first.

3. Problems in teaching research methods

The particular challenge associated with teaching research methods to undergraduate students are well known to those involved in facilitating such modules and need to be carefully considered when developing research methods for an e-Learning delivery mode. These problems can perhaps best be summarised in the title of Benson and Blackman’s 2003 article ‘Can research methods ever be interesting?’ and reflected in the general consensus amongst RM tutors regarding such courses. This is that the student experience can be very disorientating, particularly when faced with terms such as ‘phenomenology’ and ‘epistemology’. There is a real danger that after undertaking such a module students can be left with the feeling of ‘what was that all about?’. As such, the course has failed to stimulate much interest in the student and business research concepts are something to be avoided in the future.

Unquestionably this is partly because research methods courses cover a broad spectrum of academic disciplines and personal transferable skills that were previously unknown to the student. This usually begins with issues such as ‘how do we learn?’, quickly passes through weighty philosophical debates, moves on to practical skills such as literature searching, and somewhere along the way includes a course in basic statistics. The final part of this epic is to teach basic writing skills that are required in the presentation and analysis of research results. Underpinning these generic issues are four specific factors that also make teaching RM problematic.

3.1 Descriptive nature of the content

The subject can be very descriptive in nature, with very little to actually ‘get a hold of’. Whilst in a learning environment some of the concepts are relatively straightforward to describe, the problem is that the subject is actually very applied in nature. For example whilst general principles of good questionnaire design can be outlined, in reality each questionnaire is designed for a single purpose. This can cause a problem of relevance to the student, as relevance only comes through doing. Thus much of the learning environment is concerned with the formation of expectations as to the type of issues that may arise in the course of undertaking research rather than real world research problems.

3.2 Nature of the subject

The subject has developed from what are fairly weighty academic debates about how research should be carried out. Whilst these issues are unquestionably relevant at higher levels of academia, the relevance for undergraduate dissertation students is less apparent. Owing to the highly academic nature of the discipline, the language associated with the subject can be fairly weighty and certainly distracts from the concepts being considered. It is also the case that most business research methods have been ‘adopted’ from the social sciences, and as such many aspects remain considerably underdeveloped in a business discipline context. Ethnography is an excellent case in point. Few, if any, texts explain satisfactorily the relevance of this methodology to undergraduate business students. A further barrier is that there is a distinct reluctance to admit this lack of development, hence such ideas and concepts are presented as the finished article, whilst in reality they are not.

3.3 Widespread and differing views

A third problem is that everyone has an opinion and in many cases an entrenched view on what should be taught in a research methods course. This ranges from the diehard positivist to the deep-rooted constructivist and all points in between. The problem is exacerbated for the RM lecturer because the ‘products’ of their labours are served up across a wide range of colleagues through honours dissertation supervision. The student can therefore become further confused as project supervisors advise differently on research issues.

3.4 Lack of a really good text

Despite the high number of texts on the market, a fourth problem in teaching research methods is the lack of a really good text on the subject. Taking two of the market leaders as examples, one tends to become overly
engrossed with the language of the discipline, which makes for weighty reading and bombards the student with difficult terms. The other is overly wordy, and whilst informative is not very useful. Using the literature review as an example, it explains what it is but not why it is a good thing to do and what you actually do with it.

One of the biggest problems in developing an e-Learning form of business research methods is that the issues highlighted above are multiplied several times over when this is transferred from a campus based activity to a distance learning approach. This is because the ‘human face’ of research is lost and the abstractness of the discipline can potentially be reinforced. Any e-Learning form must therefore be designed to attempt to minimise any such problems. In order to obtain some ideas on how this may be achieved, the first part of the development of our own RM site was to examine existing web resources on teaching and learning materials in research methods.

4. Existing web resources on research methods

At the beginning of this exercise there was a general conception amongst staff that there was masses of material already on the web that could be employed in our own resource. In order to uncover this material, due to the high degree of cross over in all social science based research methods courses, the search was not restricted to purely business areas. Given below in Table 2 is a partial overview of five of the resources they were found and evaluated. This evaluation was undertaken from a beginner’s perspective of what was believed to be important in the design of a website for e-Learning. All of the table headings are self-explanatory, but it should be noted that this review included other headings such as inter-activity and the extent to which the website created the sense of an on-line learning community.

Table 2: Evaluation of existing resources on the web – five examples

<table>
<thead>
<tr>
<th>No.</th>
<th>Website</th>
<th>Type</th>
<th>Graphics</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carter McNamara’s Basic Research Methods</td>
<td>On-line book</td>
<td>Basic html</td>
<td>Content is brief, and lacks depth. Is described as a library of resources, but is effectively a very short on-line book.</td>
</tr>
<tr>
<td>2</td>
<td>Bill Trochim’s Center for Social Research</td>
<td>On-line resource</td>
<td>Good</td>
<td>Colleagues at other institutions have commented upon the extensive nature of this resource. For our own purposes however, i.e. a fully off-campus e-Learning course, whilst the breadth and depth would appear to be appropriate, the content is introductory and supplemental. May be useful however in a blend learning approach.</td>
</tr>
<tr>
<td>3</td>
<td>Internet for Social Research Methods</td>
<td>On-line tutorial</td>
<td>Good</td>
<td>This site is limited in scope as it is mainly concerned with information retrieval skills. Whilst ‘billed’ as an on-line tutorial, the approach taken is more consistent with a strictly distance learning approach. Does however contain some useful links to on-line material.</td>
</tr>
<tr>
<td>4</td>
<td>T Wilson’s Electronic Resources for Information Research Methods</td>
<td>Resource library</td>
<td>Fair</td>
<td>This is an extensive source for on line reading materials on many aspects of the different types of research methods and methodologies that are employed within the business disciplines. In terms of developing our own resource, this provided useful access to supporting materials but provided little in terms of ‘e-Learning’ i.e. lacked interactivity.</td>
</tr>
<tr>
<td>5</td>
<td>Saunders et al, Research Methods for Business Students, 3/e</td>
<td>Textbook Support Site</td>
<td>None</td>
<td>Despite being referred to on the front cover, this website was very disappointing. Consultation with the publisher’s representative however, revealed that this is the major aspect of the text that is to be further developed.</td>
</tr>
</tbody>
</table>

Although only five examples are listed above, these include virtually all aspects and all the limitations of freely accessible RM resources on the web. All have a tendency to be simple (and short) on-line books or lack the required depth and breadth of material for an undergraduate RM course. As a result, the usefulness of these resources ranged from none to limited. What came out of this process was the identification of some materials that
5. Design philosophy of the e-Learning component

One of the advantages of the lack of appropriate web materials was that when it came to designing our own website the development team could start with an uninhibited view of what we wished to achieve from it. The development team were also very aware that for our own resource we did not wish to create something that was simply a case of electronic page turning (Forsyth, 2001). A further advantage at this stage was that GCU has adopted the Blackboard virtual learning environment. Armed with the knowledge of a few simple commands therefore, actually ‘putting it on the web’ was not a major issue.

In terms of the overall philosophy of the design of the e-Learning form of this module, an important element was the structure of the Business Studies degree at GCU for which this variant was specifically aimed. Unusually in Scotland, this degree is offered as a single honours only. In practical terms, all students must complete four years and undertake a final year honours project to receive any degree. In the design of the off campus module therefore, traditional on-campus approaches were discarded and a fresh approach applied, with the only requirement that these met the learning outcomes of the module descriptor.

Given the problems listed above in teaching research methods to undergraduate students, a very simple approach was adopted. Rather than beginning with the usual ‘what is research’ and weighty philosophical arguments about research issues, the nature of reality and so on, a problem based approach was taken. The overall course design philosophy is shown in figure 3.

![Course design philosophy](image)

**Figure 3:** Course design philosophy

The more observant will notice that this is not really a Business Research Methods course but rather Dissertation Research in the Business Disciplines i.e. project based business research. As this (a) was designed for a single honours degree, (b) met the learning outcomes of the Business Research Methods module, and (c) was educationally believed to be the best approach to delivering the discipline, this difference in emphasis was not envisaged as being a major problem.

At the core of the design is the research idea. Students are required at a very early stage to come up with a research idea. Around this are then based the various concepts involved in undertaking business research. Such a design fits in very well with both the ‘e-tivity’ approach to web based learning (Salmon, 2002), and
Benson and Blackman’s (2003) model of teaching research methods around a practical approach.

The general design philosophy was to begin with fairly accessible ideas. Hence the student begins with their own very simple research idea. From this derives the type of literature to be searched and reviewed, the research method/methodology to be employed, the limitations of this research (i.e. the research paradigm) and the methods of analysis to be employed. It is in principle a progressive approach to which are attached concepts as and when these are required. Therefore, each piece of newly constructed knowledge is actively built on previous knowledge (Lauzon, 2000). Hence a student that begins with a research idea such as ‘what was the impact of the introduction of free bus travel for senior citizens in Scotland’, produces a research proposal at the end of the module outlining ‘a positivistic case study of free bus travel for senior citizens in Scotland based upon a quota sampled F-2-F survey analysed using SPSS’. This sounds very simple, but the ‘leap’ from one to the other is considerable. This was bridged by setting relatively short assessments throughout the course that would enable the student to slowly assemble all of the required elements of a research proposal.

6. RDTF and the cross-disciplinary design team

Development of the e-Learning module centred upon a Rapid Development Task Force (RDTF) event, employing the Carpe Diem Methodology (Lennon and Roberts, 2003), which took place over two days. This consisted of the development team working in conjunction with support staff in IT and Information Resources staff and was led by GCU’s Visiting Professor in e-Learning, Dr Gilly Salmon, supported by Dr Gillian Roberts, CBS Research Fellow in e-Learning. Dr Roberts had been heavily involved in the earlier stages of development of the on line form of the module.

The RDTF event was very much a ‘hands on’ exercise with the team having direct access to IT facilities and all on line resources. The process began with the agreement of a mission statement for the aims of the whole RDTF event. The final wording was that we would create an on-line resource that would provide:

- “An interesting and rewarding journey though the landscape of research methods that are commonly applied in business contexts”.

Although a bit overly grandiose for the author’s taste, the mission statement did communicate the sentiments of what we were seeking to achieve. Three main themes were identified as being of underlying importance to achieving this aim, which were that any learning resources to be created should be rewarding, stimulating and fun. Given the problems outlined beforehand in teaching research methods, this was particularly challenging and, as it transpired, not always attainable. It was useful however in giving some direction to the whole process.

We then agreed the pedagogical approach to be taken in development of the on line course. This was to base the design of the on-line course around four main principles. The first was that the tutor’s role would be minimal. Specifically, it would be to briefly introduce each particular topic that would act as the ‘spark’ to each discussion. The tutor would also summarise and outline the learning points arising out of any student discussion that followed i.e. e-moderate (Salmon, 2003). Secondly, where possible we would use existing web links that had already been identified prior to the RDTF event by the development team. For example, these could be used as a ‘spark’ to begin a discussion. Thirdly, student input would be used to develop themes and concepts. This would be done through discussion groups/boards, where students would be asked to respond to the ‘spark’ and comment upon other participants contributions to the topic. Fourthly, and perhaps over-ambitiously, multimedia would be used to add visual interest and exploit technologies such as mobile phones to which students already had access.

These prime resources would be supported by a single core text that students would be required to purchase, links to GCU electronic journal articles, and the provision of digitised forms of key works and supplementary readings through the HERON service.

After this was agreed, the team clarified the role that the VLE, i.e. Blackboard, would play in the development of the on line course. These were that Blackboard would be used to:

- upload multiple files
- create chat and discussion boards
- use course statistics to monitor issues such as user participation
reason resources

access on-line tutorials

potentially link Blackboard to software

potentially link Blackboard to software

products such as SPSS, SNAP

and Nudist

The last of these proved problematic, both in
terms of the technical issues involved and the
coverage of a ‘site’ licence. It was therefore
decided that all such activities should be
designed around software packages that
students would have relatively easy access to,
such as Microsoft Excel. Another possibility
was the use of a research methods text that
came packaged with the student version of
SPSS. The text however was American and,
despite offering a ready made solution to this
particular problem, was not suitable for our
own course.

Also problematic was the digitising of
additional references that could be made
available to off campus students. Access to
these resources are governed by the Copyright
Licensing Agreement (CLA), hence this
required careful consideration of the
appropriate chapter to use in a given text, as
the CLA specifies that only one chapter may
be used per text i.e. the same conditions apply
to on-line support as apply to hard copy
learning packs.

Having outlined these fundamental principles,
the event then centred around development of
the three elective units that were to be
included in this particular variant of the
module. These were: Interacting with People,
The Survey Process and Identifying
Differences. Team members worked in pairs
along with technical support staff to develop
these units. Firstly, a storyboard was
constructed that broadly outlined the on-line
activities that were required to achieve the
particular aims of the unit. The types of
assessment that would be required to test the
student’s knowledge of this material were then
outlined. It was found that a single assessment
was all that was required for each unit.

Once the development team had outlined the
broad framework for each unit, these were
then passed to IT staff who set up the actual
unit on Blackboard. Some of the learning
activities required development after the RDTF
event, however this progressed rapidly and
were then easily set up on Blackboard.

An important observation about the actual
development team was that it emerged in the
process of the exercise that two of the
members of the team would not be involved in
teaching any aspects of the module. This runs
contrary to Evans and Taylor (1996) and
Murray and Savin-Baden (2000) views that
most of the teaching team should be involved
in the development and planning of any new
course. The problem appears to be that such
events are driven primarily by short term
priorities, where development comes before
delivery. As mentioned, this particular problem
was overcome by working in ‘pairs’, hence at
least one member of the pair would be a part
of the teaching team.

The RDTF was unquestionably an extremely
useful exercise, but perhaps did not run as
smoothly as it should have done. The main
problem arose out of a lack of academic
responsibility for this module and module
development not being equated with module
teaching. Both factors come down to the issue
of ownership – ownership of the module and
ownership of the learning resources to be
developed.

Despite these difficulties, the event did achieve
its objectives, as it rapidly progressed the e-
Learning form of the module to its final
completion. In its final form, the study of
research methods on line was divided into
seven different topic headings, which are:

- Choosing and developing a research
topic
- Developing a research strategy
- Initial thoughts on collecting research
data
- Project organisation and administration
- Interacting with people
- Surveys
- Identifying differences

The final stage was to bring in ‘reality
checkers’. Essentially this group was made up
of colleagues and research students who went
through the various units of the course to
check for ease of use, legibility, ease of
understanding etc. Several minor points arose
out of this, such as fully integrating some of the
course materials, but these were easily
correctable.

7. Subsequent events

The ‘development team’ in the end had a fairly
short working life, but nevertheless did deliver
a full on line version of the Business RM
module. This was completed, mainly due to the
RDTF event, well in advance of the date set by
CBS and some six months before the on-
campus form of the module was due to be
delivered. Consequently, this particular form of
the course has led the overall development of the module. One important element however had been overlooked. Whilst previous on-line courses had been delivered to either on-campus full time students or off-campus part-time students that had signed up to study, i.e. volunteers, on this occasion placement students could be best described as ‘conscripts’, as they had little choice in the matter. ‘Conscripts’ however need to be given the equipment to undertake the task that is asked of them, in this case access to (a) a computer and (b) the internet. Whilst the institution was willing to provide a limited supply of laptop computers to plug any gaps, lack of accessibility in larger numbers than had been anticipated led to the postponement of the e-Learning version of this module for at least a year. This underlines the contention by authors such as Azer (2001) and Kaufmann and Holmes (1996) that contextual factors, particularly institutional support, are important in any innovative approaches to learning.

Attention has now turned to the campus based delivery of the module to 750 students across the business school. Whilst obviously not the issue of this paper, it is worth noting that organisationally this has proved extremely difficult as the business school is simply not structured for the delivery of such a module. At the practical end however, the on campus form has been developed through a process of dialogue and discussion with colleagues across the school. As a consequence, all teaching staff now consider that students will be given an appropriate course of study in research methods that is relevant to their own subject areas. This is largely based upon a core lecture programme and subject contextualised seminars i.e. we have a set of seminar headings but tutors will use their own learning materials. Some divisions have chosen to base their seminar programmes around many of the e-Learning activities developed for the off-campus module and some of these activities are now also being used on the business school MRes programme. This should allow some feedback to be gained from the actual activities that have been developed.

As regards the off campus module, the future remains uncertain. Access is a major issue and one that had been completely underestimated by the institution. On a more positive note, next academic year part-time evening students will have to undertake this module. This will almost certainly be based around a blended approach, where on campus work will be supplemented by e-Learning activities that will be drawn from the e-Learning form of the module.

8. Points of reflection

As stated in the introduction, this paper has been written from the perspective of a beginner to e-Learning. To many therefore some of the following points of reflection may appear obvious. Some are obvious, however not always appreciated when involved in the practicalities of undertaking such projects.

Firstly, there is a large difference between the theory of ‘pulling together’ a cross faculty module and the practice of actually doing it. As the student numbers ‘reward’ system in GCU is based upon what is delivered rather than what will be delivered, it is simply not conducive to such developments. In a cross divisional module such as our Business Research Methods, this resulted in a lack of commitment of supporting resources at all levels. This particular project however had the good fortune of a strong core of committed staff at the centre of the project.

Secondly, the use of the VLE unquestionably proved to be invaluable when actually putting the course on line. Nevertheless, this does restrict the structure of the course to a certain degree to the structure of the VLE. To an extent this can be navigated around by the use of internal links. These can be provided by technical support staff or even a very basic knowledge of html. The author’s html skills for example are limited in the extreme, having been acquired from working through the NTL basic guide to html (NTL, 2004). Even such limited skills however were found to be very useful.

Reflecting on actually ‘e-Learning’ business research methods for on line delivery, two key issues emerged. The first was the sheer time that was required to allow students to complete the activities associated with each unit. Once completed, the course was designed to run over a twenty-five week period, however initial thoughts had been based around a 12 – 15 week timeframe. This extended timeframe is partly due to the part-time nature of the participants on this particular module. The second issue was the role of the tutor. Although we had a stated aim that this should be fairly minimal, i.e. introduce topics and summarise, the subsequent undertaking of an e-moderators course brought home the time requirement that such a ‘minimal’ role would require.
A final point of reflection already touched on is the issue of staff. It is worth repeating that this project had the good fortune of a strong core of committed staff at the centre of the project. These individuals brought enthusiasm and direction to the project, and made things happen through innovative approaches to research methods that space prohibits giving examples of. When undertaking any such project such as putting business research methods on line, there can be a tendency to focus on the technical issues, but the critical factor to success is undoubtedly the human aspect. People make technology work.

References
Adopting a Web-Based Collaborative Tool to Support The Manchester Method Approach to Learning

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Abstract: Manchester Business School employs a distinctive approach to learning known as the Manchester Method which is based on the principle that the most effective and rewarding way to learn and remember is through a practical reflective, live/real project-based approach. This paper investigates the use of a collaboration and information sharing application, IBM Lotus QuickPlace, for enhancing the Manchester learning experience.

Keywords: Computer mediated communication; collaborative tools; group work; Information and Communication Technologies (ICTs); teaching and learning strategies; web-based learning.

1. Introduction

Manchester Business School employs a distinctive approach to learning known as the Manchester Method. The Manchester Method is based on the principle that the most effective and rewarding way to learn and remember is through a practical project-based approach. Individuals can achieve far more by working collaboratively in groups rather than on their own. The learning process is not merely an active process but rather a reflective one; the practical experiences combined with exchange of ideas and collective reflection create deeper understanding and generate new knowledge. Information communication and technologies (ICTs) are increasingly becoming accepted as important tools for supporting educational and organisational learning and teaching. The aim of this work is to explore if and how ICTs can be used to enhance the Manchester Method. The challenge is to understand the ability of such technologies to improve communication, decision-making, thinking, and personal learning. Rather than using ICTs for making information readily available and easily retrievable, this work investigates the use of ICTs for enhancing the Manchester learning experience.

The MBA programmes are dominated by the use of projects as a standard learning method. Over the years this has become the characteristic feature of the MBA programmes, distinguishing it from other business schools. The projects are designed to be a challenging experience where the students apply the knowledge and skills they have learnt, and also nurture their ability to work as part of a team. When students participate in projects they are encouraged to assume the role of an actor rather than that of a bystander. The courses and structure of the MBA programme ensure that students go through three stages: training, education and development. There has been little change from the original thought and design of the programmes; not to impart knowledge but to develop the skills of students (Wilson 1992). In the initial stage training is provided through intensive instruction in relevant disciplines and skills. The projects help the students in their personal development by allowing them to develop their skills. This strengthens the educative process allowing a multidisciplinary approach to problem solving to evolve into a more independent attitude to problem solving (Wilson 1992). The whole process leads the students from well-defined exercises and tasks through to open-ended tasks and problems which are unstructured and not well-defined. The Business Environment Project (BEP), which is the first real/live project, marks the transition to more active, self-managed learning (Rickards 2003). Learning is a journey and there are many paths that a student can take. The BEP reflects the key principle of the Manchester Method that students should learn to tackle real projects and acquire many disparate skills through their participation in group activities.

As part of the development of the school’s e-Learning strategy, a need was identified to invest in a project collaboration tool that would facilitate the co-ordination of group projects and enhance the learning experience. A decision was made to purchase IBM Lotus QuickPlace, a Web-based tool that facilitates information sharing and collaboration. This research explores the introduction of QuickPlace in project-based group work with the aim of exploring the school’s use of the system as part of its e-Learning strategy.

2. Collaborative e-Learning research

The use and effect of ICT in education has been the source of some research over the
past years. The main thrust of this research is answer the question “has the use of ICT really affected the learning process and outcomes?”

In her research Alavi (1994) investigated the impact of a group decision support system (GDSS) on collaborative learning. The study was conducted in a field setting involving MBA students enrolled in management information systems courses. Some of the students attended the class with GDSS software while others attended the course in a traditional classroom setting. The findings of the study indicated that GDSS-supported collaborative learning leads to higher levels of perceived skill development, self-reported learning, and evaluation of classroom experience in comparison with non-GDSS supported collaborative learning. Although there were no significant differences in midterm scores, the final test grades of the group of students who were exposed to the GDSS were significantly higher than those of the other group of students who participated in the experiment (Alavi 1994).

In 1995, Alavi et al. evaluated another ICT tool in an educational setting through a longitudinal field study (Alavi et al., 1995). They evaluated the efficacy of three learning environments: proximate groups with ICT support, non-proximate team groups with ICT support and traditional face-to-face groups with no ICT support. The ICT tool being used was desktop videoconferencing. The results indicated that the subjects’ learning achievement in terms of critical thinking was different under the three learning conditions. The subjects who participated in the distant collaborative telelearning environment demonstrated the highest level of critical thinking achievement. The study also found that the three environments were equally effective in terms of students’ knowledge acquisition and satisfaction with learning process and outcomes.

Hiltz et al. (1999) undertook a three-year longitudinal study of a number of courses that are part of an undergraduate Information Systems degree. The courses were all delivered in a distance asynchronous learning network (ALN) using a combination of videotaped lectures and computer conferencing with special features to support asynchronous learning. A number of findings came as a result of this study. Students reported that the ALN improved not only access to education but also the quality of the learning process. The most important outcome of the research indicated that when students are actively involved in collaborative learning using an online method, the outcomes can be as good as or better than those for traditional classes. On the other hand when individuals are simply receiving posted material and sending back individual work, the results are poorer than in traditional classrooms. This stresses the importance of using communication tools in any learning environment and the importance of moderating the communication.

Another study by Piccoli, Ahmad et al. (2001) compares a web-based virtual learning environment (VLE) to a traditional classroom by using a longitudinal experimental design. The study was conducted on two groups of students undertaking an introductory course in management information systems. One group undertook the course using a VLE whilst the other group attended the course in a traditional classroom environment. The findings revealed no significant difference in performance between the two groups. However although the students undertaking the course in a VLE environment did report a higher computer self-efficacy, they were less satisfied with the learning process.

In summary, a fair amount of research has been conducted on the effect of ICTs on the educational environment and its effect on the performance of the students. While one can draw from these studies for insight, the introduction of emerging technologies requires further study and evaluation. The motivation for this research stems from the need to observe the use of ICTs within project-based group work in order to make necessary changes and achieve the best possible results.

3. Current VLEs - Manchester method

ICT has been used in the development and delivery of training and educational programmes. Whereas training is a narrow term focusing on preparing an individual for a particular function or profession, education is a process of learning that develops moral, cultural, social and intellectual aspects of the whole person as an individual and member of society.

Many of the current VLEs provide no more than a drill-and-practice approach to learning. The technologies are simply being used to replicate the traditional ‘chalk and talk’ ways of teaching and learning. These are valuable in
transforming understanding into automated skill, making the information and procedures available without conscious effort. However, these approaches are weak in motivating the learner and in providing conceptual aids for understanding and critical thinking.

Currently there is no system or platform that has been widely adopted by either the educational or corporate sector. There is no technology platform that suits every organisation, discipline or programme. Most of the technology platforms are still in their ‘infancy’. They lack the diversity and capabilities that come with the maturity of technologies (Salmon 2002). Therefore, in higher education institutions, e-Learning is not extensively used for delivering entire courses.

Off-the-shelf commercial VLEs currently being used in UK HE institutions include WebCT, Blackboard, and Virtual Campus. Organisations are however rarely satisfied with all the functionalities such systems provide. Coupled with this dissatisfaction are problems of integrating the system with other organisational systems. Customisation becomes therefore a critical issue in choosing the right VLE. Commercial VLEs provide more or less similar functions and tools but they differ in the degree of customisation allowed. In some cases, bespoke online environments, such as those developed in-house or as a result of collaboration between institutions, are being developed and used by many HE institutions in the UK. Examples include Colloquia - developed at the University of Wales, Nathan Bodington - an open source system originating from the University of Leeds and CoMentor - from the University of Huddersfield. The advantage of such systems is that they fit more closely within the practices of these institutions. An additional benefit the ability of using industry tools such as Microsoft NetMeeting within the VLE. But the maintenance of such systems can prove to be a problem as there is a dependence on the individuals involved in the development. Thus, the cost-effectiveness of implementing such systems as opposed to customising commercial applications is questionable.

While the introduction of ICT can contribute to learning, on its own it cannot deliver learning. The integration of pedagogy and learning models within the appropriate technology is essential and this is what makes a VLE successful. Each institution employs its own model of learning and therefore needs to ensure that the technology adopted can enhance the learning process.

At MBS the Manchester Method extends the education process to include learning-by-doing. As current e-Learning software packages are not well suited for such an environment, MBS explored other tools more suited to their approach to learning.

When implementing a VLE, an organisation has various options, a bespoke system, a complete off-the-shelf solution such as WebCT or a modular approach combining off-the-shelf components with customised solutions. The advantages and disadvantages of these are discussed earlier in the paper. MBS has selected a modular approach combining off-the-shelf components with customised solutions. The reason is primarily because of their approach to learning – The Manchester Method.

As part of the development of the school’s e-Learning strategy, a need was identified to invest in a project collaboration tool that would facilitate co-ordination of group projects and enhance the collaborative learning experience. A decision was made to purchase IBM Lotus QuickPlace, a Web-based tool that facilitates information sharing and collaboration. This research explores the introduction of QuickPlace in project-based group work with a goal of enhancing the school’s use of the system in its e-Learning strategy. In addition to using QuickPlace, the IBM Domino platform and IBM Lotus Notes and iNotes applications for messaging and calendaring were also installed. A legacy system, an extranet, is also used by the school to distribute course materials and act as a repository of general information needed for the courses. The legacy, Microsoft platform, system is being phased out during 2004 and being transferred onto QuickPlace.

4. IBM Lotus QuickPlace: Industry Standard Group Project Tools

IBM Lotus QuickPlace is a self-service Web tool for team collaboration and provides teams with areas of webspace to work on a project for example Master workspace (parent) group workspace (child), folders (sub-workspaces - grandchild), rooms (specialised folders), and inner rooms (private breakout or personal rooms). Groups can use QuickPlace to store files e.g. Microsoft Office, thoughts, and schedules related to a project in a common place, where everyone can find and respond to
the latest information. In addition, teams have a workspace to share information, collaborate and discuss through the use of discussion boards, chat (two or more members exchange messages by typing them in a chat window) and awareness capability (members can spontaneously encounter other members within the context of the content they have authored, e.g. reading a page in the 'marketing room' while the author of that page is online). It is also possible to use white-boarding to work on documents, manage and coordinate activities and track events. It also includes support for other activities associated with group-based project work such as task assignments and schedule management.

As well as working online with QuickPlace it also offers the option to working offline. When a person works with QuickPlace online, they have to be connected to a QuickPlace server. However, if a user is remotely located and cannot connect to the QuickPlace server or would prefer to work offline to avoid connect charges, it is possible to take their QuickPlace offline. The offline QuickPlace is a copy of the online version and resides on the hard disk rather on the server. When the individual makes changes to the offline version and then synchronizes to the QuickPlace server - for example, when you add or edit pages in the place - QuickPlace automatically updates the online version.

Some of the general characteristics of Lotus QuickPlace include:

- Primarily designed for smaller groups or teams
- Duration of usage is often limited or for a specific period of time
- Requires minimal infrastructure and support from ICT (self-service)
- Easy for users to create, manage and customize (self-service)
- Project-centred or activity-oriented
- Designed to facilitate enhanced collaboration
- Emphasis on user productivity and getting the job done

Lotus QuickPlace can be viewed as an electronic project room. It provides not only a central location for sharing information but is flexible enough to grow and change with the project. It can be used ‘out-of-the-box’ without any customisation. However to get the maximum benefit from the application, customisation is possible through various standard tools.

5. The Setting – the Business Environment Project

The Business Environment project - BEP is a client-sponsored live project on an issue of direct relevance to the organisation and marks the transition to more active, self-managed learning (Rickards 2003). In May 2003, the project involved 157 students who were divided into groups with each group working for one of 30 company-based projects. They were divided into groups of 3 to 6 individuals. All the groups had the possibility of meeting face-to-face. Every student was equipped with a portable computer making the access to ICT facilities quite even. Lotus QuickPlace was available to them as a tool to be used but it was not compulsory for them to use it.

The students had four weeks (150 hours) to undertake the project and produce a group report on the project itself as well as a personal report to reflect on their personal experiences and learning. Students were advised to spend 100 hours on the content of the project: in essence doing the work for the client or sponsor. The remaining 50 hours on attendance at the introductory sessions on the management of the project and its format and, above all, on reflecting and learning from the project. This meant that individually and as a group they were expected to spend a significant amount of time watching and reflecting on the processes that they were going through and, when use of a skill or area of knowledge, study the background issues related to these: e.g. when a ‘model’ is used, check its description in a text book and look at other applications.

Although the specific project is centred around the needs of the client or sponsor, the main focus being to help students learn the broader knowledge and skills that will help them in the future. During the project, students interact with the faculty team in many ways, sometimes offering ‘deliverables’ for consideration, perhaps a project plan or a mindmap of the key issues that need be addressed in the project. It is important to emphasise that during the course of the project students are not assessed in a summative way, i.e. to award marks that counted towards an overall mark on the module. The intermediate deliverables and discussion and feedback on them are formative, i.e. focused on helping students learn.

At the end of the project, the students have to produce a group report and an individual
report. The group report addresses the issues related to the project and may make proposals for the client. The individual report is part of the personal learning process in which the students reflect and discuss new skills learnt, the way the group arranged the work of group members and the way the group addressed unforeseen problems.

6. Lotus QuickPlace Design

The overall structure of QuickPlace for the Business Environment project consists of several workspaces:

- a parent workspace template which holds general information about the project and is accessible by all students and staff concerned;
- a Group Workspace for each group which is accessible for only the members of the group and the staff concerned.

6.1 The Parent workspace template

The Parent workspace holds the documents relating to the Business Environment project such as report guidelines and marking schemes. By having a central place for this means that the project coordinators can log onto one place to post information for all students rather than logging on to all the group workspaces to post information. This template that acts as the parent folder is accessible from the groups’ workspaces by a special link page. This gives the students the illusion that the information is within their workspace and they do not have to log on to another workspace to view the information.

The Parent workspace contains a range of standard folders and rooms. The Getting Started folder is explains how to best use the system and gives a tutorial. A description of each of the option and their purpose is placed in the Guide to this QuickPlace folder. The discussion folder provides students with a place to post general questions about the project which any tutor can then answer or initiate a discussion. The calendar folder holds events for the project such as project clinic dates and dates when tutors are available. Basic project documentation links to the parent workspace and upon selection takes the students to the documentation folder in the parent workspace. The students do not need to log onto a different site for this information as the transfer is automatic.

The document library is a room (i.e. a special area than can be seen as a “child workspace” within the “parent workspace”) for document storage. Its main use is to separate content and access. The reason for the library to be a room rather than a folder is that the students can organise the documents into folders. A room can have multiple folders but a folder cannot have sub-folders. The room is also equipped with an instructions page to guide the students on how to create folders and how to best use this option.

During the project, the tutors provide specialist support and advice either on a one-to-one basis or during project clinics. In the parent workspace, rooms are introduced to support this process. In each room a discussion area that allows students to ask questions or initiate a discussion is provided. There is also a library folder for tutors to post references or documents that students may find useful. The idea of specialist areas is significant in supporting the Manchester Method. In the Manchester Method the tutors actively guide the students through the learning process. Specialist areas provide not only access to the right information but also the discussion channels for obtaining advice on issues and problems. Tutors are expected to log on regularly and answer questions or even instigate discussions, which can trigger reflection.

The other options and folders are standard in a workspace. This includes the application for chat, sharing and online meetings. An index folder lists all pages and folders in alphabetical order and a members’ folder provides a list of all the members of the workspace.

6.2 The Groups’ workspace

As previously mentioned, each team has access to a group workspace. This allows group members to publish, share and track all information relevant to the project with other members of the team. It contains a range of folders and resources.

The project discussion folder is for the group to discuss the running of the project and issues surrounding the group work and allows for threaded discussions to be recorded. Two other special rooms are designed to help students with monitoring of group processes and reflecting on what they are learning. The learning log has two folders, the group diary and the ideas and suggestions folder. The group diary is designed to help students reflect on any event that made them stop and think. The aim is to help them recognise aspects of group projects and applications of
management skills that they can apply generically. The folder has a special form with questions that guides them on finding out the above. The students may then comment on other’s entries and start a discussion. The ideas and suggestions folder is an area for them to start a discussion on ways the group may work better or ways to tackle problems.

The team dynamics room is designed and primed with three options that help students monitor the group processes as the team develops. The three options are the team factors measure (TFI 5) that assesses the effectiveness of the group along a number of dimensions such as creativity, the form/storm/norm /perform model and the option to discuss roles and personal differences in the team. In the current template the TFI option is done through an Excel spreadsheet. The form/storm/norm /perform model is a simple HTML form for the students to fill and the summary is displayed for them to monitor the changes over time. The personal differences in the team option, is designed for students to fill in their desired Belbin role and then for other students to comment and assign what they perceive the role of the person is.

The calendar folder is for students to record events for the group. The system automatically copies all the events from the parent calendar to the group calendar. This is done through an agent written in LotusScript. The agent runs on a scheduled basis. This again makes it easy for the staff to post events to the group calendars as they only have to post it to the parent calendar. The tasks folder is a standard folder that allows the students to assign tasks and to monitor them. The tasks can be viewed in a Gantt Chart view or as a simple list. The tasks can be defined as milestones and can also be assigned to the calendar. Students who have been assigned tasks are notified by email of the tasks and reminders are sent by email as well. The expenses folder is there to help students record their expenses. The folder displays a summary of the expenses for them to print out for accounts purposes. An HTML form is custom built for this purpose.

The index folder lists all pages and folders in alphabetical order for management the workspace. The members’ folder lists all members of the workspace.

7. Evaluation

The introduction of any VLE requires time and effort in not only designing the appropriate course and other materials within a VLE but also in training the staff and students so that they gain the maximum benefit out of the system. Given that this impacts on the quality of teaching and the operation of a course or project, understanding and monitoring the use of these tools is worthwhile.

The initial work involved the building of a rapid prototype for the students to use. This prototype included a number of options for students to use during the project. The building of the prototype helped in understanding the system and some of the requirements.

The evaluation was achieved using a cross-sectional survey and actual monitoring of the usage. It has sought to understand the system’s value in supporting the Manchester Method of learning, group work and personal learning by investigating how it was used, its overall usefulness and effectiveness. From the survey the students’ perceptions were obtained and from the monitoring of the actual usage a better understanding of how the system was used were gained. There are clear indications from this study that the majority of students are positive about using the system. But the results also indicated that although the students were positive about the system they were unsure of how to best use the options.

The survey also revealed that the majority of group although not being compulsory used the system in different ways. This helps the students get used to industry-standard tools and hence better prepare them for work. This achieves one of the aims of the Manchester Method, which is learning-by-doing. It would not have been possible if a “typical” VLE was used as they do not cater for such an environment. From the survey, some of the requirements for the new workspace were obtained. This was not the only way the requirements were obtained. A number of staff was interviewed and the processes involved in project-based group work were also modelled. This provided a better understanding of what was required to fully support project-based group work activities and the Manchester Method of learning. This allowed us to design and implement a better workspace.

The new workspace has been designed and implemented with a number of new options. The new options incorporate the options needed for monitoring team processes and

http://www.ejel.org
also the various requirements as dictated by the Manchester Method. It was challenging to understand how to incorporate all elements of the Manchester Method within the workspace. The first attempt of implementing such a workspace has been completed but it needs to be tested in a live situation.

A very interesting finding of this study was the actual level of usage. There was a gradual increase in the usage as the project progressed. This finding suggests that the novelty of using the system did not diminish even though students did have other means of working such as central location on the server for data-storage and face-to-face meeting. Although the most common reason for using the system was for posting shared documents, some groups did make use of the various options such as the Learning Log, discussion forums and tasks. It was also encouraging to see that one of the groups went to the extent to customise their workspace themselves. The majority of the students in that group did have previous experience with using the system. This shows that the more familiar the students are with the system, they will use it to its maximum.

The study has also provided us with a number of issues to consider for improving the use of the system within MBS’ programmes. It is clear that consideration of such issues as training, online moderating of discussion forums, online tutor presence and developing an online culture is needed if the full range of benefits is to be gained. Students must feel that the system is a part of their learning and development.

8. Conclusion

ICT are increasingly becoming accepted as important tools for supporting educational and organisational learning and teaching. The aim of this work is to explore if and how ICT can be used to enhance the Manchester Method, a distinctive approach to learning that has been evolved over the years at Manchester Business School. The challenge is to understand the ability of such technologies to improve communication, decision-making, thinking, and personal learning. Rather than using ICT for making information readily available and easily retrievable, this work investigates the use of ICT and collaborative tools in particular for enhancing the Manchester learning experience.

This work discusses our experiences in customising and evaluating a web-based collaborative environment based on IBM Lotus QuickPlace. QuickPlace is a system that offers many possibilities with a minimum of effort and provides many of the capabilities needed for a virtual learning environment. Although the study is limited to a specific project it has revealed that the use of the system can be successful. However, it is important to bear in mind that technology alone does not affect or enhance the learning process. The use of Lotus QuickPlace at Manchester Business School represents a new challenge to faculty members, to adapt and change the Manchester Method of learning to best take advantage of the ICT tools.

A survey has been undertaken to explore students’ responses and reactions to QuickPlace in order to understand the system’s value in supporting the Manchester Method of learning, group work and personal learning by investigating how it was used, its overall usefulness and effectiveness. The results from the survey suggest that the majority of students made use of QuickPlace and were positive about using it in their project work and as a tool for learning.

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The Social Shaping of a Virtual Learning Environment: The Case of a University-wide Course Management System

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Abstract: Expectations surrounding the role of e-learning need to be tempered by an awareness of the variety of technical, institutional, social and economic constraints on the innovation process. This paper reports on a case study of the introduction into a university of one of the most central e-learning initiatives in higher education, an enterprise-wide virtual learning environment. Findings identify constraints on innovation and highlight changes likely to evolve from the diffusion of such environments, which can be amplified by interrelated technical changes underway in universities.

Keywords: courseware, course management system, virtual learning environment, VLE, e-learning, information and communication technologies, institutional change, social shaping of technology, online learning

1. Introduction: The diffusion of courseware in Higher Education

Likely outcomes of e-learning innovations in higher education using information and communication technologies (ICTs) have been hotly debated, with utopian excitement about the new media matched by critical concerns over their appropriateness in many contexts (Dutton and Loader 2002). With notable exceptions (Hara and Kling 2000), this debate has been illustrated more by anecdotal evidence than empirical research on the actual role of ICTs in higher education.

This study seeks to develop an empirically-anchored perspective on the implications of e-learning through a case study, informed by work on the social shaping of technology (SST) that highlights organizational, cultural, economic and other factors influencing the process of technological change and innovation (Williams and Edge 1996; Kling 2000). It provides evidence centred on an in-depth analysis of one e-learning innovation, in order to surface patterns and themes of potential relevance to a wider range of e-learning initiatives. The innovation we focused on was an institution-wide virtual learning environment (VLE) designed to support the management and operation of most aspects of an online course: the distribution of multimedia material (such as readings, lecture notes, assignments and images); student-teacher and group discussions; exam and grade administration; and other teaching and administrative tasks.

We chose to study a VLE because such course management ‘courseware’ systems appear to be among the most rapidly diffusing e-learning technologies across the world. The adoption of this kind of environment has become a symbol of innovation, with many higher-education institutions not wishing to be left without their own system. A VLE can also create incentives to invest further in electronic content, create links to other ICT applications within the university, such as wireless networks and services, and generally enable institutional innovations in learning and education.

Our study seeks to answer questions such as:
- What is the actual experience of implementing VLEs?
- Which main social, cultural, psychological, economic, technical and other factors facilitate or constrain the uses to which the VLE is put?
- To what degree does a VLE complement or replace traditional learning environments?
- What kinds of VLE-based teaching and learning approaches are most effective?
- Which VLE capabilities lead to difficulties or are underused?
- How easily can a VLE be tailored to the needs of particular contexts, teachers, students, administrators, etc?

1 This applies to both proprietary systems, like Blackboard (www.blackboard.com) and WebCT (www.webct.com), and open source software, such as the Bodington Common (http://bodington.org/index.html).
Who in educational institutions are likely to be the winners and losers from the introduction of a VLE?

What kinds of policies and resources are needed to make a VLE effective?

What are the implications of the way a VLE can be used to reconfigure how faculty, administrators, students and others in an educational institution gain access to people, services, information and technologies (Dutton forthcoming).

The following sections describe our methodology, the patterns of eClass adoption and use we identified, and our findings on the main factors shaping these outcomes.

2. Methodological approach

2.1 The analytical framework: social shaping of technology

Theoretical approaches from the social shaping of technology (SST) were employed to understand the responses of technical staff, administrators, instructors, students and other actors towards the adoption and use of the VLE at the university studied. This framework was chosen because it encompasses a broad perspective that enabled us to move beyond narrow speculation based on the technical functions and capabilities of a VLE to focus on how people design, deploy and appropriate these technologies in actual social settings.

At an institutional level, SST highlights the implications for innovation of the way a university or other educational establishment is, to some extent, organized to support and maintain existing standards and practices. This helps to focus attention on the manner in which an institution resists, assimilates, subverts or otherwise appropriates what is being proposed or imposed when a technical innovations threatens to disrupt the established ways of doing things. Thus, the values and assumptions of all relevant institutional actors need to be understood, including both supporters and critics of e-learning, as does the nature of the technological innovation if researchers are to discern the practical implications of VLE courseware.

In addition, an SST perspective guides researchers to investigate the ways in which specific users shape technological development and innovation. In Bijker’s (1995) words, this should aim to include a consideration of the different ‘relevant social groups’ involved in interpreting a technology, including the determination of whether a technology ‘works’. For example, a social-shaping perspective sensitizes research to the role of teachers at a university, since instructors are among the most critical decision makers on the adoption and use of technology in classes and for the way students organise their work with computers (Layton 1994). Decisions regarding computer use in classes are also affected by instructors’ teaching styles, flexibility in adapting to new teaching situations, attitudes towards computers, length of experience using computers in their own lessons and their self-perception as computer users (Levin and Arafeh 2002). Other relevant social groups include the specialist developers who implement systems within organizations; students as users; and administrators and senior managers, who often regulate and sometimes mandate the use of technology. Policy choices by those who run school or departmental systems can result in different units having different levels of access to the Internet, dissimilar requirements for student technology literacy skills and different limitations on student Internet access (Levin and Arafeh 2002).

SST also reveals how conceptions and responses across all this range of policy makers, administrators, developers, instructors and students can support or frustrate technologically-enabled change. From this perspective, Dutton and Loader (2002) argued that educational technologies were underpinning the emergence of a ‘digital academe’ – a change in the institutions of higher education that is supported by the increasing application and use of ICTs across all higher education management, administration and operational processes.

The main premise of this view is that ICTs are becoming increasingly central not only in terms of how higher educational institutions accomplish their tasks, such as promoting their institutions on the Web, but also in relation to the nature of the products and services they provide, for instance in considering new initiatives in distance education and e-learning. This directs attention to discerning just how far VLE technologies are going, and could go in the future, towards being more than ‘electronic white boards’. One possibility is that they could alter the whole manner in which faculty, administrators and students will gain access to one another, to information, services and technologies that support these processes and their outcomes. In going further along this route, VLE courseware could undermine or
support the role of traditional gatekeepers in education, such as faculty instructors, at the same time as fostering new gatekeepers, such as the technology administrators and technical support staff that control access to digital library resources and make decisions about technology upgrades.

This SSE background convinced us that we use both a comprehensive survey questionnaire and ‘embedded case studies’ to undertake more detailed interviews that drill down to get a richer feel for the actual issues confronting everyday use of the system. This provided a balance between institutional and user perspectives. Given the significance of instructors to any innovations in e-learning, we used our research resources to focus on this group, while using knowledge from SST research to take account of the critical role played by others in the innovation process in order to detect more general patterns and issues.

### 2.2 The case study: A university-wide course management system

We examined the diffusion and use of a proprietary, commercially-marketed VLE at a private US university. To protect the confidentiality of our respondents, individuals involved are kept anonymous and fictitious names are used for the university (‘North East University’ (NEU)) and VLE (‘eClass’). We chose NEU because eClass had appeared to diffuse rapidly within this university. The principal organizational actor at NEU was ‘the Centre’, which was responsible for the use of ICTs in teaching and research. As the study progressed, we discovered the diffusion and impacts of eClass were more limited than anticipated, which shifted the focus of our study on the social and institutional factors constraining this e-learning innovation as well as the likely impacts for the most innovative adopters.

### 2.3 Research approaches used

We employed a variety of empirical approaches to gain a systematic understanding of how eClass diffused, and what effect on learning and education. For instance, we undertook a detailed analysis of the electronic records and reports on everyday use of eClass. These had to be restructured and inspected to develop a reliable count of actual adopters and users. The electronic facilities of eClass enabled us to email all registered current and former instructors, asking them to complete (in about 15 minutes) a Web-based questionnaire, asking for information such as participants’ use of eClass and their overall usage of personal computers and the Internet. Two reminders were sent, yielding a response rate matching half of the estimated population. In addition, we conducted in-depth embedded case studies (through interviews of about an hour each). These involved 20 instructors who were among the most intensive or creative eClass users.

These surveys and interviews were complemented by interviews with key staff of the Centre. We also attended training sessions and eClass courses, enabling more participant-observation of these events. These sessions created many opportunities to speak informally with eClass technical specialists, department coordinators and users. Finally, we reviewed the content of selected eClass course sites, focusing on sites of our embedded case studies.

Survey responses from 225 individuals were gathered from January to March 2002, representing about a 50% response rate, based on our estimate of the number of actual users. Of these, 191 were completed fully and the rest were typically from individuals ‘registered’ for eClass but not actually using the VLE.

### 3. The multi-layered diffusion of eClass

#### 3.1 Booming eClass Registrations

The Centre introduced a trial version of eClass at NEU in the Spring 1999 semester. Workshops and training sessions for faculty and instructors plus general word-of-mouth recommendations led to rapid growth over the next two years, from six at the start to over 1000 by Spring 2001 (Figure 1).

Despite continuing growth in demand, in Spring 2001 the introduction of new courses was stopped because eClass had reached the limit of the pilot version’s capacity. The Centre therefore upgraded in Summer 2001 to a newer version that could support many more courses. When the Centre began migrating older courses to the new system, implementation problems arose that caused many instructors to abandon their use of eClass because they were no longer able to use it effectively.
3.2 Discrepancies between actual and registered users

There was real interest in eClass at NEU, but system logs had inflated the actual level of diffusion. Many eClass courses listed as being live on the system’s logs were actually old courses. The logs also included ‘shell’ courses that had been set up by some departments but not used by teachers, along with some of the Centre’s own internal training courses, some mislabelled courses and various test runs. Once these were eliminated, the diffusion curve of eClass remained substantial, but significantly less widespread than had been commonly understood (Table 1).

Table 1: The layered diffusion of courses

<table>
<thead>
<tr>
<th>Semester</th>
<th>Summer 2001</th>
<th>Fall 2001</th>
<th>Spring 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of courses</td>
<td>355</td>
<td>1080</td>
<td>752</td>
</tr>
<tr>
<td>requested by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>instructors or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>departments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of “actual”</td>
<td>273</td>
<td>879</td>
<td>700</td>
</tr>
<tr>
<td>courses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of “actual”</td>
<td>145</td>
<td>70</td>
<td>110</td>
</tr>
<tr>
<td>users</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In analyzing eClass courses in more detail, we uncovered multi-layered levels of innovation. In the spring of 2002, 6,814 courses were offered at NEU, with 752 (about 11%) registered for eClass. Of these, 700 actually used eClass, accounting for about 110 teachers among a faculty approaching 2,000. However, in line with the general perception that eClass was diffusing rapidly, our survey respondents believed eClass was used by many others: 19% said all courses in their department were using eClass and 35% thought most courses were using it. Only 13% said eClass is rarely used in their department, which is probably closer to the reality.

Moving beyond mere adoption to look at actual usage, we found that most did not make extensive use of eClass, although some did. This is one reason why we decided to conduct a selected number of embedded case studies to see how active eClass users applied the VLE in their courses. We also sought to discover emerging patterns of use.

4. Perceptions of the helpfulness and value of the VLE

Questionnaire responses indicated that eClass users spent an average of 2 to 3 hours a week on the system (Table 2), with 60% using it for no more than 2 hours per week. Instructors had used the system for an average of two semesters in about three courses; just 26% used it for three or more semesters and 31% for only one.
Table 2: Average levels of use

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours per week spent on eClass</td>
<td>2.73</td>
<td>2.73</td>
</tr>
<tr>
<td>Number of semesters using eClass</td>
<td>2.32</td>
<td>1.49</td>
</tr>
<tr>
<td>Number of courses using eClass</td>
<td>2.97</td>
<td>3.13</td>
</tr>
</tbody>
</table>

Despite limited levels of use, most eClass users (71%) felt it was “very helpful” or “helpful”; less than 9% found it “not helpful” (Figure 2). 70% of respondents said they would definitely use eClass, further supporting its perceived value. This is consistent with the attitudes of other users (Kent 2003).

Figure 2: Perceived helpfulness of eClass

The primary value attributed to eClass was its ease of use in posting and distributing documents, assignments and announcements to students (Table 3). An important secondary use was for communication, such as emailing students. E-Class enabled email lists to be generated automatically as students registered for their courses. But most respondents place most value on distributing information rather than in online discussions, group facilitation, virtual chat and other more interactive forms of communication.

Table 3: Perceived value of eClass features

<table>
<thead>
<tr>
<th>Rating Features of eClass</th>
<th>Very Useful + Useful (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posting course documents</td>
<td>87</td>
</tr>
<tr>
<td>Posting assignments</td>
<td>78</td>
</tr>
<tr>
<td>Posting announcements</td>
<td>72</td>
</tr>
<tr>
<td>Communication via email</td>
<td>58</td>
</tr>
<tr>
<td>Posting external links</td>
<td>47</td>
</tr>
<tr>
<td>Posting student information</td>
<td>43</td>
</tr>
<tr>
<td>Communication via discussion board</td>
<td>27</td>
</tr>
<tr>
<td>Viewing usage statistics</td>
<td>27</td>
</tr>
<tr>
<td>Using gradebook</td>
<td>25</td>
</tr>
<tr>
<td>Using course calendar</td>
<td>23</td>
</tr>
<tr>
<td>Creating and facilitating groups</td>
<td>22</td>
</tr>
<tr>
<td>Tracking document downloads</td>
<td>19</td>
</tr>
<tr>
<td>Using address book</td>
<td>17</td>
</tr>
<tr>
<td>Administering exams/quizzes</td>
<td>12</td>
</tr>
<tr>
<td>Surveying students</td>
<td>12</td>
</tr>
<tr>
<td>Using eClass resource Centre</td>
<td>9</td>
</tr>
<tr>
<td>Communication via virtual chat</td>
<td>8</td>
</tr>
</tbody>
</table>

5. Instructors motivations for using a VLE

Respondents saw improvements in pedagogical practices (such as increasing communication among students or helping students learn about online media) and in work efficiency (such as in saving time, as among the main motivations for using eClass, as shown in Table 4). 74% felt ease of use is a major motivator, which also helps to save time and investment in learning to use the software. Other analyses showed that those who rated “ease of use” as an important motivation were more likely to have used eClass in more courses, and those citing pedagogical reasons were more likely to spend more time per week with eClass.

Table 4: Motivations for using eClass

<table>
<thead>
<tr>
<th>Motivations</th>
<th>Very Important + Important (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase communication among students</td>
<td>77</td>
</tr>
<tr>
<td>Ease of use</td>
<td>74</td>
</tr>
<tr>
<td>Save time</td>
<td>68</td>
</tr>
<tr>
<td>Help students learn to use online resources</td>
<td>61</td>
</tr>
<tr>
<td>Learn more about online course development</td>
<td>48</td>
</tr>
<tr>
<td>Keep up with technical change</td>
<td>47</td>
</tr>
<tr>
<td>Respond to students’ request or interest</td>
<td>45</td>
</tr>
<tr>
<td>Comply with school or departmental policy</td>
<td>19</td>
</tr>
</tbody>
</table>

Factor analysis among the motivations identified convenience and effectiveness as two relatively independent defining groups of characteristics affecting attitudes towards eClass (Table 5).
Table 5: Factor analysis of attitudes to eClass

<table>
<thead>
<tr>
<th>Variables</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1. Convenience of eClass</td>
<td></td>
</tr>
<tr>
<td>Students like to use eClass</td>
<td>.803</td>
</tr>
<tr>
<td>eClass is easy for students to use</td>
<td>.882</td>
</tr>
<tr>
<td>eClass is easy for me to use</td>
<td>.680</td>
</tr>
<tr>
<td>eClass is convenient for students to access</td>
<td>.885</td>
</tr>
<tr>
<td>Factor 2. Instructional Effectiveness</td>
<td></td>
</tr>
<tr>
<td>I am teaching in new ways since using eClass</td>
<td>.721</td>
</tr>
<tr>
<td>Students’ performance is enhanced when using eClass</td>
<td>.710</td>
</tr>
<tr>
<td>I interact more with students when using eClass</td>
<td>.737</td>
</tr>
<tr>
<td>Some students participate on eClass who do not participate in class discussions</td>
<td>.771</td>
</tr>
</tbody>
</table>

Table 6: Change in time allocation linked to eClass

<table>
<thead>
<tr>
<th>Time Spent</th>
<th>Increased (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being online</td>
<td>54</td>
</tr>
<tr>
<td>Communicating with students</td>
<td>43</td>
</tr>
<tr>
<td>Sending and receiving email</td>
<td>42</td>
</tr>
<tr>
<td>Preparing for classes</td>
<td>38</td>
</tr>
<tr>
<td>Working from home</td>
<td>36</td>
</tr>
<tr>
<td>Working in your office</td>
<td>22</td>
</tr>
<tr>
<td>Working with teaching assistants</td>
<td>18</td>
</tr>
<tr>
<td>Working with course builders</td>
<td>16</td>
</tr>
<tr>
<td>Evaluating students’ work</td>
<td>14</td>
</tr>
<tr>
<td>Working in a computer lab</td>
<td>14</td>
</tr>
<tr>
<td>Working one-on-one with students</td>
<td>12</td>
</tr>
<tr>
<td>Preparing library reserve materials</td>
<td>10</td>
</tr>
<tr>
<td>Reading professional journals</td>
<td>9</td>
</tr>
<tr>
<td>Doing library research</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 7: Respondents’ use of multiple media (%)

<table>
<thead>
<tr>
<th>Media</th>
<th>Never</th>
<th>Seldom</th>
<th>Often</th>
<th>Regularly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td>4</td>
<td>10</td>
<td>20</td>
<td>66</td>
</tr>
<tr>
<td>Computer presentations (e.g. PowerPoint)</td>
<td>7</td>
<td>20</td>
<td>23</td>
<td>50</td>
</tr>
<tr>
<td>White/chalkboard</td>
<td>12</td>
<td>19</td>
<td>22</td>
<td>47</td>
</tr>
<tr>
<td>Internet/Web</td>
<td>17</td>
<td>18</td>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td>Overhead projector</td>
<td>14</td>
<td>37</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td>Videotape</td>
<td>21</td>
<td>40</td>
<td>22</td>
<td>17</td>
</tr>
<tr>
<td>Simulation/gaming</td>
<td>52</td>
<td>25</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Groupware/collaboration software</td>
<td>73</td>
<td>21</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Flipcharts</td>
<td>75</td>
<td>20</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>35mm Slides</td>
<td>77</td>
<td>17</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Audio conferencing</td>
<td>85</td>
<td>12</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Video conferencing</td>
<td>86</td>
<td>11</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

6. Impacts of Use

6.1 Reallocation of Time and Place

The most widely perceived changes tied to eClass were the respondents’ use of time and the geography of teaching and learning. The activities that had increased most by the use of eClass were being online, communicating with students and emailing, followed by increases in the time spent preparing for classes and working from home and at the office (Table 6). These also indicate more time at the computer, or what might be called a growth in more computer-centric work patterns.

6.2 Correlation with the Use of Other ICT Media

Access to a wide variety of computer and Internet resources are critical enabling factors in e-learning. We found a clear positive correlation between instructors’ use of eClass and other computer-based instructional technologies, such as email, presentation software and the Internet/Web (Table 7). For example, almost all eClass users had a computer at home, 46% had broadband Internet access at home and 76% had a portable computer. Except for white boards, more traditional non-computer-based media had lower rates of use among the users of this VLE.

6.3 Challenging e-Learning stereotypes

Only a weak positive correlation was shown between the times spent using eClass and a number of factors conventionally expected to be relevant to e-learning, such as the age of teachers, their computer knowledge and experience and the discipline of the course. The acknowledged ease of use of eClass might have contributed to the lack of effectiveness correlated with the use of eClass.
differentiation between more computer-oriented and non-technical schools.

7. Six patterns of use: A typology

The embedded case studies identified six main patterns of use, divided equally between one-to-many and many-to-many forms of communication (Box 1). The most common feature was that eClass was used mainly to enhance and complement traditional forms of classroom teaching (see also Morgan 2003). To help illustrate each pattern type, the following descriptions include some hypothetical instructors based on a composite of actual users.

**Box 1: Patterns of eClass use**

**ONE-MANY**

Type 1. eCopier: use of courseware to replace the copy machine.
Type 2. ePublisher: creating electronic content for students.
Type 3. eProjector: replacing the 35 mm projector.

**MANY-MANY**

Type 4. eProject: facilitate team projects outside of the class.
Type 5. eTeam: student initiated virtual study group.
Type 6. eClassroom: use for distance and distributed learning.

7.1 eCopier: Substitute for the copy machine

eClass was used most often as an alternative to the copy machine, by providing students with online access to assignments, readings, lecture notes and other class documents. This was typified by Professor 1, who felt the system simplified his work and enabled him to concentrate more on his research by freeing the time he previously spent using the copier. He also employed eClass’s interactive functions, such as group discussion and asking students to post additional links to relevant materials. Despite these innovations, his teaching was unaltered and he confesses that eClass is more helpful to him than his students.

7.2 ePublisher: Electronic distribution of enhanced course content

The Publishing mode is distinguished by a commitment to using e-learning capabilities to create and enhance content, as well as to ‘ecopy’ it. For instance, Associate Professor 2 was eager to “eliminate all paper” by placing online all materials for his introductory class. This included multimedia, such as cartoons and movie extracts, to enliven lessons. eClass was mandatory for the course and students had to check its Web site regularly for frequent updates of announcements and changes in assignments, which were not repeated during class lectures. He opened an online ‘virtual office’ using eClass to interact with students at home, and he encourages students to interact outside the class by regularly kick-starting online discussion sessions.

Assistant Professor 2 believes eClass has enabled him to spend more time teaching and preparing for class. Despite some technical problems, he is convinced that evaluations and polls of students reflect favourably on his use of eClass. He senses differential use, with good and conscientious students using eClass to their advantage, while poorer students do not make the effort to engage with their fellow students.

7.3 eProjector: Substituting for the 35 mm slide projector

Professor 3 teaches in the art history department, so is interested in the technology’s obvious value in handling visual images electronically. eClass has been very helpful to her and her students by giving online access to high-quality images they could previously see only at a library or museum, or in relatively poor-quality reproductions. She found that online discussions were not important to the class and were monopolized by a few students. She rarely used other eClass features. Professor 3 believes that eClass has changed the time and place of her work, as she can prepare visual images for her classes online from home rather than at the University or a library. However, she is concerned that using eClass has reduced interpersonal interaction with her students.
7.4 eProject: Promoting group work

Assistant Professor 4 teaches accounting primarily with undergraduates. He uses eClass for Type 1 e-copying but sees its main value lying in the discussion board, as it helps students to learn how to work with technology in virtual teams. For instance, students are required to post their solutions to assigned problems on the discussion board so that other students can comment. He believes this exercise of peer critique assists the development of a “spirit of excellence”. In a central part of this course where students must work in small groups to analyze case studies, eClass functions as an electronic gathering place for students who do not wish to meet on campus. Professor 4 can occasionally check students’ progress by accessing all the archives of the discussion board and virtual classroom meetings.

7.5 eTeam: Grassroots innovation in student groups

In at least one case, students obtained permission to reconfigure eClass software to form a virtual student study group. These computer-science graduate students were working on a group project to evaluate the use of various courseware systems. Although their instructor did not utilize eClass, the group decided they wanted hands-on experience of such a system. The Centre provided them with an eClass account, which they used on a regular and frequent basis for personal group discussions and research.

The students’ team leader said eClass facilitated online group discussions by giving flexibility and convenience in scheduling discussions because group members did not need to be on campus for meetings. For instance, using the virtual chat feature for fruitful discussions online with colleagues accustomed to working late into the night. The group also posted relevant papers and external links online via eClass, enabling them to maintain an evolving group-reading list that eventually helped them to write the literature review for their final paper. Their use of eClass also aided them in critically evaluating the system and offering suggestions to the Centre for improving the software for student use.

7.6 eClassroom: Substituting the virtual for the real

Only a couple of instances were identified of eClass being used in ways that approach e-learning visions of truly ‘remote’ or ‘distributed’ learning. For instance, Professor 6 used it to create a ‘semi-distance’ approach for a Technology in Contemporary Education and Training course for 40 graduate students. This restructured the courses he had taught for 20 years in a traditional classroom setting. Materials for the course, including online instructions, assignments and course readings, were filed in an ‘evolving’ workbook on eClass. Students on the course have to meet on campus only a few times a semester, including an initial orientation session, a mid-semester ‘get-together’ and a ‘wrap-up’ final session. They use eClass for individual work and small live and/or electronic work groups. Their final product is a student-created portfolio of work presented in class as a PowerPoint presentation and posted on eClass for others to review.

Professor 6 sees his role as a “facilitator of learning”. He is available on campus during weekly office hours, schedules virtual office and classroom meetings via eClass and encourages interaction via email, telephone, fax and post. Two teaching assistants offer administrative support to help him respond to students efficiently and with personalized care. One summer he taught the same course with students from other universities in a complete distance education format, in which he substituted the campus meetings with interactive television sessions.

8. Constraints on innovation in higher education

The embedded case studies revealed some individuals who worked hard to experiment with new approaches to their teaching. Taken together, however, the cases reinforced our other findings that most uses of eClass were anchored in traditional teaching approaches, with eClass used primarily as a substitute for the copier or projector to support one-to-many forms of lecture-based instruction. Most professors did not adopt eClass, while those who did tended to use it to support their current practices, although the same technology could clearly support a variety of approaches to teaching.

This analysis highlighted a number of significant influences shaping the use of courseware in this institutional context, which could be relevant to a much wider range of social and institutional settings. This would be supported to the degree that similar themes emerged from other case studies. In this case, the SST framework enabled us to identify
factors constraining innovation that had led to the conservative patterns we found in this context and to appreciate how addressing these potential constraints could release spread innovations that are valued by key actors.

8.1 Technology shaping technology: Technical limitations

The Internet, Web and e-learning have been built on the shoulders of technical breakthroughs, so it is somewhat ironic that some of the most critical constraints we found were limitations of the technology. Responses to an open-ended question in our survey were almost uniformly focused on technical glitches in the software and telecommunication infrastructure on and off campus.

The implementation of eClass was plagued by slow response times, trouble in updating courses from registration data and many other problems. For example, when a subset of students in one class was unable to log-on for several weeks because of errors in assigning unique passwords to students with the same last name, the entire class was delayed – indicating the importance of protecting all students from specific problems. Another class was frustrated by difficulties in downloading materials for use by the instructor and his students, which contributed to his teaching evaluations plummeting and consequent modifications to his initial course to ensure there was hard-copy backup of all compulsory class materials. And difficulties in upgrading eClass courses caused extreme frustration among an accounting professor’s students when the course's Web site was frequently unavailable at times when they needed to upload their assignments.

The degree of technical interdependencies involved was another significant break on innovation. Instructors can often optimize use of an e-learning system only if they also have appropriate access to the right equipment, in the right place – whether it is a projector in a classroom or access to the courseware from home. For instance, an art professor was frustrated when she used eClass for students gaining access to digital images of art work since there was a lack of adequate projection equipment for her classroom to display images from the Web. Technical advances should therefore move in parallel in the classroom, offices, households and dorms.

These kinds of technical problems frustrated the easy implementation and use of eClass and represented a more substantial barrier than anticipated. Moreover, these were barriers that could not be overcome simply by technical know-how on the part of instructors. Ensuring the technology works smoothly and can be easily operated and flexibly tailored by users remains as a difficult challenge, but its accomplishment could greatly improve opportunities for more radical changes. Continuing advances in courseware and the wiring of households, classrooms and universities, such as through innovations like wireless networks, could help to achieve far greater take-up, and more imaginative uses of VLEs by diminishing many of the types of technical limitations encountered in the case we studied.

8.2 ICT paradigms and practices: Old paradigms in new e-Learning bottles

A characteristic of higher education culture throughout the world is that instructors generally teach the way they were taught: using a traditional one-many teaching paradigm based on class lectures and discussion. With notable exceptions, such as the one on one tutorial approach, this paradigm is entrenched in most university cultures, which generally tie teaching rewards to the quality of lectures and discussion. These paradigms are key influences shaping outcomes from the introduction of a VLE and other ICTs within institutions of higher education.

Traditional teaching paradigms are in fact designed into many e-learning products, such as eClass. They are even sold using analogies to what teachers already know in order to make the system’s functionality more understandable. BlackBoard, for example, uses the analogy of the ‘chalk-and-talk’ to convey its centrality to traditional conceptions of teaching. The Bodington Common employs an analogy to university buildings to help teachers and students understand how to move around in its virtual space. However, these traditional analogies can lead to built-in constraints on the use of VLEs. For instance, eClass was not designed to enable students to form their own groups; it took an engineering class to have the know-how to create a system to support their study group.

However, ICTs such as eClass are more than just a better white board. Without a new paradigm for education and e-learning, educators are likely to see ICTs as a means of carrying on doing things as before – perhaps
more quickly or professionally, but with more expensive technologies (Dutton 1999, p 216). It takes time for individuals to discover how new technologies enable them not only to do things in new ways, but also to do new things.

8.3 Institutional policy and practices: Risk-adverse academic cultures

Two aspects of the culture of campus-based higher education can constrain innovation outcomes: the strength of entrenched values underpinning university teaching and the degree to which students and systems of teaching evaluation can discourage risk taking in the classroom.

Expectations about the number of hours instructors meet with students are enshrined in rules and norms of universities. For instance, an NEU administrator warned us that some innovations in virtual classrooms could easily lead to a professor being accused of not meeting his class sufficiently, assuming that a virtual classroom is not a ‘real’ one. The expectations and values of students are therefore as much a constraint on innovation as those of top administrators. One professor stopped distributing his lecture notes electronically when he realized that students were deciding not to come to class as they could read his notes online. Associate Professor 2’s plummeting evaluations following technical problems also illustrate how technical failures can reflect poorly on the instructor, making it safer not to experiment.

Crook and Light (2002) examined the self-reports of undergraduate students and found that the ability of students to access ICT and email did not lead to change in the more communal aspects of learning. For instance, computer-resourced students did not spend more time on study-related activities or report a greater academic productivity than their non-networked peers. Networked students also did not spend less time in scheduled classes, in libraries and other campus resource areas. Participation in traditional classroom formats was still considered an important experience by all students, suggesting that the cultural context of higher education constrained the role of innovations in ICTs.

The culture of academic freedom in higher education is another important influence in universities. For example, the dean of an NEU school instructed his staff to put every class in the school on eClass. But only a few of the instructors actually used the system. Such difficulties for top university management in enforcing particular policies means successful innovation cannot usually be imposed from above, but depends on diffusing new ideas among the rank and file. Copyright was mentioned explicitly as a constraint on innovation by only one professor in our study. However, this is one factor that has made the copy machine less useful to instructors and one significant uncertainty surrounding the provision of electronic access to course readings, images and lectures.

9. Emerging opportunities and problems

The pilot eClass system at NEU was not ready for widespread deployment at the time of our study. Nevertheless, among the predominantly traditional approaches to using eClass we did discern emerging opportunities and problems in e-learning innovations that we believe are relevant throughout higher education.

First, we could not dismiss the value that instructors placed in a VLE supporting traditional tasks, such as in distributing their required readings. Efficiency and medium matters, especially as teachers and students expect more material to be online. In the long run, this is not simply an enhancement of the efficiency of copying functions, but an adaptation to a more fundamental change in how students prefer to get access to course materials, which could have dramatic implications on the geography of access, such as where students study.

Secondly, the degree to which the lack of access to other ICTs undermined the use of VLEs and vice versa suggests that VLEs are likely to become more central as laptops, wireless and multimedia classrooms continue to diffuse. This is already apparent in high-end multimedia classroom environments, where access to the Internet, VLEs and other multimedia systems can create a synergistic effect on the use of each technology. It is in these classrooms that the students appear to gain the greatest role in managing information and communication resources in a multimedia, multitasking environment, for better or worse.

Box 2 summarizes the main factors we think must be addressed in an e-learning strategy aimed at nurturing the opportunities and reducing the problems.
Box 2: Strategic e-Learning policy aims

Accept the continued value of traditional educational paradigms in guiding early use of VLEs and explore new possibilities as instructors gain experience and experiment with other new ICTs, such as wireless.

Rethink teaching practices embedded in university cultures and rules that make innovation in online learning difficult.

Enable new forms of content and communication media to support new educational patterns and paradigms, such as group work and multitasking.

Diffuse e-learning innovation by motivating grassroots take-up of new electronic media, as e-learning policies cannot be imposed top-down.

Offer ample training and support to encourage better management of information and communication as a university becomes more dependent on ICTs.

Complement e-learning with appropriate face-to-face contact.

Provide sufficient resources to support effective innovation not only in the classroom, but also in the offices, libraries, households and dormitories of students and teachers.

Do not expect an overnight revolution, as much time is needed for teachers and students to understand how to utilize e-learning capabilities fully.

Identify, target and support key likely benefits of e-learning, such as saving teachers' time, supporting individual and group student working and opening new ways to reconfigure the geography and timing of class activities.

Centre staff at NEU concluded that the findings of our research underscored the need for training to extend beyond the knowledge of how to use its features. We found no evidence of what Pea (in Perkins 1990, p.21) calls the "fingertip effect" that occurs "when administrators and teachers presume that people will automatically take effective advantage of the surrounding new media just because it is there to take advantage of". New techniques for screening, filtering and prioritizing information and communication demands will also become ever more critical to effective learning.

Despite the many technical glitches and limitations of eClass, its restricted capabilities were still valued by most users. This has been supported by other studies of VLEs (Kent 2003; Morgan 2003). This indicates that the value of such courseware to academic staff and their students is likely to increase as the technical constraints are addressed. The growing availability of more online content and better communication facilities is also likely to move e-learning more centre-stage in higher education. This could lead eventually to the emergence of sustainable new e-learning paradigms. These are illustrated by the emerging subtle shift we found from one-to-many to many-to-many forms of teaching and learning, as well as by signs of an emerging multimedia-multitasking classroom in which students are online – in class as well as out of class.

10. Building on the case study's findings

Our research discovered that the VLE at NEU was highly valued by many users and used innovatively by a few. The embedded case studies added a 'human face' to the social and institutional factors affecting an e-learning innovation such as the introduction and use of this kind of courseware. This showed that a great deal of optimism about e-learning opportunities at NEU had been dampened by a variety of specific technical, institutional, economic and other social constraints. As a result, the VLE was limited to uses that primarily supported traditional patterns of classroom instruction. Research by others has also noted this conservative role of e-learning in support of traditional classroom activities, in what some have called 'blended learning' (e.g., Crook and Light 2002; Morgan 2003; Williams 2003).

The NEU case shows the value of the SST framework in fostering a rounded assessment of change that reveals the key social and technical dimensions that need to be understood and addressed if innovations like eClass are to fulfil their potential for enhancing learning and education. For instance, the relatively limited use of the VLE at NEU in the time period of the study does not support the anti-technology stance of some critics of the more visionary, technology-driven predictions for e-learning. But it does back the view that educational institutions are not just providers of information or codified knowledge, but are vibrant learning communities offering contextual and social cues that are vital to shaping learning and education outcomes (Brown and Duguid, 2000). VLEs can be used, and were used at NEU, for supporting communication, study groups and learning communities in valuable new ways that can complement traditional media and methods, rather than replace them.
The in-depth case study was sufficiently rich to provide substantive evidence to identify some important general themes and patterns. However, we are aware that our findings need to be refined and expanded on by further research on the many relevant institutional, social and technical dimensions highlighted in this case. For instance, much of our study was seen primarily from the instructor’s viewpoint. Further research should explore the use of courseware from the perspectives of administrators, students, technicians and other actors. Comparative research on the diffusion of educational technologies in institutions at all levels, starting from elementary schools, and studies lasting for longer time frames than available to us could also help to better illuminate the unanticipated consequences of e-learning innovations like the VLE in our case. Investigations into interactions between a VLE and other innovations in the use of wireless networks, laptop computers, and other new ICTs in higher education could also improve understanding of how more innovative e-learning approaches can be fostered, even in environments strongly influenced by traditional educational paradigms and teaching methods.

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References
A Cultural Analysis of e-Learning for China.

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Abstract: This e-paper discusses e-Learning for China based upon the experiences of a free content website. Chinese culture, The Internet, and education are discussed using a number of deep links into online bibliographies, online journals and other knowledge objects. A cultural analysis is undertaken and conclusions are made. The future of research into e-Learning for China is considered.

Keywords: China, Internet, e-Learning, Cultural Analysis, Marketing.

1. Introduction

This e-paper discusses the future of e-Learning for the Greater China Region (GCR) from a Western perspective. It builds from a conference paper delivered by Friesner and Hart (2003) that evaluated a case study, and conducted a cultural analysis, of free e-Learning for the GCR. Some of the commentary included therein is also included here. However this e-paper will enhance points made as well as interlinking with an array of knowledge objects that will give a richer flavour to future discussions on e-Learning for China. It does not aim to be all encompassing but intends to stimulate discussion and research on the topic of e-Learning for China.

In this e-paper the general drivers of Chinese culture are addressed. Then the cultural aspects of e-Learning for China are discussed in more detail. A cultural analysis of the Marketing Teacher experience is undertaken, and the context of learning online in China is explained. The discussion is then considered in relation to the cultural drivers of Terpstra and Sarathy (2000) namely language, religion, values and attitudes, aesthetics, law and politics, technology and material cultures, education, and social organisation. Conclusions are made and areas for further research are anticipated.

2. Chinese culture

Culture embodies the ideas, customs and social behaviours of a society. In broad terms the study of culture is often associated with many disciplines including economics, politics, media studies, sociology, history, anthropology, science and information technology, the law, education and literature. This e-paper considers only a few aspects of Chinese culture. Heidelberg University has a first class Internet Guide to Chinese Studies if a deeper understanding of the disciplines mentioned above is required. Their portal offers links to valuable information on Chinese culture under a number of subject headings. However, this e-paper considers culture from the perspective education, or more specifically e-Learning. Education is important to the Chinese Government and many Chinese learners study in Europe and The USA, and Western Learners also have the opportunity to study in China. A useful bibliography on education in China is offered by The Ohio State University. The importance of e-Learning in China is recognised by The China Education and Research Network (CERNET). E-Learning forms part of a blended learning strategy that includes radio, video and IT, and forms part of the solution for growing demands for education and shortages of teachers in China. The topic of education and e-Learning is returned to later in this e-paper. Throughout this e-paper there is an opportunity to follow deep links to online-journals and e-papers, online bibliographies and websites. The links represented by tables 1 and 2 represent some additional sources of information on Chinese culture that may prove useful to readers of this e-paper.
Table 1: Additional online bibliographies on Chinese culture

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<td>Modern Chinese History, A Basic Bibliography</td>
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<td>Asian Studies WWW Virtual Library</td>
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Table 2: Additional online journals on Chinese culture

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<td>Chinese Law</td>
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<tr>
<td>Comparative Connections</td>
<td>Chinese International Relations</td>
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3. A cultural analysis of www.marketingteacher.com.cn

The experience of creating and running a free e-Learning website for The GCR forms the basis of a case study. Marketingteacher.com was created in 2000. It is a website dedicated to marketing learners, teachers and professionals and states a clear mission ‘for marketing learners.’ The website contains over twenty short lessons on marketing topics including the marketing environment, strategy, tactics, and planning. Each lesson is supported with its own exercise and associated answer. Best of all for its 700,000 annual visitors (or 5,000,000 yearly hits) is that the website exploits the most powerful words in marketing, it’s free! Praise has been received from students, lecturers and practitioners from many Western nations. However, a strategy of adaptation is needed if the same free e-Learning is to be marketed to Chinese learners. This section of this e-paper aims to answer the question, how can the underpinning idea of free e-Learning using the Marketing Teacher format be applied to non-Western cultures?


China has 1.3 billion people and the second revolution, that of the market economy, is now nearly twenty years old. There are three main reasons why China will quickly develop online learning. Firstly there are as many companies in China as there are people living in New York, approximately 19 million. Secondly there is a dramatic need for growth since nearly 400 new cities, with the associated explosion in jobs, have been created over the last two decades. Finally the Chinese population has a bimodal distribution of wealth (Levy 2003). The Eastern provinces tend to be very wealthy whilst those in the West remain relatively poor. Pressure has been put on the Chinese Government by the World Trade organisation (WTO) to resolve this inequality and a central strategy is learning. Such an approach is deemed to be appropriate to drive a shift from a manufacturing economy to one that has a more knowledge-based workforce. Tang (2000) offered an overview of recent Internet development in the People’s Republic of China (PRC). The Chinese government has been committed to developing information technology research and development since the late 1980’s and demonstrated this by implementing its ‘High Tech Research and Development Programme’ containing four Golden Projects. The four Golden Projects were launched in the 1990’s: The Golden Bridge provided the information technology backbone, the Golden Duty aimed to connect financial and taxation organisations, the Golden Card’s goal was to allow the acceptance of credit/debit cards in stores and at ATM’s, and the Golden Trade was designed to assist Chinese businesses to trade in Chinese characters (language symbols) in global markets. In 2003 it remains difficult to see how successful the Golden Projects have been. For example, it is very difficult to arrange credit card transactions in Renminbi (RMB) over The Internet, something that Western e-
commerce takes for granted. Credit card usage forms the basis of later discussion since Marketing Teacher does have a non-obligatory, chargeable online course. The latest survey on China's Internet development shows by 30 June, 2003, China had about 470,000 portals, with 68 million Internet users, and the numbers are growing every day (Financial Times 2003) . More information is available from The East Asian Collection at the University of Melbourne. The PRC is a country with a population in excess of one billion and the future opportunities for e-Learning are fantastic.

A model was needed to analyse the issues of adaptation of the www.marketingteacher.com concept of free e-Learning to a Chinese context. The literature was reviewed relating to models and frameworks of business culture. The benefits of this approach are that there is an academically respected base of research that can be drawn upon to assist with cultural analysis. The business approach to cultural assessment does rely upon an accepted epistemology that links in with other areas of cultural knowledge. For example, antecedents such as values and beliefs, education, social hierarchy and many others have their basis in cultural studies.

5. Selection of appropriate cultural models

There are a number of models and frameworks that could be used to analyse the culture of the People’s Republic of China (PRC) to give an indication of the appropriateness of e-Learning strategies. Some are very detailed whilst others are straight-forward. The models and frameworks initially considered included those of Hawkins et al (1992), Terpstra and Sarathy (2000), Hofstede (1984, 1994, 1996), and Wills et al (1991). This list is by no means conclusive but gives an indication of the breadth of models and framework in the literature. The models of Hawkins et al (1992) and Terpstra and Sarathy (2000) are similar and contain some common antecedents such as values, education and learning, social status and organisation. Hawkins et al (1992) approaches culture from a consumer lifestyle perspective whilst Terpstra and Sarathy (2000) consider culture in its wider contexts. This means that the Terpstra and Sarathy (2000) cultural framework is much simpler and easier to apply. For these reasons Terpstra and Sarathy’s framework was preferred and implemented over the model of Hawkins et al.

The influential work of Hofstede (1984,1994,1996) on culture contains more than 11,600 questionnaires from more than 50 countries. The dimensions of culture are based around individualism/collectivism, power distance, masculinity/femininity and uncertainty avoidance. Unfortunately none of the original surveys focused upon the PRC. However parts of the Greater China Region, Singapore, Hong Kong (not part of the PRC until 1st July, 1997) and Taiwan, were included. The Greater China Region is made up of diverse cultures and this should be taken into account when creating web content for learners. As educators we try to deal with learners as individuals but we need to appreciate the collective nature of culture in the Greater China Region. Perhaps as these regions adapt to the market revolution a more individualistic culture will emerge. Hofstede (1996) revealed an additional fifth dimension namely Confucian dynamism. Confucianism is a Chinese trait and its characteristics include a strong bias towards obedience, the importance of rank and hierarchies and the need for smooth social relations. The Chinese e-learner may feel that they are subservient to a teacher and this could prove problematic when no physical tutor exists. There could also be an indication that if problems exist that the learner may not contact the teacher/website to put things right. They could accept second rate materials or simply not revisit a website. The age of the Hofstede’s findings is recognised and any further analysis at this stage would need to take into account the undoubted changes that have occurred in China over recent years.

Wills et al (1991) consider learning as part of their model of culture. The dimensions of learning, or ‘diffusion,’ are used to consider a cross-cultural model that suggests a relationship between the high/low context of a culture and the rate at which new products are adapted (Wills et al 1991). Naturally products per se are not considered here but an educational service is. Therefore once an e-Learning website meets the needs of its patrons one can expect it to diffuse into use relatively quickly i.e. the number of visitors and repeat visitors will increase relatively quickly. Once again, the age of this research is recognised and it is used here more as an indication of, rather than a driver of e-Learning in China.

The cultural framework of Terpstra and Sarathy (2000) is used to consider the cultural context of the Marketing Teacher China free website. The key areas from the framework
provide the structure for the analysis. The detail was provided by the responses from the two business teachers interviewed and a summary of key parts of the literature relating to values and attitudes, education, social organisations, technology and material culture, law and politics, aesthetics, language and religion.

![Figure 1: A cultural framework – Tersptra and Sarathy (2000).](image)

6. Language

The national and official language of the People’s Republic of China (PRC) is Mandarin Chinese (Putonghua) with 1.3 billion speakers. There are a further 200 languages in use as well as a countless number of dialects. People from differing provinces often have trouble understanding each other. However the dialects do have a common written form and this would be a saving grace when it comes to communicating with the whole GCR.

Translation of the Marketing Teacher website is an important issue and indications show that direct word-for-word translations are not adequate. Therefore any Western co-ordinators of e-Learning projects need to beware the pitfall of self-referencing. From a Western perspective it would be like a Chinese website being translated into English, and as one respondent commented ‘It would be very boring.’ Hedberg and Brown (2002) comment that grammar is context specific in Chinese languages so that the student builds up a picture of the meaning of symbols as the text is being read. Hence graphics and pop ups can distract the reader and confuse the context of the communication. So catchy homepages that are intended to grab the eye can also confuse the non-Western reader and therefore have the opposite effect. More information on the languages and linguistics of China can be found at the Chinese Language Teachers’ Association.

7. Religion

Taoism, Confucianism and Buddhism are the main religions. Care should be taken to make sure that religious beliefs are not contravened. However there may be a benefit in recognising the behaviour of Chinese e-learners. For example, one respondent pointed out that by recognising a particular religious event or festival a website could earn favour and respect. There are a number of useful links to information on Chinese religions such as Taoism, Confucianism, Buddhism, Christianity in China, and Judaism in China.

8. Values and attitudes

Chinese culture is influenced by the philosophical principles of key thinkers. Despite the ideological changes encountered during the Cultural Revolution and more recent market orientation, Confucianism still has a strong cultural impact upon Chinese society (Chan 1999). The culture in China strongly respects a good education and degrees and diplomas enhance a virtuous education (Oh 1991). The Chinese have a value orientation (Zhu and He 2002). Communism, materialism
and Post-materialism are the three competing value orientations. The communist values see a selfless dedication to the well-being of society and mankind. The materialism values see the pursuit of immediate rewards and physical happiness. The post-materialism values see a way of life where the importance of material rewards is downplayed and there is an emphasis upon harmony between people and nature (Inglehart, 1979). To understand the place of education in the GRC one need only to look at the expansion of education in the GCR and the increasing number of Chinese learners gaining Western qualifications. Whichever value the student subscribes to, education is highly regarded.

9. Aesthetics

There are a series of cross-cultural differences between Western designed websites and Chinese developed sites (Hedberg and Brown 2002). The results of their study into visual media and cross cultural meaning holds some interesting results for websites that undergo a straight translation from English into Putonghua. For example the left edge of the page may not be the point where the student begins to read. The aesthetics of Chinese art may hold the key to web design that suits Chinese learners. The Chinese are keen gamblers and game players. Games tend to be rich in colour and appear very complicated to the Western eye, and this is reflected in the popularity of Internet gaming. The cultural understanding of colour and images could also lead to confusion in communication. For example parts of Chinese culture see people marrying in black and being buried in white. Logos and symbols associated in marketing may not carry the same impact to Chinese learners as they do with their Western counterparts. According to the Chinese Peoples Daily top Chinese brands include Hongtashan (cigarettes), Haier (household appliances) and Wuliangye (liquor). Chinese branding and images need to be considered when constructing case studies or using examples.

10. Law and Politics

The National People’s Congress is the highest organ of state power in the PRC. The Government is controlling and this makes commerce very different to that in Western culture. The recent problems encountered during the SARS virus outbreak may make the Chinese government less prone to holding back information that is in the public interest. Copyright remains a huge grey area. This means that website content could be copied or reproduced without permission. Censorship still exists if one wishes to publish an educational text in China. The Asian Law Centre links to resources on Chinese law and banking and finance, competition law, commercial law and e-commerce law, amongst many other legal areas. China has its own laws on e-commerce and e-transactions, privacy and information security that need to be considered especially if an e-Learning project is to collect information, collect fees or protect any intellectual property.

11. Technology and material cultures

Filtering is a problem for Western websites. Effectively the Chinese government censors websites by blocking access from China. The Chinese government maintains an active interest in preventing users from viewing certain web content. It has managed to configure overlapping nationwide systems to effectively block such content from users who do not regularly seek to circumvent such blocking. Such blocking systems are becoming more refined (Zittrain and Edelman 2003). Blocked sites tend to fall into one of a number of categories including democracy, health, news, government, religion, Taiwan, Tibet, entertainment and education. Indeed both the Western and GCR Marketing Teacher websites suffer from filtering. They share this disability with MIT and the Learning Channel as well as almost 700 sites list in Yahoo’s education directories (Zittrain and Edelman 2003). The Chinese government does not cooperate on the issue of filtering and this makes it difficult to accurately represent the extent of this problem. Until its extent is understood, strategies for overcoming the problem cannot work. This is a huge problem for providers of free or chargeable content. One could invest time and effort in created online materials and promoting their existence only to find that your site has been filtered and that no right of appeal exists.

As technology develops apace there is a sources of very up-to-date information on China and technology. The Australian National University publishes a free online journal entitled ‘The Asian Studies WWW Monitor’ that covers a variety of related topics.

12. Education

An overview of the educational system of China is offered by Surowksi (1996) and includes systems for primary, secondary,
higher and adult education. The educational system in China is described for the Chinese army in a summary displayed by The University of Maryland. Both of these sources support a wider dialogue about Chinese education. E-Learning is one aspect of blended learning and has its own series of issues that are evaluated as follows.

A simple text translation into Mandarin has a series of problems. It should be appreciated that learning is an active process and teaching materials should be variegated (Liu, Lin and Wang 2002). The activity associated with online learning is seen as a clear advantage. It is the critical engagement with the World that ensures that learning takes place (Dewey 1916). The system of education in the PRC is demanding and often begins at a young age. Learning Putonghua demands a good deal of effort as well as time consuming rote learning. Chinese culture is collectivist and often depends upon informal chains of communication. Therefore open discussion albeit in forums or web casts could see an infringement of cultural values (Can 1999). Western educators need to be sympathetic to the successful teaching strategies used by Chinese teachers, and embed them into e-Learning projects. Levy (2003) explains that most learning in China takes place in classrooms. Even where technology such as television or software is used it tends to be heavily instructor lead.

13. Social organisation

Liu, Lin and Wang (2000) advocate that the individual learning styles and preferences of e-learners need to be taken into account since a simple text translation may suit some learners whilst a multimedia approach is beneficial to others. Indeed it is possible to take a deeper look into the learning styles of Chinese students. Confucian philosophy has a role in shaping Chinese thinking and learning styles (Chan 1999). So there is an opportunity to conduct leaning styles surveys (Kolb 1984, Mezirow 1991). This may give an indication of the preferred learning environment of the Chinese e-learner. Then web content can be developed to suit the preferences of a number of individuals. There is a need for further research into the learning styles of e-learners from the Greater China Region.

14. Conclusions

Based upon this cultural analysis, there are a series of drivers that will be taken into account as www.marketingteacher.com.cn is developed for the Greater China Region. The challenges for free e-Learning are:

a) The Greater China Region is made up of diverse cultures and this should be taken into account when creating web content for e-learners.
b) Once an e-Learning website meets the needs of its patrons one can expect it to diffuse into use relatively quickly.
c) The Chinese e-learner may feel that they are subservient to a teacher and this could prove problematic when no physical tutor exists.
d) Indications show that direct word-for-word translations are not adequate.
e) Care should be taken to make sure that religious beliefs are not contravened.
f) Whichever value the student subscribes to, education is highly regarded.
g) Chinese branding and images need to be considered when constructing case studies or using examples.
h) The PRC Government is still controlling. Copyright remains a huge grey area. This means that website content could be copied or reproduced without permission.
i) You could invest time and effort in creating online materials and promoting their existence only to find that your website has been filtered and that no right of appeal exists.

15. Directions for future research.

The reason further research is necessary is that there is undoubtedly the potential for income generation for Western organisations by providing e-Learning for China. The Chinese manufacturing economy is booming and education is a highly regarded commodity. There is a shortage of quality education provision in China, and a shortage of trained teachers. It is anticipated that Western universities and training companies are already in the process of creating such services. Any e-Learning project will need to be supported by research in the same way that international marketing research supports business enterprises that trade in the global market. It is anticipated that any research would be supported by a Terpstra and Sarathy (2000) type model that considers the drivers on culture discussed in this e-paper. Some areas for further research are stated in the conclusions above. The results of such research would then form the basis of a strategy for e-Learning for China. The strategy would have to be resourced either by central...
governments or by public/private partnerships. There would need to be local Chinese representation and partnership in any venture. This forms the basis of potential research from a strategic point of view. From an operational perspective, the educational needs of individual Chinese e-learners would need to be addressed. There are a number of areas for further research including individual learning needs, preferred learning styles and the learning environment, lesson planning, the blend of learning and e-Learning methods. The applicability of Western learning taxonomies to Chinese learners and the balance pedagogical and andragogical would need to be considered in relation to Chinese culture. The usefulness of Western e-Learning strategies would have to be considered, for example video conferencing, forums, java based quizzes, and animation to name but a few. Finally the assessment and grading of Chinese e-learners against learning outcomes and assessment criteria would have to be addressed. E-Learning for China will generate rewards to those that identify the needs of learners and then satisfy them with a tailor-made learning package. This e-paper opens the door on a discussion for e-Learning for China from a Western perspective.

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The Entrepreneurial Legacy for e-Learning

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Abstract: At last years ECEL conference e-Learning in practice was often concluded to be more e-Teaching in that it focused on delivery and technology, with relatively little attention paid to the context of learning or the long-term consequences. This paper uses the example of a highly entrepreneurial company, who have adapted their business model, previously developed to deliver content to a consumer audience, to an e-Learning context. The paper posits a need to return to a more creative and entrepreneurial mindset in the understanding of the use and deployment of e-Learning within an organisation.

Keywords: e-Learning, entrepreneur, emergence, human values, Skinkers

1. Introduction

e-Learning, Virtual learning Environments (VLEs) and ‘blended learning’, supported by their ancestors, Distance Learning, Computer Mediated Communication (CMC) and Computer Based Training (CBT) are now well established in large businesses, public sector and academic institutions. Computers are an everyday part of life and using them to support learning via an established technical architecture of Intranets and Extranets is relatively simple using, for example, FirstClass, Blackboard or eRoom. Take-up may not be all that is wished yet but the potential is clear and the there appears to be a relentless shift towards Internet learning via multimedia content, flexible desktop agents and secure communication platforms. Doing so goes a considerable way towards addressing the old issues of poor delivery, costly maintenance and low take-up (Grani et al (2002); Hebel & Mathiesen, 2002a).

But is it good enough and are we moving fast enough to warrant the attention lavished on the subject? It may be that we the practitioners are guilty of being cast in the role of vicars angrily delivering a sermon from the pulpit shouting, “Why are there so few of you here?”. Indeed if e-Learning is the answer, what is the question posed?

An answer may lie in returning to the roots of business innovation, entrepreneurship. This paradigm of creating and forcing solutions to problems within tight and unreasonable constraints of budget, time and resource can produce some unexpected results. An example of this is provided by Skinkers Ltd\(^1\) who have developed a very innovative e-Learning system without realising they were doing so.

The Skinkers products are delivered as services and allow timed ‘digital data and information parcels’ to be delivered at exact times set by the system manager. Interestingly, users can be profiled in such a way that they do not have to part with personal information. In addition, the designers have given considerable thought to how information is received and more importantly welcomed by the user. Information goes directly to people’s computers in front of all other applications and without them search for the information for themselves. A desktop agent called a ‘Skinker’, which usually takes the form of an animated figure and a pop-up mini-screen, does this with figure and box existing in any form. Humour, colour, design and succinct information, often in the form of questions and answers, makes this product fun, interesting as well as informative. This offers two main things - sales benefits derived from appropriate content distribution and learning benefits based on a relevance association with the ‘figure’ and the small size and therefore digestibility of the information ‘parcels’ received.

Skinkers started life as a consumer advertising proposition being used to deliver affinity messages to audiences such as Harry Potter lovers (a ‘desktop owl’) through to Arsenal FC fans (the ‘desktop Wenger’). At no point did the company believe they had a product suitable for e-Learning until they chanced to describe

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\(^1\) http://www.skinkers.com/ (19/9/03)
the product to an acquaintance in charge of e-Learning at Vodafone. He was looking for a way to be more effective and reduce the substantial bill for training call centre operatives about the latest mobile devices. The results that resulted from that entrepreneurial insight have been very strong indeed.

This paper further describes the Skinker product, the learning delivery tests with Vodafone and reflects on the long-term consequences for eLearning in terms of values when it comes as a result of such entrepreneurial activity.

2. Case study

Skinkers is a small, privately funded, technology company that has developed an innovative communication platform. This new technology enables companies to communicate with their customers while at a PC through an additional channel to those already provided by the Web and Email (Skinkers Ltd, 2002).

Skinkers’ offers content owners and distributors a facility to deliver content directly to customers’ desktops without "getting lost" within the already cluttered email channel (Skinkers, 2003). Due to the personal nature of a Skinker, the downloadable desktop application installed by the user, marketers and trainers are able to cement a far stronger relationship with their customers. They can also engage with them far more frequently and effectively than through traditional methods such as advertisements, emails and posting.

The technology behind Skinkers combines the interruption capability of TV advertising with the entertainment value of animated characters and the timeliness of mobile phone text messaging. The software is original enough in its construction to warrant application for patents and simple enough to be used by most people.

As mentioned the word “Skinker” is also used to refer to the desktop agents that are used in conjunction with the Skinkers Communication Platform to deliver messages on people’s computers. An example is the Skinker created for the UK TV comedian Graham Norton which was used to alert users about interesting content available on the sponsors web site (Virgin Mobile). This Skinker was developed for Channel 4.

![Figure 1: Example of Skinker and information box](image)

After launching with Sky Sports for the West Indies cricket tour in April 2002 the company experienced considerable success and has around 30 clients including Halifax, Vodafone, Arsenal football team, Channel 4, Centrica, Warner Village and The Independent newspaper. The clients can deliver information on products or remind people of upcoming events; they can deliver training packages in manageable chunks or gather information on user preferences and feedback. The user can request alerts, reminders, trailers, music, competitions, gossip, offers etc

Unbeknown to the company they were in possession of a device that offered huge e-Learning potential. It was only when this application was explained to someone just given the task of reducing the training budget for Vodafone did the overt connection exist between the product and the learning requirement.
This resulted in a trial of a learning delivery package with Vodafone in the early part of 2003. The trial was conducted in conjunction with Vodafone's Learning & Development department to test delivery of information on 3G technology. The objectives were to:

- Determine the effectiveness of the Skinkers Communication Platform in delivering learning information
- Contrast the effectiveness of the delivery by running a parallel email delivery
- Assess effectiveness using the following criteria
  - Receiving information/content
  - Receiving content on time
  - Consuming the delivery of content
  - Learning/internalising content.

Information was delivered using five ‘nuggets’ delivered over five days to two distinct groups of users. Twenty email users with the information contained as an attachment and twenty Skinkers users receiving Flash presentations of a friendly scientist and information box similar in style to the one shown in figure 1. Three days after the last ‘nugget’ was delivered all participants received a questionnaire to assess level of participation and uptake.

The results show that the Skinkers Users had a much higher level of involvement and a much higher response to the information. The lowest level of participation of Skinkers Users equated to the highest level of Email Users. However the most striking result was the high level of achieved learning. In some ways, this is not surprising due to the higher level of participation but even so information was retained more accurately by the Skinkers Users who returned with almost three times as many correct answers.

It is recognised that this was a small sample and over a short space of time, however this is a trial that can be repeated and most importantly - given the concern at last years ECEL conference – it includes some assessment of learning and not just successful delivery. The next section gives a brief overview of the theory behind eLearning and entrepreneurship in order to put the Skinkers trial into context.

3. e-Learning, Entrepreneurship and emergence

e-Learning is characterized by a blended mixture of delivery via technology and some change in the learning state. The take-up of e-learning is enormously diverse and dependent on context whilst not always cognisant of the consequences (Flynn, 2002; Massy, 2002). Complaints include information overload, difficulties accessing the web, conflicting technologies, too few contributors and too many lurkers (observing but not participating), reluctance to commit an opinion in writing, insufficient time, difficulties getting senior people involved (in this context) or the directory structure isn’t intuitive.

The pedagogical issues to be considered include size of group being assessed, previous student experience, means of delivery, use of technology, plagiarism, co-ordination with other learning programmes and feedback as well as student and teacher experience (Flynn, 2002; Hart & Haslem, 2002; Hebel, 2000a).

In a previous paper for ECEL (Hebel & Mathiesen, 2002b) a model was presented to show the transformation process of building a human value system (Hebel 1998a & b), which provides a filter for all information and subsequent behaviour. This model can be extended to model the growth of an organisation where all new learning and change is always coloured by our previous knowledge.

The model in figure 2 builds on the systems thinking concept of interconnectedness and the notion that humans form their value systems based on reinforcing what they’ve learnt of life. So the ‘natural’ state of affairs is for reinforcement of value systems, thus learning occurs but mostly, only when it supports existing knowledge (Steinberg, 2003). Because humans are very good at doing things tacitly rather than explicitly they can express only a fraction of it in words. So learning, behaviour or cognitive dissonance can seem natural but unexplainable (Hebel & Mathiesen, 2002).

This values comparison is integral and ongoing if new people and new situations are sought. However it can be argued that the reinforcing nature of value systems means that we will seek or prefer to accept situations we are comfortable with e.g. passive or confrontational. Ultimately it seems that we are unlikely to change very much as individuals, although the occasional shock can cause an occasional readjustment of values priorities and in some cases surprising, emergent properties.
It is this shock or surprise element that is considered most relevant to this paper. This is because while there might be an organisational imperative to ensure all ‘frontline’ staff are trained, the contextual gap between what is needed and what is delivered is often such to render whatever is attempted, redundant at best. Skinkers, by the nature of their apparently random intervention of alert and data, create a surprise and a welcome at the same time. This in turn has presented a surprise emergence of additional uses.

Skinkers, by their own route of experiential learning, marketing and web design have come to similar conclusions and offer a practical solution. They recognise that although different industry areas have their own unique characteristics they often share the difficulties posed by plural sites, multiple cultures and amalgams of technology and processes. They recognise that organisational and individual learning shares roots with marketing and capitalises on both of their best qualities, maintaining their creativity and momentum.

This quite personal approach is typical of entrepreneurial activity. Entrepreneurs are often people who appear ambitious and innovative (Kirby, 2003). Some like to put their success down to luck although this may really be attributed to willingness to see and react positively to opportunity or challenge. Entrepreneurs who are often characterised by their risk taking and long hours of hard work within very tight limits of budgets and time. They can also be identified as having novel ideas and being different, undisciplined and unconventional (Birley & Muzyka, 2000) implying the likelihood that conventional business practices will be difficult for them to follow and that organisationally they are going to need other skills to support them (Kirby, 2003).

4. Conclusion

It appears that the secret to successful eLearning – and probably all learning – is surprise and reinforcement both at the design stage and the learning point. The values of both need to be spoken to and challenged in an entrepreneurial fashion by being novel, positive and with an element of risk.

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Usability of a Virtual Learning Environment Concerning Safety at Work

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Abstract: Most of the VLE design methods focus on producing content for a VLE. However, usability of the VLE is also of great importance. Several potential usability problems have been reported in recent e-learning conferences. These problems could have been avoided by applying usability engineering methods before the VLE was taken into use. This paper describes usability engineering methods used to ensure the usability of Virtu, a virtual learning environment (VLE) concerning safety at work. The results of using each method are summarized and as a conclusion, some general VLE design guidelines are listed to help others in VLE design.

Keywords: VLE usability problems, Usability engineering, Human centred design, VLE design guidelines

1. Introduction

Most of the VLE design methods focus on producing content for a VLE. However, usability of the VLE is also of great importance. If the user interface of a VLE is not usable, the user’s focus on the actual content is diminished, because using the VLE requires a considerable amount of concentration. Good usability, on the other hand, allows the user to focus on the content thus improving learning results.

Several potential usability problems have been reported in recent e-learning conferences. Remarkable obstacle to taking VLEs into use rises from the users’ background knowledge of computer technology (Jones et al, Kent 2003). Ever increasing VLE sizes make the VLEs disorganized and therefore a navigational aid is needed (Armitage et al 2003). The high enthusiasm on latent potential of VLEs makes the designers implement as many features as possible. However, the VLEs may thus contain unnecessary features that students never or rarely use (Beasley and Smyth 2003).

Virtu is a virtual learning environment (VLE) concerning safety at work (Figure 1). Virtu was developed in a co-operational project between the Institute of Occupational Safety Engineering and Institute of Software Systems in Tampere University of Technology (TUT). In addition to more traditional VLE content, such as theory and exercises, Virtu contains a virtual enterprise, which simulates a visit to a real company.

The early design phase of Virtu was done according to ISO 13407 Human centred design processes for interactive systems (ISO 1999). The standard includes four user centred design activities to be started at the earliest stage of a project. These design activities

Figure 1: Structure of Virtu

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resulted in defining two main usage scenarios related to two main end user groups for Virtu.

The first scenario is about teaching safety at work for students of Occupational Safety Engineering at TUT. The second scenario is testing and updating industrial workers’ knowledge of safety issues related to their work. Virtu user interface was designed applying usability practices including stakeholder and user interviews, prototyping, heuristic evaluation, iterative design and user testing so that both end user groups would find the environment interesting and easy to use (Preece et al. 2002). Virtu supports constructivist learning model where individuals are assumed to learn better when they discover things themselves (Ahmad et al. 1998).

This paper describes usability problems of current VLEs. Usability methods used during Virtu development process are also outlined and, as a conclusion, some general VLE design guidelines are presented. Potential usability threats of current VLEs reported in publications are discussed in Section 2. Section 3 presents usability engineering methods used to ensure usability of Virtu and the summarized results of using each method. Virtu learning environment produced by the software and usability engineering activities is outlined in Section 4. Section 5 provides general VLE design guidelines, which rose from Virtu development process.

2. Usability problems of current VLEs

In their study Jones et al (2003) identified eight primary causes of student withdrawal. Three of these causes were to some extent technology related. Technical problems as such were reported as a cause of withdrawal by 20% of the respondents. Also, own IT skills were identified as a reason for withdrawal by 15% of the respondents. Moreover, the use of technology had an impact on student confusion and lack of understanding, which contributed to 15% of the respondents’ withdrawals. Also Kent (2003) reports on students having had difficulties in using a VLE. The lack of technical skills necessary for understanding or participating in activities within the VLE was reported to be one of the features the participants did not like about the e-Learning module (Kent 2003).

Another aspect that propagates the student withdrawal from a course is the impersonal and faceless nature of VLEs (Kent 2003). Lindh and Soames (2003) state that there is still a need for human-to-human interaction. For example, asking questions is much more time consuming in purely electronic environments than in face-to-face contact in a classroom. When more and more students are part time students having work career and family life at the same time, the challenge is to activate students and to make them to commit themselves to a course.

Students’ interests towards a course can collapse because of muddled and ambiguous electronic material. Identifying content can be a problem (Lindh and Soames 2003). For example, a document containing multiple pages may come out of printer without page numbers or pages have irrelevant title or no title at all so they cannot be connected to the topic later on. The level of navigational freedom affects to the user’s feeling of control (Armitage et al. 2003). Navigational aids providing higher navigational freedom (maps, indexes) give higher feeling of control compared to navigational aids providing lower navigational freedom (back and forward buttons, hypertext). Even navigational aids do not guarantee the optimal use of learning material, but instructions on how to study non-linear hypertext material are also needed (Beasley and Smyth 2003).

According to Beasley and Smyth (2003), students often interact with VLEs in a manner that will not allow them to fully exploit the VLEs’ potential. In their paper concerning students’ selective use of a virtual learning environment, Beasley and Smyth (2003), in addition to their other results, reported on VLE features which were either rarely used or were not used at all. These features included individual progress report and asynchronous discussion forum.

To relieve the students’ stress caused by online activities, Lawless and Allan (2003) recommend that the technology used should be user-friendly and errorless and should provide a pleasant experience for the user. Another aim of VLEs is to provide cost effective education (Lindh and Soames 2003). By designing and testing the VLE according to usability engineering methods before taking it into use, all these objectives can be achieved.

3. Usability engineering

In the beginning of the iterative design process, a paper mock-up of Virtu user interface was developed based on stakeholder
interviews. Usability tests with real end users were conducted using the paper mock-up and the test users were also interviewed. Based on the test results, a software prototype of the user interface was developed and usability tests with end users performed. After the second usability testing round, a new software prototype was designed and heuristic evaluation was conducted by an usability professional.

As a result there was list of changes to be made in every area of design: structure, content and user interface. Because the shortcomings were detected before the implementation was completed, they could be corrected before the final release version. Thus, iterative design process diminished the need for changes in the future.

3.1 Human centred design

Requirements were formed by specifying the context of use (UsabilityNet) and thereby the purpose of use. Also the user and organizational requirements were collected through stakeholder interviews (UsabilityNet). Technical limitations and updates must be considered in early design phase, too.

The stakeholders of Virtu were specified first by listing all the factors affecting the use of Virtu and thereby the people related. Virtu’s stakeholders included end users, teachers in the Institute of Occupational Safety Engineering, maintenance, marketers and those who are responsible for the safety at work issues in industry.

3.1.1 User and organisational requirements

Virtu has two main end user groups. The first end user group is students of Occupational Safety Engineering at TUT and the second group is industrial workers. The computer skills and the requirements for the content of Virtu differ greatly among these groups.

The approach to safety at work issues should cover all the legislation concerning safety and health at work. It should be challenging enough for students who already have a wide knowledge of the subject. However, the content cannot be too theoretical, because the learning environment is to be used by industrial workers, too. They do not necessarily have a wide knowledge basis on the issue but are more interested in practical ways of improving the safety of their own work.

The human factor goals of end user groups can be established according to Schneiderman’s five measurable human factors:
- time to learn,
- speed of performance,
- rate of errors by users,
- retention over time,
- subjective satisfaction. (Schneiderman 1998)

The priorities of the human factors vary between students and industrial workers.

For students time to learn and retention over time are the most crucial factors. Students use Virtu instead of traditional course material, and it is supposed to be as intuitive to use as a book and a pen. The usage time is limited to only few hours a week as if there were traditional lectures. The knowledge of how to use Virtu must be maintained between lectures.

Retention over time is even more important to industrial workers, who may have an intensive course on safety at work, and are returning to Virtu after long period of time. Subjective satisfaction counts when the use of Virtu as a reference book is discussed.

3.1.2 Context of use

The context of use turned out to be complex. At least three environments and three different purposes of use were defined. Users should be able to use Virtu independently at home or at work, and, in addition, by groups in safety at work training. There should also be a possibility to use Virtu as a quick reference book. All these different usages must be taken into account in the user interface design.

In most of the cases Virtu is used for studying occupational safety engineering at university, training safety at work issues related to everyday work in industry or revising issues related to safety at work. Students are enrolled in a course dealing with safety at work. Industrial workers are participating in a course arranged by employee or otherwise are recommended or required to get familiar with safety at work material provided by Virtu.

Students will mainly use Virtu in computer classrooms with internet connections. Computers usually include Pentium 500 MHz processors with 128 MB memory. However, high processor and memory capabilities cannot be expected from computers used by industrial
workers at their workplaces, and in that environment internet is usually not allowed. Both user groups can use the Virtu also at home, but those environments cannot be taken into account in the design process.

3.1.3 Technical limitations and updates

Virtu will be a commercial product and therefore should not be used freely in the internet. Instead, some kind of a copy protection or license practice in its distribution must be implemented. CD-ROM was chosen as the distribution media. Distribution via internet was rejected due to the requirements of participating companies. In the future, Virtu might be used through a web browser, and therefore there should be a possibility to change the user interface to a web based version without changing the application logic.

Legislation concerning safety and health at work changes from time to time and also other new information on the safety at work issues may emerge. To ease the introduction of updates, changing the content must not cause changes in the user interface. Also, changing the content should be possible without programming. Internationalizing Virtu for Western cultures should be easy, too.

3.2 Usability tests

As Virtu was designed according the ISO 13407 Human centred design processes for interactive systems (UsabilityNet, ISO 1999), the proper usability engineering methods including iterative design, user interviews, prototyping, user testing and heuristic evaluation, were used to gather and verify Virtu’s properties.

3.2.1 Iterative design

Virtu user interface was developed based on an iterative design process, which means that new versions of the user interface were produced based on the usability problems and opportunities disclosed by empirical testing (Nielsen 1993). During the iterative design process the interface was evaluated by end users and usability professionals.

Iteration began with user interface drafts drawn in a paper. There was one paper for each type of displays; menus, theory, exercises, virtual enterprise, function points and description of the enterprise. After end users had tested the paper version, a software prototype was developed. In the first phase only menus and one case of each functionality was implemented. After user tests, the first full version was built for further testing.

3.2.2 Stakeholder and user interviews

Many aspects of usability can be studied by simply asking the users. This is especially useful for issues that are related to users’ subjective satisfaction and possible anxieties (Nielsen 1993). In the beginning, when nothing was implemented, the stakeholders of Virtu were interviewed. The analysis of results of the interview produced requirements for the first paper prototype of Virtu. During Virtu usability test with a paper mock-up, the users were asked to fill two interview forms.

The first form was filled in the beginning of the test. It contained open and multiple-choice questions concerning users’ computer usage and demographic information. The age of participating students varied from 20 to 29 and the age of participating industrial workers from 27 to 53, being very typical to both user groups. The sex ratio in interview was 4/5 females in students and 2/6 females in industry workers. 80-83% of both groups used computer about 3 hours per day. Most of the students but clearly a minority of industrial workers used computer also for leisure. 2/6 of the industrial workers used computer also for leisure. 2/6 of the industrial workers used operations and work management systems in their work.

The second form, filled at the end of the test, contained five open questions. This questionnaire was about the ease of use of Virtu and the users’ subjective opinion about it. The results indicated that all students but only half of the industrial workers considered Virtu to be easy to use. The main reasons for finding Virtu difficult to use were navigation problems. More than half of the students and less than half of the industrial workers said to be interested in using Virtu for studying purposes.

3.2.3 Prototyping

Prototypes are useful for conducting system-specific usability tests early in the development process. Their role is to demonstrate and test aspects of human-computer interaction, which might be difficult or more time-consuming to produce in another medium (Lindgaard 1994). Especially low-fidelity prototypes like paper mock-ups are useful, because they are simple, cheap and easy to produce and thus easy to modify for testing alternative design ideas. Software prototypes as high-fidelity prototypes are useful in testing out technical issues (Preece et al. 2002). Both paper mock-up and
a software prototype were tested during Virtu development.

3.2.4 User testing

User testing with real users is the most fundamental usability method, because it provides direct information about how people use computers and what their exact problems are with the concrete interface being tested (Nielsen 1993). During Virtu development, formative evaluation was carried out in order to improve the user interface as a part of iterative design process. Formative evaluation was performed as a typical thinking-aloud test.

The major finding of the usability tests with the paper mock-up was the need to divide the content to different difficulty levels to match the needs of different user groups. In the beginning of the tests, there was only one common content, which most of the industrial workers found quite irrelevant because it was too theoretical compared to their work. Another important finding was the users’ difficulty in navigating in the virtual enterprise section. A ground plan of the virtual enterprise with marked function points, for example Gate or Check in, was used for navigation. The users did not recognize the function points as buttons but were wondering what they were supposed to do with the ground plan.

There were also some minor findings. Navigation from one page to another in the textbook section was considered somewhat difficult by some industrial workers, because there were only arrow-buttons without a text to indicate where the button leads to. Most users considered the link from the virtual enterprise section to theory topics quite unnecessary.

Usability testing with the software prototype only provided some minor findings. Some of the function points in the virtual enterprise section contain questions, for example “Do you know the nearest emergency eye rinsing at your workplace?”, for industrial workers to consider at their own working environment. The users found the visibility of such points on the ground plan to be quite weak and they also thought the questions were not separated clearly enough from the rest of content of the function point. Also the terms in the main menu were considered to be quite ambiguous, and it was not clear to the users what each section contains.

3.2.5 Heuristic evaluation

Heuristic evaluation and user testing should be alternated, because these two usability practices have been shown to find fairly distinct sets of usability problems (Nielsen 1993). Heuristic evaluation is done by studying a user interface and then forming estimation about what is good and bad about it. The evaluation is conducted according to a certain set of rules, such as those listed in typical guidelines documents (Nielsen 1993). In Virtu heuristic evaluation, the list of Nielsen’s ten usability heuristics (Nielsen 1994) was used.

Nielsen’s ten usability heuristics include:
- elements in user interface (4 heuristics),
- language (2),
- interaction (2),
- error prevention (1) and
- helping information (1).

User should have appropriate feedback in time and the system status should be clearly seen. All the error descriptions and UI terminology should use users language and terminology. Consistency can be maintained for example by using standards and UI guidelines. Operation is made easy and efficient by providing accelerators, shortcuts, exits and easy escapes. The interface should contain all the essential elements but nothing more. (Faulkner 2000)

Heuristic evaluation was conducted for each display and for Virtu as a whole after user tests with the software prototype in order to search for usability problems undiscovered by user testing. Usually the heuristic evaluation is carried out before user tests, but in this iterative process it was reasonable to use the usability professional to verify the design decisions before release version of Virtu.

Results indicated that some terminology like ground plan and enterprise description had to be changed into more user oriented vocabulary like visit and table of contents. Easy exits had to be added in the theory section, and the cursor had to be changed in appearance, when placed over buttons to show to the user the possibility of interaction. Some minor notes were reported about consistency among different parts of Virtu.

4. Virtu learning environment

The structure of Virtu was split into two entities because of the requirements (Figure 1). Some educational material concerning safety at work already existed, and it needed to be presented
in electronic form in order to utilize the interaction possibilities of VLE. It was also necessary for both user groups to see some real life examples of safety at work. The practical part should also support the adaptation of theory.

The two parts of Virtu are:
- textbook section,
- virtual enterprise section.

The textbook section was divided to theory and exercises. The virtual enterprise section contains interactive function points and a description of the enterprise providing background information on the virtual enterprise. The material provided in function points was gathered from three real life companies.

4.1 Textbook section

The textbook section can be studied as a guided tour including theory and exercises on every topic. Each theory topic can also be studied independently from the others and the textbook section can thus be used as a quick reference book. The use of textbook section begins by selecting one of 8 topics covering different areas of safety at work.

The content of the textbook was divided to two difficulty levels based on usability test results. Theoretical level contains information on different safety at work topics including legislation, occupational safety management, risk management, ergonomics, occupational hygiene, machine and system safety, mental welfare and occupational accidents. This level is to be used in industry by the people responsible for safety at work issues and by the students, because they need a deeper understanding of the issue.

Practical level is to be used by industrial workers. Thus, the topics included differ slightly from the content of the theoretical level. The practical level contains information on risk assessment, ergonomics, occupational hygiene, occupational accidents, signs and traffic. Included information can be easily applied into practice in the user’s own work environment. Even the topics, which are same or similar to ones in the theoretical level, were re-designed to match the requirements of the group using this level.

4.1.1 Theory

Theory displays were designed using a book metaphor (Figure 2). Each view reminds opened book, which consists of two pages. The user’s location in the Virtu is indicated on the top and there is always possibility to exit the current theory section. User is informed of the total number of pages included in the section.

Figure 2. Theory display
User navigates between theory displays using back and forward buttons at the bottom of the pages. Menus in the bottom of the display are consistent through the program. The user is expected to read the content as traditional textbook content. The main difference compared to traditional textbooks is the amount of graphics and the length of text chapters. Text chapters are short because reading is 25% slower from screen than it is from paper (Nielsen 1997).

4.1.2 Exercises

The textbook contains seven different types of exercises including for example multiple-choice questions, drag and drop exercises, and crosswords (Figure 3). Feedback on the correctness of the user’s answers is given in graphical form. Also exercises on each topic can be used independently. Thus, Virtu can be used to test the user’s knowledge of safety at work issues for example in the beginning of a safety at work training session or to test learning at the end of such session.

![Multiple-choice exercise display](image)

**Figure 3.** Multiple-choice exercise display

In the beginning of the exercise page user is guided how to carry out the exercise. There is a possibility to check if the answers are correct. In the case of an error the right answers are not displayed, but the user has to revise them based on the theory part.

4.2 Virtual enterprise

The virtual enterprise is to be used by both user groups. Its purpose is to simulate a visit to a real company and to spread good safety at work practices to industry. The content of the virtual enterprise includes photographs, pictures, text and video and it has been integrated of three different industrial fields (metal, paperboard and plastic). Material collected from real companies makes the virtual enterprise realistic.
User navigates in the virtual enterprise by clicking the marked function points on the ground plan (Figure 4). The function points are buttons through which additional information on the subject can be found. Some of the points contain safety at work questions for industrial workers to consider in their own working environment.

4.3 Implications of usability engineering

As an outcome of paper mock-up testing and interviews, some changes were made to both content and the user interface of Virtu. Because the user test results showed a need for different difficulty levels in the content, the people responsible for developing it were informed, and some new content with a more practical approach to the issue was thus developed.

Navigation in the virtual enterprise was made easier by adding instructions to the ground plan display. Also the marking of function points was improved to make them easier to recognize. Some texts, which might disturb the user, were removed from the ground plan so that then only texts left were those of function point buttons. The link from the virtual enterprise to theory was removed, and description texts were added to the arrow buttons used in navigation.

Usability testing with the software prototype resulted in some minor changes in the user interface. Visibility of function points containing questions for industrial workers was improved in the ground plan by changing the icon, and the distinction between the questions and other content was made clearer by adding a title for the questions and marking the title with the same icon as on the ground plan.

The main implication of heuristic evaluation was that the virtual enterprise section was divided to two different sections already in the main menu. Also the terms in the main menu that were difficult to understand were changed, so that they would be clearer to the user. Changing the cursor when the cursor is over some button was also included.

However, the possibility to jump to the table of contents while the user is in the middle of a theory section or a function point was not provided. The rationale for this is that in a case of a VLE it is sometimes appropriate to limit user freedom to improve learning (Alessi et al. 1991).
5. Conclusion

The experience of developing Virtu can be presented in three guidelines of VLE design:

- Specify the stakeholders of the VLE.
- Specify how the VLE is used.
- Apply usability engineering methods in designing and testing phases before taking the VLE into use.

User groups can be defined as a wide range of stakeholders or as the end users of the VLE only. The stakeholders could be for example maintainers of the VLE or teachers responsible for teaching the content of the VLE to students. The advantage in wide range of users is a design covering all areas related to the use and lifecycle of VLE.

The purpose for using the VLE can vary from being like a textbook or scientific material to more like demonstration or even a game. The VLE may be used only once or the users may refresh their memory with VLE when needed. In some cases there can be many users simultaneously. They may all use one computer together or interact through networked computers.

As technical difficulties may cause dissatisfaction resulting in student withdrawals, the technical skills of the potential users should be accounted for, and the user interface should be designed respectively. Unnecessary features increase implementation and maintenance costs. Therefore, the features included in a VLE should be carefully considered according to the usability engineering results in designing phase. Many of the usability problems in current VLEs could have been avoided by applying usability engineering methods before taking the VLE into use.

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An Initial Evaluation of Student Withdrawals within an e-Learning Environment: The Case of e-College Wales

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Abstract: The proliferation of e-Learning programmes on offer within the UK raises critical issues that have yet to be fully addressed in terms of the nature of learning, effective pedagogy, learning expectations and student profile. The amalgamation and influence of these factors is also having an impact upon student retention. This paper examines student withdrawals associated with the online BA Enterprise programme initiative designed by the University of Glamorgan, which aims to help improve the entrepreneurial capacity of Wales. Utilising content analysis of student questionnaires at one of the University’s delivery partners, eight prime cases for student withdrawal were identified including factors such as technical problems, pressure of work and lack of time. The paper concludes by identifying strategies to manage these barriers to e-Learning.

Keywords: e-Learning, retention, withdrawal, student motivation

1. The e-Learning phenomenon

Internet use has increased to the level where it has become universally recognised as the dominant commercial and social force (Sloman 2001) - but what does this mean for today’s lecturers? The emergence of e-Learning has created a new platform for the delivery of training, it is, a phenomenon, and the impact of this technology will create opportunities that will enhance and transform the learning experience for both student and teacher (Sloman 2001).

It is vital within any study of e-Learning to illustrate the true nature of this new pedagogical resource. It is believed to be a new medium “involving the delivery and administration of learning opportunities and support via computer, networked and web-based technology, to help individual performance and development” (Pollard & Hillage 2001). Fry (2000) supports this and believes that the focus of e-Learning is primarily channelled via “networked interactivity and a range of other knowledge collection and distribution technologies”. One of the problems with appraising e-Learning however, is that it is eclectic and one can learn from many different electronic mediums. For example, we can learn from surfing the web, from online courses, from participating in an online discussion forum or from being coached or mentored via e-mail (Honey, 2001). Nevertheless, there is one common thread running through all these forms of e-Learning – they all offer the possibility of learning from information exchanged electronically (Honey 2001). Whitlock (2000) offers a more holistic perspective and argues that a suitable term to cover all definitions has yet to emerge. He suggests that the best way forward is not to search for the definitive definition but to apply e-Learning as an ‘umbrella term’ that encompasses all forms of electronic delivery, whether online or via other electronic mediums such as CD-ROM. Irrespective of definition, e-Learning has received attention from academia as it arguably able to offer educational qualifications to a wider geographical population and provides the means to further the education of those with other work-life commitments unable to study full-time (Alexander 2001; Daniel 1997; Johnstone 1992). It also provides the most fertile ground for growing these key ingredients of university renewal: lower costs and unique attraction (Daniel 1997). Green & Gilbert (1995) anticipate that e-Learning will yield new levels of institutional and instructional productivity.

The proliferation of e-Learning programmes on offer within the UK however, raises critical issues that have yet to be fully addressed in terms of the nature of e-Learning, effective pedagogy and learner expectations. Moreover, issues associated with e-Learning and retention, especially those associated with widening participation, have made many institutions question the benefits of the e-Learning (Alridge & Rowley 2001; Higher Education Funding Council for England (HEFCE) 2001; Select Committee on Education and Employment (SCEE) 2001). Studies conducted alongside e-Learning initiatives have often recorded varying levels of success in retention, identifying student motivation and satisfaction as reasons as to why a significant number of students ultimately decide to withdraw (Mason & Weller 2000; Alexander 2001; Bonk 2001). In addition,
whilst technological advances have widened access and provided what in essence is a new educational platform there are still limits to technology’s ability to respond to individual learning demands (Laurillard 1993).

Historically, a considerable amount of academic attention has been given to why students withdraw from Higher Education (HE). Reasons for non-completion are typically complex and multiple, yet institutional records are often simplistic or inaccurate (Hall 2001). In general, drop out rates ranging from 30% to 75% have been associated with e-Learning courses in the United States (McVay-Lynch 2002). Further, McVay-Lynch, (2002) identified a number of factors that contributed to withdrawal including technology, the student experience, lack of tutor feedback and online miscommunication. Concurrently, the work of Diaz (2002) suggested that these factors could be further categorised into:

- Student factors – where the educational preparation, motivational and persistence attributes and the actual academic self-concept of the student are important.
- Situational factors – where the life circumstances of students affect their ability to complete the course.
- Educational system factors – examines the educational standards and qualities of the course and the impact of pastoral support for the student.

In fact, it has been argued that the above factors are no different to the problems encountered by traditional students. Nevertheless, much has been made of the need to improve current levels of retention before e-Learning can be considered viable by most HE Institutions.

1.1 Retention and e-Learning

A result of widening access to HE has been an increase in the number of students without traditional qualification being admitted through the clearing system. HEFCE (2001) however, suggests that entrants with low or non-A-level qualifications are less likely to complete HE study. It is also believed that entrants without recent experience of HE lack the ability to be ‘self-determining’ and to organise their studies effectively. Thus, induction and study support programmes for these types of student become invaluable (SCEE, 2001). Furthermore, HEFCE (2001) maintain that students who are not prepared for the HE experience can lack the necessary study skills required. The SCEE (2001) recommend that wider access incentives for HE institutions should include ‘completion incentives’ that encourage the admission and support of student from non-traditional backgrounds. Nonetheless, the literature also implies that despite the recent political agenda to widen participation, those targeted may still be at a disadvantage.

Financial difficulties and lack of student funding have also become significant factors in student withdrawal from HE (Aldridge & Rowley 2001; AUT 2001; Bennett 2003). In an effort to alleviate student hardship, the government has attempted to provide significant resources, administered through HEFCE, in the hope of reducing its impact on retention. According to one report, funds provided for academic year 2000-01 were £57m through the Hardship Funds, £15m through the Mature Students Bursaries and £12m through the Fee Waiver Schemes (HEFCE 2001). Despite this support, the SECC (2001) reported that 20% of students fail to receive sufficient funding, as their parents are either unable or unwilling to make additional contributions. Consequently, many students are forced to work part time (PT) alongside their full time studies, which can also have a significant impact on commitment and performance.

Associated to the issue of PT working is time, whereby its limitation to students has become one of the primary reasons for withdrawals (Mason 2001; Powers & Mitchell 1997). Griffith’s (2002) study indicates that 60% of employees have difficulty finding the time to use online training systems. Time related issues involved in online courses have also replaced the problem of distance (Mason 2001). Whilst education has now extended geographically it has limited students with time restrictions. Indeed, Mason & Weller (2002) found that one of the major complaints about online courses were associated with limited time. The study highlighted that time constraints had, on occasion, led to a modification in course content and delivery. Hunt (1998) however, argues that the survival of online courses will be dependent on their ability to reduce overall time-scales as well as providing the necessary flexibility demanded by today’s learner. Nevertheless, issues of time-management, individual study patterns, and completion time-scale variations suggest that students also play a pivotal role in their ability to complete a course successfully. Similarly, Hunt (1998) acknowledges that the constant pressure of time on staff and
students, although creating a sense of empathy between them, is not conducive to sustained continuing professional development for either group.

Recently, it has been commonly accepted that most students should possess basic Information Technology (IT) skills and the ability to use these skills competently within an educational setting. Arif (2001) however, warns that it should not be assumed that any given population is ‘technology-conversant’. In fact, Arif (2001) maintains that many students entering University have had no exposure to the Internet and very little to IT generally. Participation in e-Learning courses can therefore be seriously affected by the IT deficiencies of students and thus a significant contributor to withdrawal (Hara & Kling 1999). Reliable technical support is crucial for both staff and students as they become familiar with e-Learning, indeed students will readily give up if they are unable to get the technology to work and do not receive support (Alexander 2001; McVay-Lynch 2002). Moreover, given that many students are not ‘technology-conversant’, usability is also considered to be an important factor in improving retention (Frontend.com, 2001).

It is important for students to know what is expected of them before committing to a task (Frontend.com, 2001). Hall (2001) suggests that it is no surprise that a course failing to meet student expectations and lacking in pre-course information is linked to low rates of student retention. For example, many learners often find the whole online experience to be contrary to what they believe to be the best form of learning (particularly inexperienced learners). Therefore, for e-Learning courses to improve rates of retention, time and effort must be given to preparing students for the e-Learning experience (Alexander 2001). Ultimately, high withdrawal rates are a measure of the negative quality of the student's experience of HE (Aldridge & Rowley 2001).

2. e-College Wales: A case study

Despite complimentary feedback the BA Enterprise suffers a significant withdrawal problem. As our literature review has already highlighted, retention is influenced by a plurality of factors including admissions policy, pedagogy, course structure and nature of study (i.e. full or part time). This paper examines the retention issues within the program and identifies whether the causes of withdrawal correlate with the existing academic literature. ECW is a project designed by the University of Glamorgan aimed at creating and improving entrepreneurial and managerial capacity in the European Union Objective One Areas of Wales, where such activity has been deficient. This distance learning (with local partner Further Education colleges located throughout the objective One areas) platform has been created with the aim of aiding individuals and communities to generate their own economic development solutions, through the tools of entrepreneurship and promotion. A key component in this provision is the BA Enterprise programme, which was initiated in September 2001. Course materials are available on-line via the Blackboard Virtual Learning environment (VLE) and students have access to electronic database journals and library catalogues. Students interact online with module tutors via virtual classrooms, chat rooms and discussion boards.

3. Research strategy

To investigate the research proposition the research methodology involved quantitative and qualitative research. Descriptive statistics are utilised to provide a demographic profile of learners. Thereafter the study used content analysis of student feedback to identify reasons for withdrawal. The study focused on 44 students within the Coleg Sir Gar, Partner College. Initially a detailed analysis of the demographic breakdown of the student cohort and completion, withdrawal and deferral information was undertaken. Thereafter the authors identified and interviewed twenty (87%) withdrawn students from the programme using a semi-structured questionnaire.

A semi-structured research instrument was constructed to identify prime motivations for student withdrawal. Former students were contacted via telephone and the questionnaire was completed in a ten-minute interview with each respondent. Twenty former students (87%) completed the questionnaire, whilst 3 (13%) respondents declined or could not be contacted.

The aim of the questionnaire was to elicit the prime causes for student withdrawal and identify the student attitudes to an on-line programme. The initial question established the date of withdrawal from the programme, whilst the second questions asked the respondents to explain their reasons for leaving the course. The third question enquired whether the University could have influenced the respondents’ withdrawal decision. The next question asked whether the respondent would...
consider studying for an online programme in the future. Finally the respondents were asked to summarise their learning experience of the programme.

4. Results

Forty-four students undertook the first year of the programme. Fifteen students successfully completed the first year, 23 withdrew and 6 deferred to the next academic year (see Table 1).

Table 1: Results 2001/2002

<table>
<thead>
<tr>
<th>Total Students</th>
<th>Passed award</th>
<th>% Withdraw</th>
<th>% Defer</th>
</tr>
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<tbody>
<tr>
<td>44</td>
<td>15</td>
<td>34</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>52</td>
<td>6</td>
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<tr>
<td></td>
<td></td>
<td>13</td>
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</tr>
</tbody>
</table>

4.1 Student Gender and Age

Twenty-seven (61%) students were male and 17 (39%) female, the oldest being 66 and the youngest 25. The average age of the group was 43 with a standard deviation of 9.6. A group frequency analysis (see Table 2) revealed that the most populous group was 41-50 (34%) followed by the 31-40 (30%). Overall 59% (26 out of 44) of the year group were 41 years of age or over. Male students were predominantly 31-40 (33%) years of age whereas female students were principally in the 41-50 (47%) age group. Male students accounted for 69% of the 31-40 age group and 67% of the 51-60 age classification whilst females accounted for 53% of the 41-50 age group.

Table 2: Group frequency analysis by age and gender

<table>
<thead>
<tr>
<th>Age Break Down</th>
<th>All Pop</th>
<th>%</th>
<th>All Male Pop</th>
<th>As % of Male Age Group</th>
<th>As % of All Male Pop</th>
<th>All Female Pop</th>
<th>As % of Female Age Group</th>
<th>As % of All Female Pop</th>
</tr>
</thead>
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<tr>
<td>21 - 30</td>
<td>5</td>
<td>11</td>
<td>3</td>
<td>60</td>
<td>11</td>
<td>2</td>
<td>40</td>
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<td>9</td>
<td>69</td>
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<td>20</td>
<td>6</td>
<td>67</td>
<td>22</td>
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<td>33</td>
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<td>2</td>
<td>100</td>
<td>7</td>
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<td>100</td>
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<td>61</td>
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</tbody>
</table>

Table 3 analyses the profile of the 15 successful students as eight males and seven females. Overall, 41% of female and 30% of male students were successful. Further analysis revealed that 50% of 31-40 aged female students were successful as were 67% of the 51-60 age group. The most successful male age group was the 41-50, with a 43% success rate. The least successful age groups were the male 51-60 category with a 17% success rate and the female 41-50 group (see Table 3).

Table 3: Gender & age of completed students

<table>
<thead>
<tr>
<th>Age Break Down</th>
<th>Passed by Age Group</th>
<th>All Female Pop.</th>
<th>Passed Female Pop.</th>
<th>As % of all Female Pop.</th>
<th>As a % of Female Passed Pop.</th>
<th>All Male Pop.</th>
<th>Male Passed</th>
<th>As % of all Male Pop.</th>
<th>As a % of Male Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 - 30</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>33</td>
<td>13</td>
</tr>
<tr>
<td>31 - 40</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>50</td>
<td>29</td>
<td>9</td>
<td>3</td>
<td>33</td>
<td>38</td>
</tr>
<tr>
<td>41 - 50</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>38</td>
<td>43</td>
<td>7</td>
<td>3</td>
<td>43</td>
<td>38</td>
</tr>
<tr>
<td>51 - 60</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>67</td>
<td>29</td>
<td>6</td>
<td>1</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>61 - 70</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>All</td>
<td>15</td>
<td>17</td>
<td>7</td>
<td>41</td>
<td>100</td>
<td>27</td>
<td>8</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Seventy percent of withdrawn students were male and 30% female. The most prevalent age groups for student withdrawal were 51-60, with a 67% rate, followed by 21-30 (60%). The 61-70 groups suffered a 100% withdrawal rate although this involved only 2 students. Both the 31-40 and 51-60 groups suffered a high male withdrawal rate with a 80% and 83% drop out rate. Older males 73% were particularly
likely to withdraw as were females in the 41-50 age group (50%).

Table 4: Gender & age of withdrawn students

<table>
<thead>
<tr>
<th>Age Break Down</th>
<th>All Pop</th>
<th>Withdrawn</th>
<th>% of W/D of Age Group</th>
<th>% of all W/D Students</th>
<th>All Male Pop</th>
<th>Male W/D Pop</th>
<th>% of W/D Male by All W/D</th>
<th>% of W/D Male by Male Age Group</th>
<th>All Female Pop</th>
<th>Female W/D Pop</th>
<th>% of W/D Female by All W/D</th>
<th>% of W/D Female by Female Age Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 - 30</td>
<td>5</td>
<td>3</td>
<td>60</td>
<td>13</td>
<td>3</td>
<td>2</td>
<td>67</td>
<td>67</td>
<td>2</td>
<td>1</td>
<td>33</td>
<td>50</td>
</tr>
<tr>
<td>31 - 40</td>
<td>13</td>
<td>5</td>
<td>38</td>
<td>22</td>
<td>4</td>
<td>4</td>
<td>80</td>
<td>44</td>
<td>4</td>
<td>1</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>41 - 50</td>
<td>15</td>
<td>7</td>
<td>46</td>
<td>30</td>
<td>7</td>
<td>3</td>
<td>43</td>
<td>43</td>
<td>8</td>
<td>4</td>
<td>57</td>
<td>50</td>
</tr>
<tr>
<td>51 - 60</td>
<td>9</td>
<td>6</td>
<td>66</td>
<td>26</td>
<td>6</td>
<td>5</td>
<td>83</td>
<td>83</td>
<td>3</td>
<td>1</td>
<td>17</td>
<td>33</td>
</tr>
<tr>
<td>61 - 70</td>
<td>2</td>
<td>2</td>
<td>100</td>
<td>9</td>
<td>2</td>
<td>2</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>23</td>
<td>100</td>
<td>27</td>
<td>16</td>
<td>70</td>
<td>59</td>
<td>17</td>
<td>7</td>
<td>10</td>
<td>30</td>
<td>41</td>
</tr>
</tbody>
</table>

4.2 Employment

Twenty-four students were self-employed (62%), 7 worked within the public sector (18%), 8 were in private sector (21%) and 5 (13%) were not employed (see Table 6). Self-employed students witnessed only a 33% completion rate and a 62% withdrawal rate. Similarly public sector students recorded a poor completion record (29%) and higher withdrawal rate 43%. The worst completion record was displayed in the private sector employment group with only a 25% completion record and 50% withdrawal record. The most successful employment sector was the not employed group recording a 60% success rate.

Table 6: Employment by student completion, withdrawal & deferral

<table>
<thead>
<tr>
<th>Sector</th>
<th>All Pop</th>
<th>% Comp</th>
<th>% of Comp W/D</th>
<th>% of Sector W/D</th>
<th>% of W/D</th>
<th>% of W/D</th>
<th>% of Def</th>
<th>% of W/D</th>
<th>% of Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self Employed</td>
<td>24</td>
<td>62</td>
<td>8</td>
<td>53</td>
<td>33</td>
<td>15</td>
<td>65</td>
<td>63</td>
<td>1</td>
</tr>
<tr>
<td>Public sector employment</td>
<td>7</td>
<td>18</td>
<td>2</td>
<td>13</td>
<td>29</td>
<td>3</td>
<td>13</td>
<td>43</td>
<td>2</td>
</tr>
<tr>
<td>Unemployed/Not Working</td>
<td>5</td>
<td>13</td>
<td>3</td>
<td>20</td>
<td>60</td>
<td>1</td>
<td>4</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Private sector employment</td>
<td>8</td>
<td>20</td>
<td>2</td>
<td>13</td>
<td>25</td>
<td>4</td>
<td>17</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>15</td>
<td>23</td>
<td>6</td>
<td>1</td>
<td>17</td>
<td>6</td>
<td>33</td>
<td>25</td>
</tr>
</tbody>
</table>

4.3 Education

Sixty one percent of students possessed no prior HE qualifications, 27% were graduates and 9% possessed a Masters degree. Seventy percent of students had achieved O levels or equivalent qualifications and 50% attained A levels. When these statistics are analysed in terms of completion against prior qualifications it revealed that of the 17 students with a prior HE qualification only 24% successfully completed the year and 65% withdrew. Of the 15 successful students only 2 (13%) possessed a prior degree. Typically successful students were lacking in prior HE attainment with only 24% of students having gained a previous qualification.

Table 7: Student cohort by qualifications

<table>
<thead>
<tr>
<th>Total Students</th>
<th>Graduates</th>
<th>Masters Degree</th>
<th>HE qualification</th>
<th>No HE Qualification</th>
<th>O levels</th>
<th>A levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>12</td>
<td>4</td>
<td>17</td>
<td>27</td>
<td>31</td>
<td>22</td>
</tr>
<tr>
<td>%</td>
<td>27</td>
<td>9</td>
<td>39</td>
<td>61</td>
<td>70</td>
<td>50</td>
</tr>
</tbody>
</table>

4.4 Reasons for student withdrawal

The semi-structured interviews with students revealed 14 factors of withdrawal cited on 44 occasions. Eight prime causes were identified occurring on 3 or more occasions.
Table 8: Prime reasons for withdrawals

<table>
<thead>
<tr>
<th>Factor</th>
<th>Frequency of Occurrence</th>
<th>As a % of all Respondents (20)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Reasons</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job or Business Changed/increasing pressure of work</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Lack of Time</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Personnel Issues</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>IT skills</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td><strong>Course Related Reasons</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Problems</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Not the Right Course</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>Amount of Coursework</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Confusion/lack understanding</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>24</td>
<td>100</td>
</tr>
</tbody>
</table>

4.5 Personal reasons for withdrawal

Increased pressure of work was the most frequently identified cause of withdrawal cited by 40% of respondents. These were students who suffered a change in their working circumstances. Two of this group withdrew due to having to relocate due to new employment whilst 6 cited a change in their existing working circumstances caused by launching their own business or extra responsibility within their current post. Seven out of 8 of these students either ran their own business or were employed within the private sector where time is a critical factor. Three students identified this factor as the sole reason for their withdrawal whilst 2 students recognised it as 1 of the 2 factors behind their withdrawal. Five students (25%) cited time as a prime cause of their withdrawal. Of this number, 3 ran their own business and 2 held high-level position in the public sector. All of these individuals identified that they did not initially appreciate the amount of time the course would entail and also underestimated the demands of their current posts. As identified in the previous section there was a realisation that the coursework was onerous and required reduction. Again this factor can be identified as a contributory factor towards their withdrawal decision. Three students identified their IT skills as a reason for their withdrawal from the programme. These students identified several other factors that contributed to their withdrawal; they were all self-employed males in excess of 54 years of age.

4.6 Course related reasons for withdrawal

Six students identified that that did not think that this was the right course for them. This was a contributory factor behind students’ withdrawal as 4 candidates identified it as one of the two reasons which caused their final withdrawal. These students were from a diversity of backgrounds and quoted a variety of reasons including a lack of enjoyment of the subject matter and the method of learning not suiting their learning style. Comments included ‘lacking interest in subject matter’, ‘not meeting my needs’, ‘lacked applicability to my current job’ and ‘preferred the chalk and talk and intimacy of an actual lecture’. Three students identified a lack of understanding and confusion as a factor contributing towards their withdrawal. This was one of a number of factors, which caused the students to withdraw from the programme. Student comments included that they did not understand what they needed to do and felt confused about using the technology. Five students criticised the amount of coursework, which involved weekly tasks and assignment work. Two students withdrew stating that they could not cope with the number of assignments. Three students complained that they were unable to complete the weekly tasks due to lack of time and withdrew or stopped participating early on in the course. Four students identified it as one out of the two reasons for their withdrawal. This can be seen as a contributory factor rather than a prime reason for student withdrawal. Four students identified technical problems as a cause of their withdrawal. Technical issues severely affected the launch of the course. One student identified it as the sole cause, whilst another identified it as one of two reasons for withdrawal.

4.7 Student experiences of e-Learning

Ten students indicated that they would consider an online course in the future, comments included ‘I would provided it was the right price’, ‘if it was relevant to my job’ and
'provided it works'. Eight responded that they would not consider such a course again including "they preferred traditional learning", "not at my time of life" and "I don’t want any more education". Two students where uncertain whether they would undertake an online course in the future claiming “it depended on their personal circumstances”.

Respondents were asked to summarise their experience of E-Learning. The most frequently occurring description for the course was “demanding and challenging” (45%) followed by “attractive offer” (35%). These are positive comments bearing in mind that these are students that failed to complete the award. There were a number of less positive comments such as “over my head/confusion” 25%, “over assessed/too much work” 15% and “difficult and complicated” 10%. A number of individual comments were made such as the onus was on the learner, a great opportunity and innovative.

Twenty respondents were questioned whether the college could have altered their decision to withdraw. Fourteen respondents (70%) identified nothing could have been done whilst 6 stated (30%) positive action could have been undertaken. Of the 14 who identified that nothing could have been done, 8 claimed that their business or personal circumstances meant that they had to withdraw. Of the six students that responded positively, 4 suggested that there was a need to sort out the technical issues and increase the level of support whilst one suggested increase flexibility in the course structure and one recommended an improved induction programme.

5. Discussion and conclusions

This study identified the existence of 8 prime causes of withdrawal, which where categorised as extrinsic or intrinsic. Intrinsic factors are internal course related barriers, which the University can influence including technical issues, assessment (quantity and nature of) and readiness for the course. Intrinsic barriers can be controlled and reduced by improving the reliability and usability of the VLE, improving the design of the course in terms of structure, flexibility and assessment and fully preparing the students for the program. Extrinsic factors are barriers to e-Learning which are external to the University. These factors include the students academic profile, their family situation, employment and nature of job, and available study time. These variables are far more difficult to influence and control, a critical consideration being their identification and management strategy.

These results correlate with the findings of McVay-Lynch (2002) and Diaz (2002). McVay-Lynch recognised the existence of technological barriers and the need for a positive student experience. Diaz (2002) provides a classification of these factors as student factors, situational factors and educational system factors. Our findings support these classifications and contribute to knowledge in recognising the existence of Intrinsic and extrinsic barriers to e-Learning and suggesting appropriate strategies to rescind their influence.

Key strategies to consider overcoming these barriers include: -

- Recruitment policy on e-Learning courses – consideration of IT skills competency and available study time.
- Effective support & communication mechanisms – both academic and technical teams
- Flexible course structure – level and nature of assessment
- VLE, robustness, reliability and stability.

Survey limitations include survey size and lack of consideration of course related issues such as no fee admissions policy and developmental issues related to creating a new program. This study will be extended to consider tutor perceptions of students' withdrawals and survey size will be extended and contrasted on a longitudinal basis.

References

Association of University Teachers (AUT) (2001). Student retention – problems &


Green, K.C. & Gilbert, S.W. (1995) “Great expectations, content, communication, productivity and the role of information technology in Higher Education”, *Change*


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Understanding and reducing stress in collaborative e-Learning

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Abstract: On-line collaboration is becoming increasingly common in education and with organisations. It is believed that this can in itself cause stress for collaborators. We believe that in some ways stress can be designed out of on line collaborative exercises through management of the on-line working processes. This paper investigates methods of reducing stress on line and proposes some principles for constructing on-line collaborative events to ensure that stress is eliminated or at least minimised.

Keywords: On-line collaboration, stress, online learning, group roles, group cohesion, culture, reducing stress, barriers to online working, e-teams, e-Learning, cyber-stress, techno-stress, virtual teams.

1. Introduction

The Open University (OU) has some 220,000 students on-line using e-mail and web sites. Many OU courses now use students in small collaborative on-line teams (e-teams or virtual teams) to produce work that is assessed as part of their course work. In this collaborative work, students are dependent on each other and cannot work solely as individuals. As part of the OU, the Open University Business School (OUBS) uses collaborative on-line work extensively in their courses with more than 30,000 students per year in over 30 countries world wide. Collaboration on-line is increasingly a requisite of organisations sponsoring students with the OUBS. On-line collaboration is becoming part of normal organisational working practice – in particular in teleworking (working whilst on the telephone and/or connected to the Internet or an intranet).

Annual surveys of thousands of OU students by the Institute of Educational Technology show that on-line activity is one of the least popular elements of OU courses. This has also been the experience of the authors who have become increasingly aware, over the last five years, of the possible stressful effect for students undertaking on-line collaborative activities.

Stress is now the second greatest cause of absence from work in the EU (back pain is the greatest) with over 50% of absenteeism having its roots in work related stress – although this stress is lessened when teleworking from home (BT 2002). This is because home working means that the organisational environment is absent, and the worker has more control over their own work.

Stress can be defined as ‘when the perceived pressure exceeds your perceived ability to cope’ (Palmer et al 2003). Stress is thus always perceived; a situation is only stressful for a given individual – not for all individuals. An external viewer cannot label an experience as stressful unless the subject displays physiological symptoms of stress, and there is a medical diagnosis concluding that stress is the cause, or the subject states that they have experienced stress. This means that one student may feel that a situation is ‘stressful’ whilst another student may perceive it as ‘enjoyable’. This may account for why some students in our study described particular activities as stressful, where others did not.

We believe that stress in a distance learning course, such as those dealt with in this paper, can be minimised through course design and by appropriate ‘acclimatisation’ of the student to situations such as collaboration at the start of the course. There is little, however, in the Distance Learning literature that deals with perceived stress in students. Simpson (2000) is one of the few writers to discuss stress in
relation to Distance Learning – but only does so in the general discussion of Stress Management, rather than the question of designing out stress from courses. Surveys of collaborative work in Australian Universities, such as that carried out by Scott et al (1997), have also indicated that collaborative work can cause stress, particularly when there are time constraints.

2. Earlier research

In 2000, drawing from experience of studying 2000 MBA students in on-line collaborative activities, two barriers to fully functional teleworking were proposed by Salmon et al (2000). The barriers were ‘technical aspects’ and ‘collaboration’ and it was found that both caused stress and had to be overcome for fully functional teleworking. These barriers are depicted in Figure 1.


In the Open University we recognise the stresses that can be derived from technical difficulties and try to minimise them through the use of induction courses and helpdesks. These are, however, only aimed at the use of communication software and not collaborative methods

Traditionally stress caused directly through online collaboration has been considered less of an issue, so in order to ascertain to what degree it affects students a scoping study was carried out during the winter of 2002/2003. Students from two groups taking part in the one year long Diploma in Management course completed questionnaires to establish how they felt about their regular, course-based, online group activities. Students from the short, 18-day Online Management Challenge (OMC) course were also asked about their experiences whilst working online. The results, as well as showing that some students definitely do feel stressed when working online, revealed some other interesting findings. This has led to the development of the following proposed model to indicate the main factors in on-line collaboration stress.

![Figure 1: Barriers to teleworking © John Allan 2003](image1)

![Figure 2: Stress caused by on-line collaboration © John Allan 2003](image2)
3. Current research

In July 2003, over 120 students took part in the 18-day OMC online management course. They were asked to complete a brief web-based questionnaire beforehand, and those that did were then asked to complete a further questionnaire after the end of the course. There were 44 final responses and quotes from these are given in italics below.

All students were studying for the Certificate in Management, with over two thirds of the respondents being quite experienced at working online having studied the ‘online’ version, of the Certificate course, that is with online tutorials rather than the standard face to face tutorials.

3.1 Technology and stress

The technology used may have a significant influence on online activity (Kayworth & Leidner, 2002) and it affects the way people interact in terms of the communications environment it provides and the ease with which people can use it (Yoo & Alavi, 2001, Walther, 1996).

3.1.1 Technology provision

In the OUBS we use First Class as the conferencing medium and for the OMC it is accessed via a web interface. Although it offers very useful features and has a user-friendly interface, we occasionally experience problems with our technical provision that inevitably create stress for the students.

‘some days I missed [logging on] due to technical difficulties’ [student quote]

3.1.2 User technology

Technical problems were, however, mainly at the user end:

‘I experienced a few computer problems which restricted me a couple of days’

3.1.3 User technology skills

If the software is new to the student and is not very intuitive to use, the students’ lack of skills can also create anxiety as the students struggle to ‘make the technology work’.

3.2 The organisation

The organisation can be very influential with respect to the experience of the students, two of the main areas it can affect are culture and tutor support. (It is worth noting that at this stage we are only considering organisational culture; national and functional cultures are not explored here.)

3.2.1 Culture

In this instance the organisation is the OUBS and the culture is that which pervades all our online courses in terms of tone, activities and support. The less experienced students taking part in the course had some familiarity with online support but little in the way of online OUBS courses; the more experienced students had a better understanding of what to expect. This is shown by the less experienced student expecting to log on about once a day, and the more experienced students anticipating between once and more than once per day; the higher figure being a more realistic expectation.

<table>
<thead>
<tr>
<th>Av. for inexperienced</th>
<th>Av for experienced</th>
</tr>
</thead>
<tbody>
<tr>
<td>once every 2-3 days</td>
<td>students = 2.08</td>
</tr>
<tr>
<td>once a day</td>
<td>students = 2.53</td>
</tr>
<tr>
<td>more than once a day</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3: Student expectations for logging on

There are also differences between working on the OMC and in online tutorials in the Diploma course. In the OMC the students are far more self-directing and the lack of provided structure leads them to become rapidly aware of the different behavioural aspects of working online. To use a metaphor, in our normal face-to-face lives we understand expected behaviours such as the need to form a queue at the supermarket checkout, but online there are rules that many students are unaware of in which case there is a higher risk of unacceptable (or unexpected) behaviour. The organisation needs to acquaint the student with the rules for online working, in that specific context, if it is to avoid the stress caused by misunderstandings, for example how often they should expect to be posting messages:

‘I posted more than I thought I would as it was essential if I wanted to join in the debate and discussion’

‘I posted ‘quite a lot more than expected but we communicated really well so that was great’
‘I posted more than anticipated. This was clearly due to the enjoyment level’

Or how often they should be logging in:

‘I had to log in several times a day in the important periods, I thought I would be able to log in just once a day!!’

Work pressures meant that ‘I only had a chance to log on once each night.....it did make the [OMC] more stressful’

3.2.2 Tutor support

The organisation can also influence the students’ experiences by ensuring that the tutors are well prepared and trained, so that they help to manage students’ expectations:

‘Being in contact early by the tutor in response to my concern...alleviated a lot of stress’.

3.3 The Individual

The individual brings their own working and behavioural preferences to any group activity, and although many of us are aware of how we work in a face-to-face environment, we may have had less opportunity to consider and reflect upon how we work in an online environment. On one level it is worth being pragmatic about these differences:

‘These are however problems faced in everyday working life’

However it is also worth considering what factors can be mitigated against in advance, in order to reduce stress. The following were some of the main sources of frustration.

3.3.1 Student expectations

These have already been referred to above, but it is not just the organisation that can influence these; the student themselves can prepare themselves for the online experience in order to ensure that their expectations are realistic. This can be done through reading any preparatory materials and talking to other students who have already gone though that experience, either in person or through online discussions.

3.3.2 The pace of asynchronous working, including the time taken to build relationships

Walther (1996) notes that forming relationships online is slower than face-to-face, although the amount of information exchanged is the same, thus many students found it frustrating to be trying to build relations and work asynchronously.

‘I did get frustrated with the asynchronous nature of the communication

‘People dipped in and out according to their daily schedule, and only a couple of times met at once. This was one of the difficulties of my experience of working online’

I suffered ‘Frustration with the initial slow pace of things’

3.3.3 Time pressure

The OMC is designed with a tight time-frame in order to motivate the groups to form and work together, any longer and the momentum starts to be lost. This can be seen to work:

‘The time factor ... made me contribute earlier than I normally would’.

However students do struggle with balancing home, work, revision for their exam and the OMC:

‘the time constraints of the challenge proved difficult’.

Subsequent delays then affect the other group members:

‘...found it very frustrating waiting for others in the group to make their contributions’.

3.3.4 Task participation

Group decision-making literature shows that groups work more positively if there is active task participation (Yoo and Alvai 2001), if this is absent it can lead to stress:

‘It was also quite frustrating at times if people didn’t participate’

3.3.5 Group roles

As the students work together there needs to be a recognition of the differences between group members and the fact that these can be useful, not necessarily detrimental, to the
group (Shaw & Barret-Power 1998). Some students recognised this:

‘Allow room for all the styles and types as this provides the most efficient and effective methods of making decision and problem solving – as well as a wide varying range of personal views’

3.3.6 Group cohesion

Group cohesion is a way of describing members’ attraction to the group’ (Hogg 1992 p30) and forms as a result of the group development process (Tuckman 1965). Groups are seen to work better when there is group cohesion (Yoo & Alavi 2001). Over 90% of the OMC students felt that a sense of group responsibility helps the group to work and many of their comments reflected their own commitment

‘Realising that someone had put a lot of effort on a particular activity… I could not disappoint him’

‘I didn’t want to be responsible for letting the team down’.

This commitment is built through supportive activities, such as responding or recognising the work of others:

‘A thank you for your contributions made a big difference’

‘Feedback on ideas… encouraged further posting’.

If this is not done this too can lead to stress:

I felt ‘Annoyed that people did not answer or acknowledge points input by me’.

4. Discussion

Stress is not a medical condition but is based on the perception of an individual, thus what may appear stressful for one person may be viewed as a challenge by another. It is therefore important to understand what the individual’s perceptions are and address these if we are to address the issue of stress with online working and learning.

Our earlier work showed that students certainly do experience stress when working online, but that this is not always for the reasons you would expect.

‘Asynchronous Anxiety’ is a term used to describe stress from on-line activities caused by a distrust of asynchronous activity. Students are worried that their computer skills are not up to a long period of robust on line collaboration. (Crouch and Montecino 1997) http://leahi.kcc.hawaii.edu/org/tcc_conf97/pres/crouch.html and ‘Technostress’ is a term used to describe the stress felt by employees when receiving demands from managers by e-mail without the buffering effects of face-to face-interaction (Gardner & Scheemerhom 1988) leading to significantly increased stress (Duxbury et al 1995) http://hsb.baylor.edu/ramsower/acis/papers/staples.htm. We found evidence of both Asynchronous Anxiety and Technostress amongst the students.

In our own research we discovered that students experience what we term e-team stress, which occurs when team members feel pressured not to let down the other members of their team.

Our current research shows that there are further factors that influence participants and that the factors influencing this are predominantly at the technological, organisational and individual levels. Through understanding the influences it may therefore be possible to address some of them in order to reduce or remove the factors that cause stress for some individuals.

4.1 Reducing stress caused by technology

In the first instance the technology used should be as user-friendly and as trouble-free as possible, providing a comfortable, accessible learning space.

Some elements of stress for students can be minimised through:

- Specifying the minimum technology standards required by the students
- Specifying the minimum prior knowledge level of the student, including their technical skills level.
- Running induction courses for students who have a skills shortage
- Maintaining a Help Desk to address technical problem that arise

4.2 How the organisation can reduce stress

The organisation needs to recognise its own working culture, and may need to adapt it if necessary to enable trouble free online working. This may involve creating a set of rules for online working to expedite students’
adaptation to working in the online environment, as well as providing accurate predictions for workload and working patterns. It may also involve briefing the tutors or facilitators on how to prepare the students.

4.3 Reducing stress at the individual level

The students need to recognise and understand their own online group-working preferences, as well as being aware of other people’s. They should ensure adequate preparation, recognising that as this is still a relatively new medium for learning they may need to consider additional factors. These include:

- The pace of asynchronous working, including the time taken to build relationships
- The time pressure
- Group roles
- Group cohesion

5. Follow up research

Following on from this we identified two areas for follow up research. The first was carried out during the winter of 2003/4 where the implications of the findings were tested on a group of students starting the Diploma in Management. These students began their course in November 2003 and will be working together until October 2004, carrying out regular online collaborative activities as part of their course learning.

The students first made contact with the tutor and each other on-line and carried out a simple exercise to acquaint themselves with each other and to begin to become familiar with some of the issues they might be facing with their online working. This was followed by a face-to-face meeting where the problems of asynchronous working were discussed between students comprising the online work groups. Each group was be asked to draw up its own protocols for collaboration and to identify online group roles that would be rotated throughout the year.

After the first collaborative assignment students were given the same questionnaire as in 2002 and the results are given below.

13% of students felt ‘stressed’ other than through purely technical problems

These students indicated that the perceived peer pressure from having to collaborate was a major factor, what we have termed e-team stress.

Although this is only a small scale test, it can be seen that modifying the structure of the course to include a simple, non threatening, ‘fun’ on-line collaboration exercise, has the effect of significantly lowering the stress felt by students in subsequent on-line collaborations (compared to previous cohorts where the average was approximately 50% who felt stressed).

The second area for follow-up work involves further research into the students of the short, OMC course. The lessons learned have been applied to developing an introductory activity that is designed to alert the participants to a number of issues and required actions that affect online collaborative working. It is intended that by highlighting these factors at an early stage, and by using them as a trigger to aid the groups to develop working protocols, the groups will be able to form then perform (Tuckman, 1965) more quickly than those groups that have not been prepared in this way. It is also anticipated that this will make the online working experience less stressful.

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A Dual Perspective on an Online University Course

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Abstract: This study investigates how students and their teacher experience online courses and whether both parties perceive similar advantages and disadvantages in online learning. Both parties consider geographical independence advantageous and express the need for a well-structured course; this includes the administration as well as the content. Individual learning styles and approaches to learning play an important part in achieving success; students’ computer skills and technical knowledge may also affect a successful outcome.

Keywords: e-Learning, online courses, perspectives, communication

1. Introduction

Our study investigates how students and their teacher experienced an online course. We were interested to learn whether both parties perceived similar advantages and disadvantages in online learning.

An online course at Jönköping International Business School (JIBS) has been scrutinized from two perspectives. The course chosen for investigation was Business English Online (BUENGON 1), which was running for the second time since autumn 2001. The platform used was the school’s intranet called JIBSNet, developed to handle administration of all the courses, and to provide some facilities for communication between teachers and students. Students chose the business English online course because no meetings were arranged. The intranet served as the meeting place, and tasks were uploaded at regular intervals.

The surge in e-business and e-Learning requires new thinking about how we acquire knowledge and skills to meet the knowledge economy. This places a demand on higher education and corporations to equip knowledge workers with lifelong learning skills. Key skills, such as communication, numeracy, the use of information technology and learning how to learn, according to the recommendations set by the National Committee of Inquiry into Higher Education (NCIHE, Recommendations 17 and 21) are necessary in order to foster flexibility, initiative, creativity, problem solving and openness to change. The use of communication and information technologies (C&IT) is being used to meet this challenge (Maier & Warren, 2001).

Since the Internet is largely a text-based medium, and that written communication in e-commerce can make the competitive difference in organizational success (Booher, 2001), the focus of the business English online course was on developing students’ writing skills.

JIBSNet at present does not support any other forms of interaction other than offer a place for reading course-related materials and uploading text. Therefore, an overarching aim was to develop students’ electronic literacies (Warschauer, 2000).

2. Method

One student who had enrolled on the course, offered to provide the student perspective. The opportunity also served to gather material for his master’s thesis. This student’s supervisor was one of the authors of this paper; his online teacher was the other. The supervisor gave advice on how to perform the pre-course online questionnaire, where the aim was to determine all the students’ attitude to distance learning. One reason for not using interviews was partly because it was an easy way of reaching the students as they used IT as a tool during the course. Another reason was that not all the students lived in the vicinity. After the course, it was of relevance to conduct a follow-up questionnaire to find out why half the students enrolled, had dropped out. In parallel, and independently of one another, the teacher evaluated the course from her perspective.

3. Results

The number of places available on the BUENGON course is twenty, but only nineteen started. The pre-course questionnaire asked students about their home/work life, any previous experience of distance learning and their level of computer skills. Most of the students lived locally, whilst others were working abroad; they chose the course to

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complement their work, and a third had prior experience of distance study.

3.1 Student Perspective

The follow-up questionnaire asked for learners’ perceptions of the course and whether the medium suited them. Students thought that the delivery of the course enabled flexibility. In fact, all the students that passed the course, found that the design of the course made it more flexible (Totally agree = 9, Agree in a great extent = 1).

Those who successfully completed the course had good computer skills and were even more positive to new technology. Of the nineteen students who started the course, only ten of them finished. The nine students who dropped out gave the following reasons, as shown in Table 1.

Table 1: Give reason(s) why you left the course. (Question 6)

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>I got more work in my ordinary job.</td>
<td>1</td>
</tr>
<tr>
<td>I wanted to work with the English course during the evenings but found it was not possible because of the many group works.</td>
<td>1</td>
</tr>
<tr>
<td>The design of the course didn’t suit me.</td>
<td>3</td>
</tr>
<tr>
<td>I realized that distance learning was not for me.</td>
<td>3</td>
</tr>
<tr>
<td>I felt that I didn’t manage to study by distance. Didn’t get anything, but thought everything was a mess, and besides I felt that I didn’t get enough time</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
</tr>
</tbody>
</table>

They also found that JIBSNet was a good platform for interaction between students and tutor. To the question “Do you think the web platform (JIBSNet) has contributed to enhancing the course pedagogically? 4 students answered “Yes” and 5 answered, “To a certain extent”.

The majority of the students found that the delivery was not appropriate for them. Conversely, it could be said that the student does not suit the course, or more generally: some students do not suit these types of courses. Of course the question then is raised about different learning styles (see Table 2).

Table 2: Which of the following learning styles describes you? (Question 11)

<table>
<thead>
<tr>
<th>Learning styles</th>
<th>Disagree</th>
<th>Agree partly</th>
<th>Agree very much</th>
<th>Agree fully</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual, learn new information through text and picture.</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Auditory, learn through listening and speaking.</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Logical, learn information through experiment and pattern.</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Spatial, learn new information through painting and creating.</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Kinaesthetic, learning new information through the body.</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Group, take in new information through working in a group, comparing and relating to other people’s experience</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Individual, take in new information through one’s own work and by following one’s own feelings</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

As can be seen from Table 2, in the column Agree very much, a learning style that incorporates visual aspects seems to be most appropriate when reading an online course, at least as far as our study indicates (five students). Also logical attributes turn out to be important (four students).

Most important for these students was being able to work and learn individually. This could largely account for why these students left the course as they may have felt thwarted by all the group work tasks.

Of the remaining ten who completed the course, students benefited from the flexibility of the delivery and considered the platform a useful place to house all course matters. They also appreciated communicating via the discussion forum (see Table 3).
Table 3: Statements regarding the course (Question 12)

<table>
<thead>
<tr>
<th>General statements about the course</th>
<th>Disagree</th>
<th>Agree partly</th>
<th>Agree</th>
<th>Agree very much</th>
<th>Agree fully</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course design has enabled flexibility in my studies, both geographically and in time</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Platform has improved communications with other students</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Platform has improved communications with tutor</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Has been easy to use and understand</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Tasks have been easy to understand and follow</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>

The major problem they had were difficulties in understanding the written instructions to the set assignments, which they considered unclear, and confusing. The group work tasks also proved to be a bone of contention.

Some students would have preferred to work on their own because few were willing to take the initiative in forming and maintaining contact with their groups. A face-to-face meeting would have been welcome to create a learning community.

### 3.2 Teacher perspective

The frustration and stress related to delivering the first two offerings of the BUENGON courses were a result from lack of time and lack of coordination between the various administration bodies. The overall look and feel of the interface was dull and static. The tutor uploaded material, which the students downloaded. Lesson plans were being written and then revised as the course progressed; therefore it was not possible to give students advance notice of the assignments.

Another difficulty and source of bafflement was students’ responses, or lack of them. Students seemingly did not understand instructions; they wanted to seek personal clarification with the tutor; they had problems communicating with their group. However, the small changes in presentation of material, which in essence remained the same, changed its focus on what the tutor was preparing to what the student needed to know to be able to do the tasks. Once the materials had been written, and the design of the course put up on JIBSNet, it was possible to focus on the communication and interaction between the learners and tutor.

The activities for assessment were group-based with some assignments which could be performed individually. This was to allow for different learning preferences. The discussion forum primarily was to nurture an online community, with a secondary function of providing the tutor with evidence of student activity.

Students’ emails to the tutor seeking clarification to certain tasks provided valuable feedback on how well the course content was presented. Problems perceived concerned the structure and schedule. Confusion was caused by the heading descriptors in the menu on the webpage, which used the week numbers. Students were uncertain about the deadlines. Should the assignment be submitted during a particular week, or were they meant to be working on it that week?

Based on the guidelines format in Horton (2000), more detail was given about the steps to take in doing the worksheets and about the discussion list. Yet instead of clarity there was still some confusion because there was too much detail, such as reminders for when the previous assignments were due.

Another factor that has contributed to the clarity is adding information about the worksheet/lesson plan, etc in the header of each document to be downloaded. Each page can now be identified. This is a small detail easily overlooked when preparing Word documents (even adding pagination can be forgotten). “Tinkering with the presentation of information can dramatically improve its stickiness”, as Gladwell points out in Tipping Point, (Gladwell, 2000). As a result, students on the third BUENGON offering said in the evaluation that the information about the course contents and goals was very good (6.5; max 7). There were very few emails requesting clarity on the tasks.

Interestingly enough, students claimed that misunderstandings would be more easily rectified in the classroom which would allow instant feedback. Yet campus students tend
not to follow instructions implicitly because they are relying on the verbal instruction despite having been given it in writing, which would then be subject to various interpretations and assumptions. On the whole, online learners completed the tasks satisfactorily because they had only the same written source.

Instead the problem lay in getting students to form study groups. From the onset, students were to form their own groups so that they would be encouraged to make contact with as many participants as possible.

In the course evaluation, there was some dissatisfaction in doing group work as expressed by this comment:

*I am afraid that the "working in a group"-thing took much time and gave very little. Trying to get in touch with my group and getting any answers from them at all has taken a lot of time and the waiting without anything happening was very annoying. I can understand that the thought was well meant, but the result was just frustration and a lot of time wasted on waiting for things (e-mails, suggestions, tasks) that never came. I hope it worked out better in the other groups.*

To counterbalance this though, was this comment:

*I also want to say that my group has worked great, we have all answered right away by email which is really important for the group to stick together. We will also try to find a day to meet for a beer, just to meet IRL.*

Ideally collaborative learning should encourage learners to rely on one another for gathering, evaluating and presenting information, taking responsibility, and being more active. The benefits for the tutor of learners sharing “knowledge and the burden of learning”, (Horton, 2000) are that it is possible to monitor without too much interference, and not be the sole evaluator. Furthermore, working in small groups is a practical means of class management, whether Face-to-Face (F2F) or in a virtual classroom. Marking group assignments eases the burden instead of giving each individual a quick-turnaround in feedback. For the online course, written communication was the major means of providing feedback, which was particularly time-consuming and stressful as the tutor was only allocated the same number of teaching hours as for a campus course.

Some students enjoy close contact with the tutor and engage in an intense email exchange on a one-on-one basis. Unlike the traditional classroom setting, where a student would be considered as dominating the class discussion to the possible annoyance of other students, or feel inhibited in disclosing uncertainties, misunderstandings, etc., the student engaged in emailing has privacy to air one’s thoughts and can share concerns with the tutor in confidence. Findings in an article on online education, stated that “students on online courses report that they are getting more human interaction than on any other type of course” (Education Guardian, 2003). Common to all the BUENCON courses offered is that the tutor has managed to establish good contact with students through email, learning more about them than possible in the classroom.

Based on the experience so far, perhaps the tutor needs to take an even more active role in encouraging contact between students since it is not possible to rely on group dynamics in the traditional classroom. The problem is that budget constraints prohibit F2F meetings; students are not in the neighbourhood; and the delivery does not as yet support synchronous technology. If the design of the course is to include discussions and collaborative projects, then the platform must support conferencing and not just be the exchange of data (Meyer-Peyton in Lau, 2000).

4. Analysis

Online communication is becoming an integral part in education, training and business. There are two ways of viewing this development, with celebration or abhorrence. Some embrace reading and writing on the screen as being “more democratic, learner-centered, holistic and natural” (Bolter, 1991; Landham, 1993, cited in Warschauer, 1999). Others view it as a means to propagate taking a surface approach to content by clicking from one hyperlink to another, without pausing long enough to read in any depth.

Biggs points out that the interpretation of ‘flexible learning’ to mean uploading lecture notes on the Web because of the ease of distribution, is feared as taking a surface approach to teaching (Biggs, 1999). One of the concerns of the tutor is that discussion topics
could be mere flittings as inherent in ‘chat’, instead of being given in-depth treatment. Another concern is that students might view our intranet as an example of ‘shovelware’ (“content taken from any source and put on the Web as fast as possible with little regard for appearance and usability,” www.whatis.com), and that we have joined the bandwagon, “Quickly grasping its distribution possibilities, colleges and universities everywhere have rushed to move resources for courses on line. Material previously handled on paper or with slides and transparencies -- syllabi, assignments, notes, data, diagrams, references, exams -- are now presented through the computer.” http://fraser.cc/Talks/Chronicle.htm (Fraser, 1999)

For this offering of BUENGON, working in groups seemed to be the biggest problem. The postgraduate student’s investigation revealed that some learners wanted a minimum of instruction and examples, just details about the hand-in assignments. Others preferred to work individually and felt that the quality of the course would have been improved considerably by minimizing or even eliminating the group work. However, the teacher was concerned that the students’ focus on the hand-in tasks and reluctance to work in collaboration, suggested a surface approach to learning. As summarised in Ramsden, “Learning to Teach in Higher Education”, some students’ intention was “only to complete task requirements”, and “focus on ‘the signs’ (e.g. the words and sentences of the text)” (Ramsden, 1992). Whether the medium of delivery is on campus or online, it is important that activities are interactive to encourage deep learning to take place.

One of the major disadvantages for the tutor is that the form of asynchronous delivery is very labour intensive, something that the participant may not be fully aware of. It is not feasible to give individual feedback at the same time, so some student will be last in the chain. Waiting for feedback may be a reason for dropping out, as the student may feel isolated and demotivated.

To encourage commitment to the course in the hope of reducing the drop-out rate, new students should pledge that they will take responsibility for their learning, actively participate, and be flexible and tolerant. Furthermore, they should be willing to create and foster an online community. The advantages of what electronic learning and the particular course may bring, should be clearly expressed (Horton, 2000).

However, to be able to generate income students need to be processed through the course. Unfortunately, the retention rate so far is still low, with about half of the students dropping out. The paradox is that those students who complete the course do so successfully and express their great satisfaction. It seems to be a case of all or nothing. Either the students thoroughly enjoy the course and benefit, or they disappear.

Although teachers and students are becoming more familiar with the use of computers in education, yet there is still the need for face-to-face contact (Biggs, 1999). Despite all the seeming advantages of holding computer-assisted conversations, there is the yearning for human contact. Flexible learning is still too new, and educators and learners need to adjust to the new technologies as well as the new forms of electronic reading and writing.

5. Conclusions

Lessons learned from this experience are that it is important to establish a virtual place where students can meet to work together on group assignments in privacy, and that they need a reason to come back to the web page – the content must be ‘sticky’.

Geographical independence is one of the most important advantages in choosing an online course. Both the teacher and the students express the need for a well-structured course; this includes the administration as well as the content. The postgraduate student points out that the individual learning style is an important factor for success in taking part in an online course. The teacher views students’ approaches to learning as a key determiner as to whether students interact with the tasks and one another, and see the course through to its end. The various levels of computer skills and technical knowledge may affect the success of following through the course. The delivery platform therefore should be easy to use, reliable and support the learning. However, if students are not required to attend live classes, then money should be invested in the platform to create good venues to allow synchronous meetings, for instance.
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Web-Based Course Management and Web Services

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Abstract: The architecture of a web-based course management tool that has been developed at IIT, Kharagpur and which manages the submission of assignments is discussed. Both the distributed architecture used for data storage and the client-server architecture supporting the web interface are described. Further developments of the tool making use of web-services are also described along with a discussion of the relevance of this for recent open standards and future learning management systems.

Keywords: course management, distance education, web-services

1. Introduction

Managing online assignment submissions made via email becomes a real challenge (especially when class sizes are large) because it requires huge amounts of storage space and file management skills to process submissions efficiently. The problem is aggravated when more assignments are given as the course progresses. Distributing the responsibility of evaluation amongst staff may alleviate the problem of submission management to some extent, but this requires managing the collation of assignment marks. Centralized management of marks is also desirable to assess student progress in a course.

Our Web-based course management (WBCM) system provides easily navigable structure to all online submissions and a centralized web-based interface for submission evaluation. A customized online submission interface is generated in accordance with requirements for each assignment as specified by the staff concerned. Student progress tracking, group and individual assignment organization, assignment evaluation and marking, grade maintenance and distribution, online submission, online attendance are the important features of WBCM. In essence WBCM automates and integrates several diverse aspects of course management.

After discussing the motivation behind WBCM, subsequent sections describe the system architecture and important technical details and features of the implemented WBCM. The original intention of the developers was to evolve the tool into a complete learning management system for release as open-source. However, with the recent trend towards open standards for learning management systems, a path has opened up for developing this tool into a standards-compliant component for use alongside other LMS components.

The paper concludes with a discussion of planned further development of the tool using a web-services model and notes the relevance of recent open standards for learning management systems.

2. Motivation for a Web-based system

There were several motivations behind developing this system. The work started as a system to ease the handling of laboratory based courses. The requirements, however, turned out to be fairly general and minor additions were required to make the system handle almost any kind of course. We also had the need to handle courses running at a distance at the various extension centres. After developing two versions of this system we decided that another version with comprehensive features was required. These are described in more detail below.

2.1 Laboratory courses

Although not unique to laboratory-based courses, several factors that require significant administration are often concentrated in such courses (especially when there are multiple assignments given throughout the course, each having its own deadline and guidelines for completion). Completed assignments need to be collected, evaluated and marked for assessing students’ progress. Assignments may be given to individuals or groups. To
further assess students’ progress examinations and online tests may be conducted. Attendance records may need to be kept and some marks may be awarded for attendance. The marks for each student need to be tabulated and at the end of the course grades need to be distributed. Physical dissemination of material is difficult and involves generating and handling a lot of paper. Keeping a record of the attendance is costly in terms of time. It is also extremely difficult to keep track of individual progress manually. Such a situation is a clear case for the need of automated support through an electronic course management system.

2.2 Distance education

There are additional benefits that may be had from managing a course over the internet using a web-based course management (WBCM) system. Such a system can be highly effective in bridging geographical distance, which is an important concern in India.

In the Indian Institute of Technology, Kharagpur University we run a distance education programme. We have several centres where this programme runs and it has been extremely difficult to manage the programme running over these centres and monitor the progress of students at these centres centrally from our main campus.

Our web-based course management system has provided an excellent solution to this problem. Teachers, too, tend to get geographically separated from the students for other reasons, such as having to travel to conferences. As a result, they either have to curtail their travel or make complex arrangements to deal with the absence. Here again a web based course management scheme has provided useful advantages.

2.3 Development of WBCM

We have already implemented and used three versions of WBCM. Two earlier versions were a success with staff and students, further motivating us to add more features. The packages were used for large classes. Courses run with these packages helped in reducing logistic problems for assignment from near impossible to trivial. Logistics for evaluation were simplified as submissions were available online all the time and transparent evaluation meant more student satisfaction. Dependence on printers was almost completely removed.

The third version, in particular, supports sections within a large class and distributed storage repositories. The earlier versions relied on all the submissions and databases being located centrally. This scheme has its advantages and disadvantages. Centralized data storage takes off all responsibility of storage management from the end users (in the capacity of instructors). However, it does increase the burden of storage on the central server. Also, end users sometimes feel out of control of the submissions of their courses.

Support for sections in the third version enabled common or distinct assignments to be given for separate sections. Also, students may work individually or in groups. This affects the assessment mechanism, but that is supported. Support is also available for moving students between sections.

3. Architecture of WBCM and technical details

The distributed databases (Postgres) and file (Linux) repositories, the web server (Apache) and the corresponding cgi-scripts and the http clients (tested with Netscape, Konqueror, IE) are the main components of WBCM architecture. To describe the WBCM architecture, shown in Figure 1, we divide it into two parts: Distributed architecture for data storage, and Client-Server architecture for providing the human interface (the web based aspect of the utility). We also give details of the important components: the database design, the cgi-scripts (which form the backbone of the system), the authentication mechanism, the repository directory structure and the distributed storage mechanism.

3.1 Distributed architecture for data storage

WBCM manages course data for many courses and multiple runs of each course.

A schema and directory structure (for storing scripts and assignments) is created for a course run and replicated to manage multiple course runs.

In addition to having an independent database for each course run, a database which we call the “course database” is used for keeping data about all the course runs (list of courses, list of course runs).
Classes may have very large numbers of students - e.g. for interdisciplinary courses, translating into large storage requirements.

Thus we have a cluster of database, instead of single database which allows
- the databases to reside on different hosts;
- the use of simple common schema for each course except for the “course database”.

For each course run, assignments and the submissions are stored directly as files in the file system, under suitable directory structure, which allows reconstruction of a path to them independent of their content. Other information, relating to courses, students, staff, etc. is also stored in databases. This may be considered as “control” information. Whenever there is a choice between storing information in a file or a database, the later is preferred, as operations on a database are performed at a high level.

Our experience with previous versions of WBCM, which had a centralized architecture for data storage has guided us to adopt a distributed architecture for the same. The following observations were of critical importance during the run of previous versions of WBCM, convincing us of the need to change to a distributed data storage scheme:
- The disk and database storage requirements grows considerably with increase in the number of courses managed by WBCM.
- A new distributed architecture was developed to alleviate load on a single host in the third version. Thus avoiding the impact of an increase of courses managed by WBCM creating a bottleneck. WBCM data are stored in multiple hosts as shown in Figure 1. The host used for storing either a database, or a file repository, is decided by the administrator. A database and a file repository may reside on the same host, as shown in Figure 1 where Host-1 has both a Postgres database and a file repository, Host-2 has only a file repository, Host-3 has only a Postgres database. A host may be used for storing data about more than one course run.

### 3.2 Client-Server architecture for interface access

There are two kinds of CGI resources for WBCM, namely authenticated and unauthenticated. We use an authentication mechanism provided by the Apache web server.

As shown in Figure 1 a web client makes requests via an HTML interface to WBCM generated by Perl scripts on the web server. All the HTML pages of the system are...
dynamically generated (i.e. when they are requested, the corresponding CGI script is run on the server and result is displayed). This is desirable as up-to-date information must be made available. For authenticated resources, when the web client makes a request, the server sends a response requesting authentication information. The user is prompted to enter their username and password and this information is submitted to the server for verification. If the information is correct, the server sends a response to the original request made by the web client.

To obtain the response for the web client request, the web server executes an appropriate WBCM script, which in turn queries the database and accesses the file repository to generate a dynamic HTML page.

Dynamically generated pages require server resources. The scripts can be executed from different web servers, distributing the server burden. Automatic distribution of the server load is an interesting topic for improving performance of the system. Currently, we are expecting users to move to a different server whenever performance degrades considerably or they may be instructed to use different servers when all (or most of) the possible users are at one place (e.g. during a class test).

3.3 Database design

WBCM manages a huge amount of information. The following entity-relationship diagrams and description of the tables gives an overall picture of the database design for WBCM. The ER diagram in Figure 2 shows relationships that affect online assignment submission. Each assignment comes under an assignment category, which may be an online test, an exam, a lab assignment, etc. Each section should have assignment categories associated with it. Student groups can be made for assignment submission that are under the same assignment category. Student cohorts may be divided into sections and an assignment may require individual and/or group submission.

All the information about each course is distributed between two databases.

![ER Diagram](image)

Figure 2: Online submission relation.

3.4 CGI scripts

CGI resources are distributed among directories to facilitate www authentication. Directories are for admin, faculty, faculty and supporting staff, student and public access. For each course run, a soft link is created to each of above-mentioned directories except the public access directory. The course run directory also stores all the necessary files for www authentication.

The web pages are generated dynamically by querying the database for up-to-date
information. A Perl DBI module is used to make connections (remote/local) to Postgres databases. Perl eval statements along with Postgres support for commit and rollback are used for transaction control.

3.5 Authentication

User authentication is an integral aspect of such a system. We extensively use the authentication mechanism provided by Apache (based on .htaccess). We do not describe the mechanism used by Apache here. Instead the interested reader is referred to the Apache documentation available at http://httpd.apache.org/docs/.

Use of http authentication requires some pre-planning by the programmer. Planning starts with the identification of different groups of expected user who should authenticate themselves. For WBCM these different groups are “administrator”, “faculty”, “evaluator” and “student”. All the cgi resources used by these groups are kept in their respective directory (i.e. each group has a different directory).

Each course has its own group of “faculty”, “evaluator” and “student”. When a course is started by an administrator, a local course directory is created under the above-mentioned directory as a link. Under these directories a course-specific password file is maintained which contains a user name and encrypted password for each of the group members. In our scheme the password file is maintained by a script, as group members may change. We make sure that for students who already have an account on the system hosting WBCM, the username and password for WBCM authentication is the same. Otherwise the students are given a roll/user name and some initial password automatically. For the current scheme staff should have an account with the system hosting WBCM.

3.6 File repository directory structure

The submission directory structure is shown in Figure 3. In addition to this we have a similar assignment description directory structure. As shown in Figure 3, the submissible directory structure may keep submissions for different runs of courses. That is why the immediate sub directory is named "course run (1..n)". This should be the identifier of the course run - in our case, a combination of the course code, year and semester. Classes are divided into sections, requiring a sub directory for each section (sec-1, sec-1..sec-m). For each section we have an assignment category having assignments, giving: category-1..category-o followed by asgn-1..asgn-2 levels of sub directory. Assignments are organized individually or in groups, so submissions are kept under roll and group subdirectories for individual and group submissions respectively. It is possible to distribute the repository over several machines.

Figure 3: Repository directory structure.

4. Key features of WBCM

The purpose of our web-based utility is to provide a simple yet powerful interface for managing courses, along with the flexibility of online submission for the students. The top-level course management access page is shown in Figure 4. The interfaces are either public or protected and they are linked as shown in Figure 5. Note that the users of
WBCM are: course administrator, staff (teaching and/or supporting) and students. WBCM has few publicly viewable pages, which are mainly logs of important information pertaining to a course.

The current WBCM has the following features: admin, course table, assignment management, student/staff management, assignment/submission evaluation and submission log. The admin feature allows courses to be added or deleted and initial staff to be assigned to a newly added course. The course table lists all the courses currently availing of the course management facility and also has navigation buttons for staff, students or the submission log of each course.

Assignment management allows for the addition, modification and deletion of assignments. Necessary consistency guards are enforced. Student/staff management allows for the addition or removal of staff/student from a course. Students can submit assignments via a submission link in an assignment table which lists all the assignments currently in the course. Assignment evaluation allows staff to evaluate assignments and provide comments or justifications for the evaluation. Submissions may be re-evaluated, keeping a record of older evaluations. A particularly useful feature is the submission log which shows the status of all submissions and evaluations at a glance.
5. Learning management systems and Web Services

In this section we discuss recent standards work for learning management systems, the relevance of web services, and the current development of WBCM as a collection of web services.

5.1 Standards for interoperability and LMS components

There is now significant attention being paid to the development of open standards for learning management systems. See, for example, the centre for educational technology interoperability standards (CETIS http://www.cetis.ac.uk/) and also Diffuse (2002) for details. Many of the current standards developments are being directed at the management of learning content and interoperability issues. This is motivated by the need to de-couple content from proprietary packages and to ensure that content is not locked-in to specific platforms. For example SCORM (ADL 2003) is a standard reference model for shareable content and the IEEE LOM is a standard being developed for learning object metadata. The potential use of metadata and related standards has also opened up many new possibilities for a more federated approach to constructing cooperating learning management systems and components. Stephen Downes (2002) discusses these points in describing designs for a distributed learning object repository network (DLORN).

However, there is also a drive for learning management systems to inter-operate with other systems effectively. Other open standards are needed to support this as well as to encourage a more flexible, component-based view of learning management systems. The IMS Global Learning consortium developed standards in 1999 and 2002 for interoperability of Enterprise systems (IMS 2002). These address issues of transferring data between Learning Management systems and Enterprise systems such as student record systems.

In the UK, the more recent JISC e-Learning technical framework [http://www.jisc.ac.uk/index.cfm?name=elelearning_framework] is very relevant to our work. In the architecture described by Scott Wilson (2003), a service-oriented view of components in learning management systems is discussed with an application layer and common service layer as well as a user agents layer. WBCM provides several application layer services (course management, group management, assessment, grading) making use of common services (e.g. for authentication, authorisation, statusInfo).

5.2 The potential of Web-services

The benefits of a service-oriented architecture for distributed systems are mainly to do with loose coupling of components so that systems become more flexible and components are easier to add and change. The recent advent of web-services is likely to have a big impact on the future design of learning management systems. John L. Hall points out that: "From an operational point of view, the LMS and its key components—content management, user administration and system administration—should be 100 percent Web-deployable, requiring no additional client applications."

(Hall 2003). Web-services (see, for example Cerami 2002) are based on recent standards maintained by the W3C (http://www.w3.org/). Their purpose is to enable components of distributed applications and other services to be provided over the web with a language-neutral, platform-neutral, and vendor-neutral interface. There is significant interest from the IT industries (including the involvement of all the large IT companies) in driving this new approach to distributed systems forward. The key factor is the development of global standards to enable this. The standards are based on the use of XML for describing data to be transferred and SOAP http://www.w3.org/TR/soap12-part1/ to wrap messages for delivery via HTTP. There are also standards for a language for describing services in a machine-processable form (Web-Service Description Language -WSDL http://www.w3.org/TR/wSDL) and for directories for the discovery of services (Univeral Description, Discovery and Integration – UDDI http://www.uddi.org/). Web-services are designed to be available over the web both for human-readable access (via a browser), and also for access by other software (and other services). The fact that web-services can even be discovered, and bound to, dynamically at run time is an important new feature for distributed computing and will eventually enable complex services to be created by dynamically combining simpler services.

For learning management systems, web-services will support the service-oriented architecture proposed by JISC (discussed earlier), and also ensure simpler integration of
services through the web-services standards, giving end-user/developers much more control over the design of an LMS.

Some proprietary LMS products are starting to advertise web-services features. A related academic project is Ternier et al (2003) which describes possible use of web services with the ARIADNE learning object repository system (Duval et al 2001).

5.3 WBCM and Web-services

The WBCM system is now being developed as a collection of web-services so that it can provide highly reusable components which could be made to fit in with other LMS components and work alongside them. The fact that it is web-based already, makes this transition relatively easy. The web-services version of WBCM involves the development of appropriate (implementation neutral) XML schemas for the various forms of information required and supplied by WBCM at its interfaces. Some open standards such as those proposed by the IMS Enterprise standard are already available for this.

One of the aims of the web-services version of WBCM is to isolate more of the implementation and design decisions from its main functionality and interface. For example, hiding details of the distributed nature of the repositories, and abstracting from some of the current specific data details. With the development of standards for parts of the XML schemas used in interfaces, the potential for easy integration and inter-operability with other course management or learning object management components will be greatly enhanced.

As an example, consider a service which reports assessment marks or grades for a student on a course. In earlier versions this would be a facility in a web page which would (via http and CGI) retrieve information from a database and present the information in a web page. In the web-services version this is decomposed into a back-end web-service which, when invoked, would deliver the information in XML according to a documented schema. The front-end presentation as a web page from the XML is simple to achieve with XML technologies. However, it is also simple for other services (such as a student record service) to directly process the XML and retrieve marks from the web-service. Clearly, such a direct link is always possible with appropriate programming. What is new is the ease with which the inter-operability link can be made through the generation of an XML schema for the data and standard technologies to (i) generate a service description and (ii) to process such a description and automatically use the service.

There are also evolving standards for security aspects of web-services (including authentication, message integrity, non-repudiation, etc.) so that more generalised solutions to security can be explored.

Our new design is based around the following application level service provisions

5.3.1 Mark reporting service:
This retrieves and reports on marks for individual students or groups of students for an assignment, returning data as XML (as described previously).

5.3.2 Local marking services:
The current WBCM interface provided a web-based marking facility. However, in some cases the necessity of a web access could be a disadvantage. For example, if an instructor wishes to mark assignments while on a train, web access as a necessity is problematic. A better scheme might be for him to have a copy all assignment submissions available to him locally. This would require the instructor to first download all (or some of) the submissions to his local m/c. Then he would have to mark them and record his comments and finally upload the marks. Two web services are clearly involved, one to download the submissions of a set of students and another to upload the marks with comments. A local application would be desirable to properly organize the marks and the comments. The local application could very well be third party, though it would be desirable to have simple prototype applications available as part of the tool. This would make the tool more usable.

5.3.3 Course administration service:
This will authenticate users and allow updates to course information, including generation of a new run (with duplication of information where appropriate). The service allows students to be added or removed from a course. Similarly instructors may be added or removed from a course. Differentiation of capabilities of instructors is possible. Only primary instructors may possibly perform a proxy submission for a student or allow resubmission of a student assignment after marking is over. Also, only primary instructors may add/modify/delete assignments. The administration service could
assign or retract such capabilities from course instructors.

5.3.4 Assignment creation service:
This will authenticate users and allow creation based on a marking scheme (criteria, weightings etc.) to be generated by interaction between the user (designer) and the service. The service would return a URL for identification of the assignment. The URL might also be a link to an XML document for the assignment description and marking scheme.

Services are also required by the above services for: accessing information on courses, instructors, time slots, enrolled students, etc.

The current WBCM could easily be extended to add features for complete courseware management (assignment tutorials, references, articles, internet resources, question paper etc.), although it currently only keeps information about online tests, assignments and course notices.

We have discussed the current evolution of this tool into components in a web-services architecture and how this fits in with recent views of LMS designs based on loosely coupled components as proposed in the JISC architectural framework (Wilson 2003). We believe that web-services provide for both a service-oriented architecture and full deployment over the web.

The importance of open standards for such developments has been discussed and, in particular, the potential impact of web-services for learning management systems. The new development of WBCM is aimed at improving the tool's potential for integration with other course management tools and LMS components. It will also open up some of the modularity for other developers who might want to use some services but not all of them.

Although the current system has security aspects implemented using features of the Apache web-server, it is clear that further developments of proposals for XML-based security standards for web-services are likely to have an impact on the design of WBCM in the next two years. For example the Security Assertion Markup Language v2.0 is under development (http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=saml) (SAML 1.1 was ratified by OASIS in September 2003), and OASIS work on Web Services Security is ongoing (http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wss).

The key services as described earlier may evolve to become sharable objects. Each service provider component has its user interface and script for completion of the service.

Furthermore, a WBCM component may be developed as a sharable component to enhance the functionality of an existing system (Open or Proprietary Service Layer Component) (Downes 2002). The components access interface should provide options for customization of the services.

6. Conclusions
We have described the architecture of a web-based course management tool (WBCM) that has been developed and is in current use in India. The main benefits of using the tool have been: its support for the co-ordination of many courses, even with very large class sizes (100-300); its simple, descriptive and consistent layout of interfaces, making it quite easy to learn and use; the extensibility of the architecture deriving from the modularity of WBCM.

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http://www.ejel.org


A Government Crossing the Digital Divide to Promote ICT for Adult Learners

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Abstract: The importance of information and communication technology (ICT) for modern business cannot be questioned and has lead ICT professionals to design, develop, implement and support ICT infrastructures in both the public and private sectors. Organisations, universities and therefore governments face the enormous difficulty of trying to achieve successful training programmes in areas such as ICT and subsequently increased employee numbers and the acceptance of technology by mid-career employees. WBT systems do provide numerous benefits to both the trainer and the learner. Theoretically, the systems are limited only by the technology utilized by the participants involved. These systems can be customized to the requirements of the end-users providing both participative and didactic training. They foster collaboration and reduce the boundaries of the traditional training or education model. Conversely, as with the most profound examples of technological breakthroughs, there are issues or disadvantages that should be addressed before investing in another ‘solution’. However this research conducts an analysis of a case organisation targeted by a government wishing to eliminate barriers to the acceptance of ICT by mid-career employees.

Keywords: Information Communication Technology (ICT), Web-based Training (WBT), Adult Learning, User Acceptance.

1. Introduction

Appropriate training and education are important in today’s global market (Bocij et al, 1999). Many organisations make the mistake of not training their employees adequately in the utilization of ICT or in the use of internal information systems. This error in judgement is often due to the expense of providing training and the loss in productivity when employees are absent (McCormack, 1997). In some instances the wrong training is provided. Davis (1989) represents one of the original and most influential researchers in the area of user acceptance of technology and therefore ICT. He synthesises the findings of a range of diverse research streams to propose a number of constructs that are relevant to technology acceptance. These constructs fall into two broad categories, ease of use (EOU) and perceived usefulness (PU). Davis suggests a chain of causality between these categories: greater ease of use leads to higher perceived usefulness which in turn leads to more usage of technology. However different approaches can be applied to training (Dickson et al, 1997) and ‘on the job training’, is the most common approach. The reasoning for this approach is that, having obtained the job an employee can train while doing the job.Argyle (1994) argues that research shows that it is an ineffective approach to training as an employee could be doing the same job for years and not acquire appropriate social skills. The perception that something will come with experience is fraught with misconceptions (Maguire, 1986), as the learner could develop survival tactics rather than work related skills (Dickson et al, 1997).

The second approach to training in organisations is ‘model the master training’. This approach follows a type of mentoring as the new employee is ‘shown the ropes’, by an experienced employee, for example postgraduate training programmes. However, Maguire et al., (1978) discovered limitations to the technique, ‘experts can have bad habits’. The final approach is referred to as directed training, which can be categorised as the ‘thinking’, ‘feeling’ and ‘doing’, methods of training (Philips and Fraser, 1982; Laird, 1991; Irving, 1995). Thinking involves a didactic approach as the learners, are required to assimilate the content rather than to think (Philips and Fraser, 1982). The feeling based approach involved group discussions. The doing approach involves action learning such as ‘role playing’. An effective training system must combine different approaches to obtain the goal of the corporate training strategy, which is a skilled workforce. Technology is used in training to support the needs of the employees. Web-based technology can be didactic, support problem-solving activities and provide a collaborative environment. Therefore, training can be delivered directly to the learners and the learners can collaborate with one another through online discussion forums. Training can be successfully handled online (Mason, 1990) to support a combined training model to incorporate both online and offline training. WBT allows “educators and students alike to perform learning related tasks”. (McCormack et al, 1997).

The development of a training system requires careful investigation into the requirements of
the problem situation (Checkland et al., 1990). The developer must consider factors such as the methods employed by employees to learn, incentives to ensure use, the identification of goals, objectives and the different roles that are needed to support this new approach to training (Driscoll, 1998). Models of factors that should be considered in the design of an instructional system are available (Rossi et al, 1993). For example, the developer must consider motivational factors, cognitive factors and instructional design principles prior to the development of the system.

2. Theoretical foundation

In ‘lay terms’, traditional training, is regarded as a training environment which encourages passive learning, does not develop problem-solving skills and ignores the individual needs of the learners, therefore it ignores the requirements of its End users. Traditional training has always incurred criticism, it is felt that despite huge advances in technology, the training room will always remain the same, that is, dysfunctional. It could be argued that advances in technology, such as multimedia and virtual simulations, have left the traditional classroom trailing behind with learners expecting more and more. The intensity of competition in the business market advances in technology, and a strong shift towards a knowledge-based economy have each contributed to the demand for virtual (electronic) learning environments. “There is no knowledge that is not power”, and the organisation (public or private) that can utilise its knowledge resources more effectively than its competitor will persevere. An effective training support system can provide an organisation or a university with a strategic advantage in the market. Learning /training environments can help create and maintain skills and therefore the corporate knowledge base. They both alleviate the strain on corporate resources and facilitate employees changing training needs (Driscoll, 1998).

This paper focuses on the design of a suitable training system to support mid-career employees and encourage collaboration among the employees and other organisations. The research outlines the factors necessary for the successful implementation and use of the system, through the investigation of current research and the analysis of the case environment. It also highlights the potential of the system to overcome the physical and pedagogical barriers of the traditional classroom. WBT environments can, when properly mediated and structured, facilitate cooperation (Entwistle, 1997), reduce conflict and avail of all of the benefits that technology can provide (Johnson and Johnson, 1990). The study concludes that training systems have the potential, when properly designed, to foster learning and collaboration.

3. Research objective

The organisation chosen for this study was Golden Vale plc, a multinational food co-operative. The case study organisation involved in this research implemented a number of ICT training programmes in the past, all of which had failed to increase the use of ICT in the organisation. Preliminary research integrated the construction and implementation...
of an online system (Figure 3) with a training programme (Figure 2) for mid-career employees in Golden Vale. Davis (1989) identified two constructs as relevant to user acceptance of technology, namely ease of use (EOU) and perceived usefulness (PU). These constructs were operationalised into a set of principles to underpin the training programme, which was delivered in two phases, each specifically addressing one of Davis’ constructs. Additionally the study’s external monitor (the Irish Government) sought to remove any barriers to the acceptance of ICT and subsequently increase employee skills in the target case.

4. Research approach

The overall research orientation was qualitative and reflexive in nature. A grounded theory perspective was adopted, and in line with this, an initial framework incorporating Davis’ (1989) constructs as preliminary ‘seed categories’ was created (see Figure 2). The novelty of this study was that the researchers went back to evaluate the ongoing success and value of the training system in Golden Vale. Thus, the research approach adopted for the study was based on a two-tier research design involving an in-depth investigation of the case study environment through an examination of the barriers to the use of ICT (which was primarily a fear of information technology (IT)) and an evaluation of the training systems in terms of continued ICT usage.

5. Case background

Since 1947, Golden Vale plc has been one of Ireland’s largest food co-operatives. The company is a vibrant force not only in the Irish dairy industry, but it is also one of the top cheese processors in Europe, employing 2,100 people in Ireland and over 300 in its foreign subsidiaries. Golden Vale Plc. is based in the eponymous ‘Golden Vale’, a region noted for the quality of the agricultural land and its produce. The company is sited in one of the largest towns in the region, with a population of 2,667. Golden Vale is by far and away the largest employer in the area. Thus, any slump in the long-term viability of Golden Vale would clearly have a catastrophic social and economic effect on the region. The majority of their employees are local residents, and while the younger employees would have a high standard of education, many of the mid-career employees (aged 35 years and over) would have joined Golden Vale in their teens, without even finishing their second-level education in many instances. These employees learned on the job, and have few, if any, educational or technical skills to equip them to work in other industry sectors. Given this, the Irish government, obviously mindful of a number of disastrous social catastrophes in other Irish towns, which had been dependent on a single large employer who failed to survive, funded a training initiative.

Four organisations (or consortia) were identified, by the Irish government as the core participants of this research, to monitor and evaluate the training initiative. The group provided valuable data regarding the needs of adult learners as well as participants for the target group. The IT and HR departments of Golden Vale were also key actors in the study as well as the group responsible for the creation of the training system, the ESRC (the Executive Systems Research Centre). The target group played a central role in the development of this research, as the group were at the center of the evaluation of the project. Key members of the consortia were and still are responsible for the coordination of the different activities in the training system. However the target or test group were both the end users and evaluators of the training system. The identification of the roles and responsibilities of each of the groups was vital to the success of the project and the acceptance of the training system devised as a result of the initiative. The training initiative was intended to provide a solid training in ICT for mid-career employees through technology itself. Thus, one of the primary objectives of the initiative was to provide a more skilled work group who would be able to find work more readily in other industry sectors should Golden Vale experience a catastrophe. Employees were also aware of the risk if they were to become unemployed and of the importance of ICT literacy in improving their career prospects within Golden Vale. The company had initiated several ICT training programmes, in the past, facilitated by their internal IT department who brought in training consultants to provide off-the-shelf training courses in standard ICT packages, such as word processing and spreadsheets. These training programmes, while having been applied in a textbook fashion, were acknowledged as having had little or no lasting effect in persuading employees to make ongoing use of technology in their work. The company decided to adopt a different approach for this initiative, and contacted the main university in the region to seek assistance. The author, with a number of colleagues, met with the IT and HR staff in the company and a name for the project was
coined, M.E.E.T (Mid-career Employees Embracing Technology). The approach taken in previous training programmes in the company was discussed, and some of the participants were interviewed. It quickly became apparent that the employee base was not homogeneous in relation to their skills with ICT; thus, standard training programmes which tried to achieve an average common denominator would be inappropriate, in that those who were more advanced would find the material boring and lose interest, while those who didn’t understand the rudiments would be unable to engage with the material in the first place.

5.1 The target group
The target group was identified as a representation of the level of IT skills within the organisation. The data gathering techniques used, collected and examined information regarding the participant’s current level of computer skills, usage and future training requirements. The researchers deemed it appropriate to focus the research strategy on identifying the levels of computer proficiency and training requirements among the participants. The investigation strategy formulated to conduct the analysis stage of the research consisted of: interviewing a select number of the target group, group discussions and observation. The target group comprised of employees with varying roles within the organisation, senior management, administration, operators, supervisors and IT personnel. The group was interviewed to build a picture of the training system in operation and the system required. In total 16 interviews and 4 group discussions were conducted to ascertain the skills and the issues of the participants. The first objective of the data gathering techniques was to assess the participant’s level of computer proficiency and to group the participants accordingly. To ascertain this, each interviewee was required to rate their level of skills between 1 and 4, 1 representing a basic understanding of ICT and 4 an advanced level. The results enabled the researchers to determine the structure of the training system based on the different levels of skills. The information collected resulted in the following (see Table 1) breakdown of the target group’s level of computer proficiency:

<table>
<thead>
<tr>
<th>Computer Proficiency</th>
<th>Rating</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic understanding</td>
<td>(1)</td>
<td>22</td>
</tr>
<tr>
<td>Good understanding</td>
<td>(2)</td>
<td>17</td>
</tr>
<tr>
<td>Very good understanding</td>
<td>(3)</td>
<td>4</td>
</tr>
<tr>
<td>Advanced understanding</td>
<td>(4)</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>

The level of computer usage among the participants was in direct proportion to their proficiency level. The participants with a basic understanding of computers reported limited usage in their job descriptions. A high proportion of those interviewed, 62%, reported no use of computers in work related activities and 38% reported some but limited interaction. Those respondents with a good understanding of computers reported a varying level of usage. However, the opinion among the different groups was varied regarding the availability of computer resources within the organisation. Level 1 reported a mixed view with equal numbers rating the access as good, average and poor. However those with a good and very good understanding also rated access as good but the majority of the groups with a level two and three rating are required to use computers to do their jobs. Some of the respondents did however remark that availability was good but finding the time to learn new things was difficult. The majority of the members of groups 2 and 3 did recognise the importance of increasing their ICT skills. It is also important to note that 50% of group three own a home PC. All of the participants recognised the need to develop skills in ICT. Each group attached the same benefits to the development of a new training system. The participants listed both personal and corporate benefits. The personal benefits ranged from an increased chance of promotion, increased efficiency, home accounts, accessing the Internet and the ability to teach their children the skills gained as a result of participating in the training program. Corporate benefits included increased communication, informed decision-making, greater communication and efficient record keeping. The participants from each of the groups provided detailed lists of their requirements for the new training system (see Figure 1). They suggested ways in which increased training and therefore computer usage would improve their job performance. The participants identified the importance of a structured training system that would increase their computer literacy, generate ideas for

http://www.ejel.org
improved efficiency through incorporating IT into their work activities and help the participants solve problems when they arise. Participants also identified or requested training in fundamental applications such as Word, Excel and the Internet. Figure 1 presents the findings of the interviews conducted with the target group. Each level of participants as well as their managers, from prior experience with training initiatives, communicated a clear understanding of the factors needed for the system to be successful. Figure 1 also shows specifically the issues of each level. It therefore presents what they expect from the system. Each required customised training, small classes time to practice and a support system. However, due to the small number of employees level 3 and 4 were combined to form one level.

Figure 1: An analysis of the case environment

5.2 Training programme

5.2.1 Phase one – Generic training

The researchers decided to address each of Davis’ two categories by adopting a two-phased training approach (see Figure 2). The first phase proposed was a generic training phase, during which the basic ICT concepts would be covered at a pace appropriate to each group, thus addressing the ease of use (EOU) construct. Following completion of this generic training, the second phase would involve applied training customised to address the everyday work tasks faced by the participants, thus addressing the perceived usefulness (PU) construct. The chronological ordering of these phases is congruent with Davis’ (1989) proposed chain of causality namely that greater ease of use would facilitate a higher perceived usefulness of ICT, thereby leading to greater usage. The items identified by Davis (1989) as being significantly correlated with ease of use include easy to learn controllable, clear and understandable, and easy to use.
This phase of the study is concerned with operationalising these in practice in a real situation. The following facets of the programme indicate how this ‘ease of use’ construct was operationalised:

- An initial generic training phase was used to ensure that all participants achieved a reasonable level of literacy in ICT.

- Participants were allocated to one of three groups based on their current level of ICT capability. This ensured that the common denominator for training in each group was uniform, thus reducing the possibility that participants might be too self-conscious to reveal their lack of understanding of training material.

- All sessions were held in a very well equipped training laboratory, with state-of-the-art technology for the instructors and the participants.

- The training laboratory was in a ‘neutral’ venue, a short distance away from the factory floor where the participants worked every day. This helped participants to focus on the training and avoid distractions.

- The maximum duration of training sessions was restricted to two hours, thus ensuring that participants did not become overwhelmed with complex material, or bored with repetition of material already understood.

- The number of participants at each training session was kept low—a maximum of six participants at each session. This was intended to ensure that all participants’ performance and progress could be monitored to ensure they understood the concepts.

- Two instructors were in attendance at each session, thus achieving a trainee-instructor ratio of 3:1. One generally led the instruction, while the other had a roving role, visiting each workstation to ensure that all participants understood the material. When difficulties were encountered, the instructor would provide one-on-one instruction in a discreet manner until the difficulty was fully resolved.

- All the instructors were selected following personal interviews by the company. Golden Vale is a rural location, and the participants had a rural background. The instructors selected had a rural background in the main. The company were of the opinion that one of the reasons previous training initiatives had failed to deliver was that instructors were perceived as dynamic ‘city-types’ who were more comfortable with Internet

Figure 2: Framework for operationalising the M.E.E.T programme

*The WBT system was developed to support both phases of the training programme. It enabled the employees to participate in the customisation (EOU) of the system and to add to the system through the discussion forum (PU). The arrows used in the diagram highlight the complexity of the inter-relationship between the two constructs (EOU/PU), suggesting that not only does EOU lead to PU but that PU increases the level of EOU.
chat sessions over decaffeinated *latte* in cyber-cafes rather than in discussing hogget prices in a small tea-room. One can debate the rights and wrongs of such social stereotyping, but the rapport built up between the participants and the instructors was very impressive. At the end of the training, the participants visited the university to receive a Diploma, and the camaraderie between the participants and the instructors was very noticeable.

- The training material was designed to be user-friendly. Different lessons were prepared for each element of the training. Exercises were chosen to reflect the participants’ work place. All participants received a copy of the instruction booklets.
- The WBT system (see Figure 3) was also constructed to support and implement the training. The training material was available on-line, but in addition, a discussion forum was implemented. This enabled participants to provide feedback (anonymously, if desired) to the instructors. It also allowed them to pose queries, which other participants or the instructors could answer. All participants could see the initial queries and the discussion stream of answers from other participants and the instructors. This further extended the reach of the training as workers could log on to the system at home or at their work, during night-shift, for example, and pose questions for which answers would be available when they next logged on. The facility also allowed the employees to voice their satisfaction regarding the different elements of the training. This provided the participants with the opportunity to take part in the ongoing design of the hybrid training system, and therefore increase the likelihood of user acceptance (Whitten et al., 1994; Avison and Fitzgerald, 1995; Bocij et al., 1999).

![A Web-based Training System](image)

**Figure 3:** The training system (both online & offline)

### 5.2.2 Evaluation of Phase one – Generic training

This section presents the findings gathered during an interim evaluation of the training system. A questionnaire was designed and posted to each of the 45 participants in the target group to determine their reaction to the training system devised to their specification. Feedback through the Web facility (Figure 3) was also requested and collected by the researchers to aid in the ongoing design of the prototype system. The information collected and analysed by the ESRC researchers are presented in Table 2. The objective of this interim evaluation was to determine the satisfaction ratings of the participants in the study. Prior training models or systems had
failed to impact on either the employees or the organisation as a direct result of non-user participation. The obvious finding of this questionnaire as can be seen in Table 2 is that the satisfaction ratings were very high. The researchers could not detect any significant difference, statistically, between the groups of participants. The groups, as already described, were divided according to their current level of IT skills which were determined through interviews and observation to be novice, intermediate and advanced. The questionnaire was designed to determine the participant’s evaluation of the training received in the first phase of the training. Participants were required to scale their agreement or disagreement between 1 and 5. The maximum score on the construct is 1, indicating a strong agreement. Therefore the closer the rating is to 1 the stronger the agreement and a score of 5 would reflect the participant’s strongest disagreement. The instructors were also questioned regarding their evaluation of the lessons and therefore the training system designed to support their classes. The instructors were as optimistic as the participants regarding the predicted success of the project and the affect of the training system on the study. The instructors also reported an improvement in their own skills through delivering the classes and in utilising the training system to support their learners.

5.2.3 Phase two – Applied training

The items identified by Davis (1989) as reflecting the ‘perceived usefulness’ (PU) construct included, working more quickly, increased productivity, improved effectiveness and job performance, making the job easier, and again the obvious item, useful. These were operationalised in the study in the following way:

- Again, as already mentioned, at a high level, the separation of the initial generic training phase from the subsequent applied training phase ensured that the usefulness of the technology could be demonstrated in the second training phase. Participants had achieved a base level of capability, and the researchers had made several visits to them in their work environment, inspecting work documents with a view to seeing how technology could be incorporated into their everyday work routines to solve problems.

Examples include the creation of templates to automate manual activities like creating time sheets and home accounts. Systems, already in existence, were also demonstrated to highlight the application of technology within the company. These exercises stimulated ideas in the application of the skills developed by the participants from the programme.

In addition to the examples suggested by the instructors, participants were encouraged to identify ways in which the technology could be employed in their work. Potential projects were explored during the training sessions in the applied training phase.

- The participants were, like the general public worldwide, very interested in the Internet and World Wide Web, but felt their knowledge in the area was very limited. It was decided to leverage this to get participants to buy into the training process. Thus, the first introductory session for all groups of participants was a ‘web surfing’ session. This served to break the ice between instructors and participants in a friendly atmosphere. Participants were shown the rudimentary details and then began surfing the web.

Table 2: Summary of participant ratings for Phase 1 training

<table>
<thead>
<tr>
<th>Phase One – Construct</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Avg. Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructors were well prepared</td>
<td>1.3</td>
<td>1.5</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Course notes were useful and interesting</td>
<td>1.8</td>
<td>1.5</td>
<td>1</td>
<td>1.4</td>
</tr>
<tr>
<td>I felt free to ask questions during the course</td>
<td>1.9</td>
<td>1.3</td>
<td>1</td>
<td>1.4</td>
</tr>
<tr>
<td>Instructors provided clear explanations</td>
<td>2</td>
<td>1.5</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>It helped me develop my computer/technology skills</td>
<td>1.9</td>
<td>1.7</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Overall I was satisfied with the course</td>
<td>1.9</td>
<td>1.7</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Instructors ensured that I understood course material</td>
<td>2.3</td>
<td>1.7</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Interesting and stimulating assignments were provided</td>
<td>2.3</td>
<td>2.1</td>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td>Course challenged me to think</td>
<td>2.2</td>
<td>1.8</td>
<td>1.7</td>
<td>1.9</td>
</tr>
<tr>
<td>If stimulated ideas about how to apply IT to my work</td>
<td>2.5</td>
<td>1.9</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Overall Average</td>
<td>2</td>
<td>1.7</td>
<td>1.2</td>
<td>1.6</td>
</tr>
</tbody>
</table>

(1 = mostly agree - 5 = mostly disagree)
themselves using various search engines, and visiting sites recommended by the instructors. This session was also used to demonstrate the WBT system (see Figure 3), which had been constructed specially to support the training. As already mentioned, it had been decided as a matter of policy that sessions would not exceed two hours. However, this introductory session stretched this limit most as participants were so enthusiastic and wanted to continue. The enthusiasm of the first wave of participants ensured that all later groups were very keen to get started on the training themselves. The participants were all very satisfied with their knowledge of the web and saw it as a very useful skill to have achieved.

- Upon completion of the applied training phase, participants visited the university for a formal diploma presentation ceremony. The diploma parchments were accepted with pride, and many spoke of their satisfaction with their achievement, for many, the only educational certification they had ever received.

It was also intended that the training would be a dynamic and organic experience, capable of self-perpetuation. Thus, the advanced group were considered to have potential to play a considerable hands-on role in promoting the use of ICT throughout the company and in future training initiatives. This would be reflected in the job status of these individuals, thus, it would serve as a significant motivator.

5.2.4 Evaluation of Phase two – Applied training

A postal survey was chosen to complement the personal interviews conducted in this stage of the study. The function of this survey, like the first, is to conduct an evaluation of both the second phase of the training and the WBT system used to support the MEET project. This survey addressed the following issues:

- Determine the level of user satisfaction with the programme.
- Establish the effectiveness of the WBT system in supporting training within the selected environment.
- Establish whether the system was easy to use and therefore useful.
- Identify limitations, if any, that hinder the participants use of the system.

A total of 26 responses were received out of 45 participants, giving an overall response of 57 percent. For various reasons three of the responses were found to be unusable, for example some participants did not answer the majority of the questions asked. When the researchers analysed the responses, it was determined that they could be grouped according to the participant's level of computer proficiency. Each participant was asked to rate their current level between 1 and 5, 1 being novice and 5 being advanced. The responses collected were examined using basic statistical measures such as mean and medium. The researchers also presented various cross tabulations, to highlight the different groups responses to individual constructs as well as the overall average response to each question. Table 3 presents the findings of this postal survey; the main point to note is that the overall satisfaction with the hybrid training system was very high. As in the case of the first evaluation conducted the researchers could not find statistically significant differences between the groups or the different levels of participants. In terms of specific questions addressed, the construct with the highest rating of satisfaction is *The Material was well presented* which was encouraging, as the participants were very satisfied with the roles played by the instructors in both presenting the material and that of the roving role. The construct *I was able to get help whenever I needed it* was also high. One of the requirements determined during the analysis stage of the development was the creation of a support mechanism. This was facilitated through the WBT system, which provided 24-hour support to the participants. A high rating for the support obtained was very encouraging in determining the effectiveness of the system (see Figure 4). Constructs regarding the content of the site, *The material was well presented, The course level was too high* and *Material was easily viewed on the screen*, were also favourable regarding the effectiveness of the system. The training system was designed based on Davis’ model to be easy to use (see Figure 3). However it is difficult to determine if a system is both easy to use and useful. The satisfaction ratings received regarding the ease of use was encouraging as the participants found the site easy to navigate and therefore of use.

The researchers also identified limitations to the use of the system and therefore the skills developed through the programme. Lack of resources was identified during the first evaluation as the most significant complaint.
However, during interviews, participants highlighted problems encountered in the use of the WBT system, which were as a direct result of the resources within the organisation. Lack of resources in the guise of inferior network connections was a serious problem. However the organisation is currently addressing the issue to facilitate their employee needs.

Another issue raised during the analysis stage of the study highlighted the need to provide time as well as resources for participants to practice the skills learned. The problem was identified prior to the commencement of the study but it is a slow process and the issue is still evident as some of the participants felt that they were still limited by lack of both time and resources. Finally, the training system, despite the limitations of the environment addressed the requirements of the participants in the study. It provided facilities for the users to review the lessons interactively. The discussion forum provided 24-hour support, so that the participants were in constant contact with both primarily the researchers and the other instructors. For the first time the participants themselves were given the opportunity to help design the training system, on an ongoing basis through the feedback facility available through the WBT system. The system was an effective method of supporting the training project in Golden Vale plc and enabling group collaboration and evaluation by all of the parties (consortia) involved through feedback mechanisms.

### Table 3: Summary of participant ratings for Phase 2 training

<table>
<thead>
<tr>
<th>WBT System Construct (Golden Vale Plc.)</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Avg. Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>The objectives were clearly explained</td>
<td>3.8</td>
<td>4</td>
<td>3.8</td>
<td>4</td>
<td>3.9</td>
</tr>
<tr>
<td>I received enough training on the site</td>
<td>3.2</td>
<td>3.5</td>
<td>2.8</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>The material was well presented</td>
<td>4.2</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td>The course level was too high</td>
<td>2.8</td>
<td>1.5</td>
<td>3</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>The course level was too low</td>
<td>2.3</td>
<td>2.3</td>
<td>3</td>
<td>2</td>
<td>2.4</td>
</tr>
<tr>
<td>There was too much material to cover</td>
<td>2.4</td>
<td>2.8</td>
<td>2.6</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>The classes were too fast</td>
<td>3</td>
<td>3</td>
<td>2.4</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>The classes were too slow</td>
<td>2.2</td>
<td>2.5</td>
<td>2.5</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>I was able to get help whenever I needed it</td>
<td>4.2</td>
<td>3.5</td>
<td>4.6</td>
<td>4</td>
<td>4.1</td>
</tr>
<tr>
<td>The site complemented the training</td>
<td>3.6</td>
<td>2</td>
<td>3.6</td>
<td>3</td>
<td>3.1</td>
</tr>
<tr>
<td>The site was easy to use</td>
<td>3.6</td>
<td>3.5</td>
<td>4.2</td>
<td>3</td>
<td>3.6</td>
</tr>
<tr>
<td>The site was reliable</td>
<td>4.3</td>
<td>2.5</td>
<td>3</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Material was easily viewed on screen</td>
<td>3.7</td>
<td>2.5</td>
<td>4</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>The system was accessed without problems</td>
<td>3.6</td>
<td>3</td>
<td>2.8</td>
<td>3</td>
<td>3.1</td>
</tr>
<tr>
<td>It was easy to navigate through the site</td>
<td>3.6</td>
<td>2.3</td>
<td>3.8</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>The discussion forum was useful</td>
<td>3.3</td>
<td>3</td>
<td>3.2</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>Diagrams were clear and easy to understand</td>
<td>3.6</td>
<td>3.3</td>
<td>3.2</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Labs were available when I needed them</td>
<td>3.5</td>
<td>3.3</td>
<td>3</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>I could use equipment when I needed to</td>
<td>4</td>
<td>3</td>
<td>3.2</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>Easy to access the Internet</td>
<td>2.9</td>
<td>2.8</td>
<td>3.4</td>
<td>4</td>
<td>3.3</td>
</tr>
</tbody>
</table>

(1 = mostly disagree - 5=mostly agree)

## 6. Conclusion

Golden Vale plc is still one of Ireland’s largest food co-operatives. However, the majority of their employees have benefited, with managerial support, from a solid training in ICT and any fears they may have experienced prior to the M.E.E.T project are certainly reduced through the customised training and support received as a result.

Learning / training networks (see Figure 3), as discussed, provide many advantages in breaking down the communication barriers between educators and students or in this case between instructors and employees alike. Training is an important issue that requires an adequate support system to facilitate the training of employees (Crossman and Adam, 1999). An effective training system is regarded as a strategic tool in this competitive information age (Nonaka, 1995). Therefore, it is vital that the issue of training and the development of an effective training system remain high on the list of priorities of management in multinational companies (Laudon, K.C and Laudon, J.P 1998). As discussed in section 3 the objective of the M.E.E.T project (see Figure 1) was to provide solid training in ICT and reduce any fears, the mid-career employees targeted by the project, would have. The governments objective was, through the funding of the initiative, to provide a more skilled work group who would be able to find work more readily in other industry sectors should Golden Vale close due to some
The case study organisation involved in this research implemented a number of ICT training programmes in the past, all of which had failed to increase the use of ICT in the organisation. Preliminary research integrated the construction and implementation of a WBT system (Figure 1) with a training programme (Figure 2) for mid-career employees in Golden Vale. Davis (1989) identified two constructs as relevant to user acceptance of technology, namely ease of use (EOU) and perceived usefulness (PU). These constructs were operationalised into a set of principles to underpin the training programme, which was delivered in two phases, each specifically addressing one of Davis’ constructs. The overall satisfaction with the WBT system was very high. One of the requirements determined during the analysis stage of the development was the creation of a support mechanism. This was facilitated through the WBT system, which provided 24-hour support to the participants. High ratings for the support obtained indicated the effectiveness of the WBT system. The training system was designed to be easy to use. However it is difficult to determine if a system is both easy to use and useful. The satisfaction ratings received regarding ease of use were encouraging as the participants found the site easy to navigate and therefore of use. Davis (1989) states that if a system (or skills learned as a result) is easy to use then the skills can be applied and therefore useful.

A number of important conclusions can be drawn from this research. The researcher identified factors necessary for the development of an effective training system, to support any environment. The training system must be customized, easy to use and demonstrate applications of the skills learned. Previous training in the organisation consisted of off-the-self ICT packages and CBT (Computer Based Training) courses. The objective of this research was therefore to operationalize both Davis’s constructs and WBT into a training programme that could be used in any academic course. To be successful an education programme must increase the skill-set of the learners and to expand the learners understanding skills must be applied or regarded as useful.
Table 4: The barriers to ICT and the methods employed to reduce them

<table>
<thead>
<tr>
<th>No</th>
<th>Barriers to developing ICT skills</th>
<th>Reduced by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overcome inhibitions to the use of Information Communication Technology (ICT)</td>
<td>A user friendly (EOU) WBT system, interactive lessons and demonstrations (PU)</td>
</tr>
<tr>
<td>2</td>
<td>Expose employees to Information Communication Technology (ICT)</td>
<td>Introduce the WWW through the WBT system</td>
</tr>
<tr>
<td>3</td>
<td>Delivery of course material</td>
<td>Both in class and online</td>
</tr>
<tr>
<td>4</td>
<td>Establish a point of contact between the instructors and the target group</td>
<td>Through the Discussion Forum, Feedback Facility and in the lab</td>
</tr>
<tr>
<td>5</td>
<td>Participation by the target group in the design of the WBT system</td>
<td>Feedback page</td>
</tr>
<tr>
<td>6</td>
<td>Provide 24 hours support to employees</td>
<td>Online material and contact facility</td>
</tr>
<tr>
<td>7</td>
<td>Provide methods for employees to test their knowledge</td>
<td>Online exercises and examples with playback features</td>
</tr>
<tr>
<td>8</td>
<td>Supplement classes with online support</td>
<td>Discussion Forum/Email/Feedback</td>
</tr>
<tr>
<td>9</td>
<td>Easy to use WBT system</td>
<td>User friendly navigation system</td>
</tr>
<tr>
<td>10</td>
<td>Platform independence, (Windows, Macintosh and UNIX) for home use</td>
<td>Web-based system</td>
</tr>
</tbody>
</table>

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A Tutorial Task and Tertiary Courseware Model for Collaborative Learning Communities

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Abstract: RAED provides a computerised infrastructure to support the development and administration of Vicarious Learning in collaborative learning communities spread across multiple universities and workplaces. The system is based on the OASIS middleware for Role-based Access Control. This paper describes the origins of the model and the approach to implementation and outlines some of its benefits to collaborative teachers and learners.

1. Introduction

Previous research in MANTCHI and Vicarious Learning developed a model with significant potential for giving the “learner’s voice” a central place in the creation and animation of computer mediated learning experiences, particularly in the design-based disciplines which Simon (1996) has identified as the sciences of the artificial, and in work-based learning. Post-compulsory education involves inducting the student into a community of learners. Within such a community, learning results not only from student-student and student-tutor interaction, but also via ‘vicarious learning’ from observed interactions amongst other community members. Students learn by doing, feedback and discussion, and they learn from observation of one another’s contributions to task solutions and the queries, feedback and discussions to which these give rise: “students get value from overhearing discussions or at least questions and answers involving other students i.e. ‘lurking’ in net parlance as third parties to a learning exchange” (Draper, 1998).

Vicarious Learning is a research programme, in the sense of Lakatos (1978), within the broader areas of Learning Technology and Cognitive Science. This programme is giving rise to a range of insights and techniques that we now believe are ripe for transfer into the wider user community. Within the Vicarious Learning programme, our emphasis is on the creation of Tertiary Courseware (Mayes, 1995; Mayes & Dineen, 1999; Newman et al, 1999) which captures learners’ own contributions, queries and interactions with tutors, as a resource for subsequent learners. For the research programme more generally see e.g. Lee et al (1997); Lee et al (1999); Mayes & Neilson (1995); Mayes (1997); McKendree et al (1998); Monthienvichienchai & Sasse (2003).

We are developing a scalable, secure, distributed platform for collaborative tutorial support and the management of vicarious learning across organisational boundaries. This is a generalisation of the “Atoms and Trails” model developed in MANTCHI (Newman et al, 1999). The present paper expounds the main concepts, developed in MANTCHI, upon which we are continuing to build, and discusses our approach to some particular security-related issues that arise within such a setting.

MANTCHI, funded by the Scottish Higher Education Funding Council’s UMI programme, was a multi-university project in which tutors collaboratively managed problem-based learning in the field of Computer-Human Interaction. Central to the MANTCHI pedagogy was the view that the teacher plays a supportive role in the development of the student as a member of a learning and professional community. The student learns primarily through the performance of tasks, usually problems to solve, or ‘constructions’ where the student produces an output – a design, a paper, a report, a programme, a presentation. The student’s performance is then given some form of feedback from the tutor, this may range from a formal assessment through to informal comments and encouragement or constructive criticism. The whole process is iterative and in the best kind of learning-teaching settings it resembles a dialogue.
2. New types of courseware

Extending the work of Laurillard (1993), Mayes (1995) has described a three stage-model of this process, distinguishing between the stages of conceptualisation (where the learner comes into contact with subject matter expositions), construction (where the learner tests his or her developing understanding through the performance of a task) and dialogue (where the learner gets feedback, asks questions, and starts to creates a new conceptual framework, or tunes an existing framework, for understanding. This account can be mapped onto types of learning technology:

- **Primary Courseware** is courseware intended mainly to present subject matter. It would typically be authored by subject matter experts but is usually designed and programmed by courseware specialists.

- **Secondary Courseware** describes the environment and set of tools by which the learner performs learning tasks, and the tasks (and task materials) themselves. Here, the products are volatile and of varied quality.

- **Tertiary Courseware** is material which has been produced by previous learners, in the course of discussing or assessing their learning tasks. It may consist of dialogues between learners and tutors, or peer discussions, or outputs from assessment.

The following example illustrates the co-evolution of Secondary and Tertiary courseware, by reference to the MANTCHI concept of Atoms and Trails.

In the Atoms-and-Trails model (illustrated in Figure 1), an Atom is Secondary courseware which provides a task to motivate problem-based learning, and a Trail is Tertiary courseware which is built using students’ solutions, student-tutor discussion and student-student discussion. Because solutions to an earlier version of a problem will be provided as a learning resource, it is necessary for the Secondary courseware to be re-created in a new guise, so that the students have a challenging problem to solve. Thus, an Atom will have two or more (successive or cyclical) instantiations. An Atom therefore consists of an invariant part (for example, materials for an exercise on interface modelling using Statecharts) together with parts specific to an instantiation (for example, in Figure 1 the initial version relates to a Walkman, but later versions are generated, the second version relates to a Radio Alarm, and so forth). Via Hyperlinks from the variable part of the later versions, student solutions to earlier versions, together with tutorial feedback/discussion about those solutions, are made available as a resource for vicarious learning. These tertiary courseware elements are known as the ‘Trail’. Figures 2 to 4 illustrate some elements from the Trail available to students attempting the Radio Alarm version – i.e.

![Figure 1: The Atoms and Trails OM model (Statecharts example)](http://www.ejel.org)
• the problem originally set for students doing the Walkman version of the Atom,

• one of several student-group solutions (this one hand drawn and scanned),

• fragment of dialogue about the solution between tutor and group.

Part 1
Deliverable: each group should submit a Statechart description of the device, with a commentary giving:
• a description of the functional behaviour accompanying each state transition, where this is non-trivial;
• a note of any areas of uncertainty, either about the exact behaviour of the device, or about how to express its behaviour in the notation;
• a critique of the design in terms of the characteristics of the state space as revealed by the analysis, and any usability problems which might be predicted from the results of the analysis.

Part 2 - Comparing different submissions
Your group should compare your own analysis with the results from another group. (All the submissions will be readable by everyone after the submission date.) The external expert, will also provide feedback and comments on all the specifications.

Part 3 - Modifying the interface
A “music search” facility is to be added to the device (assuming it does not already have this facility: this appears to be true of most Walkmans at the moment). With this facility enabled, the user can ask the device to advance to the next recorded track. (Presumably it positions the tape at the end of the next gap which it finds.) On most tape players with this facility, a new mode is introduced, which has to be selected using a separate button. When the device is in this mode, the effect of the “fast forward” button is changed to “seek next track”. (Normally the “fast rewind” button would similarly be overridden to mean “go back to start of current track”.) This may or may not be the best solution for a Walkman. Your task is to modify the interface design to give access to this facility, and express your modified interface in Statechart notation. In addition, the rest of the interface may also be amended to address any problems shown up in parts 1 and 2.

Deliverable: a fully-annotated revised interface design and Statechart specification for the device with the extended functionality suggested. Your annotations should include (in structured English, or other semi-formal notation) a description of the internal behaviour on each state transition where this is non-trivial, a description of how and why the existing design has been changed (if it has), and discussion of how use of Statecharts has helped (or hindered) in designing the interface extensions to give access to the new functionality.

Feedback on this part of the work will be provided by the tutor to each group individually, but will not be made generally accessible until after completion of the course.

Figure 2: Problem originally set for students doing Walkman version of Statecharts Atom
3. Requirements for supporting the model

MANTCHI devoted a very high proportion of its resources to Evaluation; thus the lessons learned by the project community are well documented and evidence-based. A general problem with the evaluation of MANTCHI, however, was that the emergent lessons of the research were not anticipated in the original planning – in particular the invention of the Atom and Trail model was not itself fully evaluated (Newman, 2001).

The approach used was Integrative Evaluation, which recognises that students will pursue their learning objectives by different routes depending upon which resources they find most readily available, informative and usable, so that one cannot evaluate technology in isolation from student learning strategies and the whole overall context within which the
They do not adequately support different approaches to presenting materials, including simulations, visualisations, animation, video and audio.

They do not adequately support different types of learning – e.g. factual, discursive, experimental, cooperative, and vicarious.

They do not adequately support re-use of materials indifferent institutions, at different levels of teaching and for different presentations of the materials.

It is important to recognise that these problems are very closely interlinked – for example the available security models inhibit the management of learning and learning materials because insufficient support is given to the kinds of activities of different roles in different phases of the academic process. For this reason the approach we have adopted to security in our current work is based on a form of Role-Based Access Control.

The core components of an atom are:
1. A Tutorial Task to be carried out (secondary courseware).
2. Links to background material relevant to the task (primary courseware).
3. Links to trails (Tertiary Courseware).
4. Administration information, e.g. details of hand-in arrangements and deadlines.

These components vary in the frequency of maintenance. Component 1 will change frequently, possibly each time the atom is presented; however, there are benefits to be had if the core content can be ‘recycled’ – e.g. having three different versions of the Statecharts Atom, and using each one in successive years (or semesters) returning to the first one on the third ‘instantiation’. Component 2 in general will require only routine maintenance from the subject specialist. Component 4 may vary even within a given term or semester, as for example when students from several different universities are studying the same atom. It should be made easy for academics to manage these changes, but the fact that the atom is built up of such components should not be apparent to the student, who should be presented with the image of a seamless web page or site.

We assume the following roles: students, subject specialists, local tutors, and administrators. These roles are parameterized – for example, a student is a student on a particular intake of a particular course at a given university, on which a particular version of a certain atom is used. General policies will
dictate, for example, that if a trail exists that was created from version V of atom A, then if a user is a student on a course that uses version V of atom A, then he/she cannot see that trail. Some policies will relate to events or temporal constraints, such as coursework having been submitted or marked.

The model is based on reciprocation, so specialists and tutors are drawn from the same pool. HCI lecturers provide each other with atoms; a subject specialist may also optionally agree to provide feedback for another's students. Tutors may also take on some or all of the administrative roles, (providing system support, checking submissions, posting marks, etc).

The fact that there is no clear demarcation of roles based on individuals is an important characteristic of the system. Because the approach is intended to support collaboration across multiple universities, and between universities and companies (e.g. in workplace learning), tutors and students will commonly be in different administrative domains from subject specialists, with the whole process being supported by a federation of interworking services.

4. Implementation

As described above, the MANTCHI project found that traditional approaches to security, for example as implemented in the UK's Athens password system for controlling access to networked electronic learning resources, were much too inflexible to support this new learning model (Newman et al 1999). Role Based Access Control provides a more flexible approach to security which we argue is more appropriate to the needs of this application (Gong & Newman, 2002). The RAED implementation uses the OASIS role-based access control architecture (Bacon et al, 2002), which allows secure interoperation of services in an open, distributed environment. OASIS provides an approach to distributed systems security based on formal policy definition. It has the following properties which make it highly suitable for our needs:

- Privileges are based on roles rather than identity. For example, suppose there is a member of the university staff (perhaps an administrator) who is also taking a course part-time. They will have certain access rights over certain files attached to most of the courses in their role as administrator; they should not have these rights over the equivalent files belonging to the course they are taking.

Similarly final year students may be used as tutors for first and second year courses.

- It is flexible enough for our needs. The mapping between individuals and roles is many-to-many. OASIS is session-based, so an individual may log on to one course with certain privileges based on their role, e.g. student of that course, administrator, specialist, local tutor, potential student, etc. – and subsequently log on to another course in a different role, with different privileges.

- It affords automation of much of the tedious and potentially error-prone tasks associated with the atoms-and-trails model.

- It can cope ably with environmental constraints – a date having passed (or not), or an event having taken place (or not).

OASIS supports parameterized policy elements, rule-based policy definition and session-based, distributed operation. Parameterized RBAC systems augment a given role credential with attributes. In the case of OASIS, its role activation and privilege authorization rules are also parameterized, and can perform environmental interaction for the sake of operations such as database lookup, or temporal checks. These policy rules are specified mathematically in a simplified Horn-clause logic (described in earlier OASIS papers as a 'Role Definition Language' – RDL), and are expressed in an XML format in the current implementation.

OASIS appointment satisfies the requirement for persistent credentials in a system. An OASIS appointment may certify employment, possession of academic or professional credentials or membership of a group. It may also be used to delegate privilege indirectly. In this case, an appointment certificate is issued by the delegator to the delegatee and this is a required credential for activating the delegated role, and therefore acquiring the associated privileges.

The current implementation of OASIS uses Enterprise JavaBeans to maintain role state within sessions over a secure OASIS network. Users authenticate with OASIS-aware portals using appointments, in this case X.509 certificates containing OASIS extension fields. Distributed OASIS services can communicate with each other using SOAP over HTTPS connections; within such a network it can offer fast revocation of credentials.

http://www.ejel.org

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The RAED implementation provides a role-based access secured infrastructure for globally distributed electronic courseware. The RBAC middleware employed is an implementation of the OASIS architecture. On the client side, the courseware is presented as web pages, which are dynamically generated, based on a set of rules for each role coupled with results from database queries. For example, students logged in to the system will be presented with pages tailored according to which course they are enrolled in, and any related material to which they are allowed access as specified by a local tutor.

Each atom is individually authored by an atom expert. These atoms include secondary courseware such as exercises, usually with links to primary courseware (outside the system) plus a form of tertiary courseware called trails. A trail is a conceptual path from a task specification to solutions created by previous students and associated discussion. The visibility of trails is specified by the local tutor for each group of students in the system. (Ultimately there will be meta-policies that control this access). Of course, as indicated in the model described above, there is an initial phase in the lifecycle of an atom when no students have ‘taken’ it and therefore there can be no prior solutions and discussions out of which a trail or trails can be created.

The system is transparent to users inasmuch as the complexities of combining material from several distributed sources are completely masked so that students see a single unified web site, although often even a single page combines information from distributed sources across two or more domains.

A database driven web site is a dynamically generated web site built by a server to handle requests from browsers. The HTML code is compiled by a server-side set of programs. Standard database driven web sites do not however include a fine grained data access model. OASIS is a middleware security technology that allows the definition of roles in the system that users may enter in order to view different parts of the data.

An OASIS-protected web site includes an additional layer of access control. The OASIS server deals with requests from the web server and checks whether the connected client has sufficient privileges for accessing database data according to the policy specified. When for example a client authenticated at Strathclyde University wishes to access data governed by the Glasgow Caledonian University domain the request propagates from the Strathclyde OASIS server to the Caledonian OASIS server. For this to occur a shared policy must be agreed between the two institutions, giving effect to an appropriate service-level agreement; thus there must be a shared ontology of roles across the collaborating institutions so that the role membership credentials issued by one institution can be appropriately interpreted in the other domain. In the present example, the Caledonian OASIS server would check the policy file plus any environmental constraints and decide whether to allow the access to additional roles and/or local data by the requesting client authenticated at, and allocated initial roles by, the Strathclyde OASIS server.

5. Discussion

The RAED project is ongoing. One aim was to test the appropriateness of RBAC for e-learning, particularly when distributed sites are cooperating. Our experience to date confirms that separating system and application administration simplifies the overall task and minimises the risk of errors, particularly when distributed sites are cooperating. System administration includes registering individuals and recording in a database, or certifying, their employment or group memberships. Application administration includes the expression and enforcement of role activation and authorisation policies, including service-level agreements between distributed institutions. For example, if GCU students are accessing material at Strathclyde, it is sufficient for the Strathclyde system to accept a GCU certified student certificate as a credential for activating a student-on-course role. One institution need never be involved with details of the individuals enrolled at the other. The fact that OASIS defines service-specific roles which are activated within sessions, as opposed to generic, persistent roles which are used for a wide variety of purposes, allows access control to be defined precisely, according to the principle of minimum necessary privilege.

We have also found that there are great advantages in the transparency of the system from the point of view of the end user, in the generality and explicitness with which policy can be expressed, by contrast with the situation in existing Managed Learning Environments, and in the ready handling of exceptions. From the student’s point of view,
we are now assessing the extent to which the system’s transparency and the support given to the learner’s voice in the process of academic dialogue will succeed in promoting the attractions of vicarious learning.

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CaseMaker: An Environment for Case-based e-Learning

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Abstract: Experience with case teaching, both at the Copenhagen Business School and also on a more large scale world basis, shows that students often do not carry out the kind of high level analysis of a case, which the case teaching paradigm claim it can encourage. Also, as the worlds of digital, multimedia and web-based educational environments emerge, case teachers want to use more than just paper-based cases, but have found that developing multimedia web cases is not a trivial matter. CaseMaker is an e-Learning environment, which supports: 1) Teachers in the development of cases. 2) Students in individual and collaborative analysis of cases. The system is currently under development and this paper reports on our first analysis and design phases, discussing the many possibilities and problems of case-based e-Learning.

Keywords: Case development, case learning, case teaching, e-Learning, collaboration, design of e-Learning environments.

1. Cases

This paper addresses some of the key issues in case-based teaching from a business school point of view. However, the research of case teaching and the design functionalities of CaseMaker described here, are believed to have a quite general applicability. And even within business schools a vast variety of case types with varying development processes, case content and learning objectives exists.

Teaching cases in business education present companies, and the problems / opportunities they are facing. (Barnes, Christensen and Hansen 1994, Mauffette-Leenders, Erskine and Leenders 1997, Manninen 1997.) The primary characteristic of the North American cases or so called Harvard cases is that the case often follows a decision-making situation, up to the point where an important decision has to be made, of vital consequences to the organisation or the project presented. The case is almost always based on real events. (Mauffette-Leenders, Erskine, and Leenders 1997, Hazard 2000.) Other cases are more like case studies, reporting on both the events leading to a decision in the company and the first results of that decision, containing a more interpretative perspective to the situation. This is a case type, which could be said to be more of a European tradition.

The case content is either collected from research in organisations via interviews and observations (a field researched case), from public available material like newspapers, company reports etc (a desk researched case), or from the case developers own work/research experience (sometimes narrated into an imagined case company) (an armchair case). (Heath 1998).

A case is often prepared by students individually, then in smaller groups and finally discussed in class. Traditionally the discussion in class has been seen as a vital part of the case-based learning process. The objective of the class discussion is to have a dialog based on the analysis of the company's situation and to come up with viable strategies for the future or evaluate the decisions taken (Leenders and Erskine 1989, Heath 1998, Orngreen and Bielli 2001). Traditionally, teaching cases have been written descriptions, but as with everything else in this era, multimedia and web-based teaching cases began to emerge in the 90’ies.

2. Motivation for the CaseMaker project

The CaseMaker project is located at the Copenhagen Business School (CBS), and is a joint venture between the schools Learning Lab (known as CBS LL), and I, from the Department of Informatics. CBS LL is a faculty support organisation, which have years of experience with development of educational programs and software. I have a special research interest in case-based learning in e-Learning environments, and I focus on design, use, and human computer interaction issues. Both CBS LL and I have hands-on experience with development of multimedia cases.

In my discussions with teachers all over Europe and in my observations of many teaching situations, I have found there are quite a lot of teachers / researchers, who
would like to develop a case, but who feels they lack the necessary skills. E.g. a number of Ph.D. students write case studies in their thesis; during their studies or later in their carrier. Case studies that, with adequate support, could be transformed into multimedia cases. CBS LL are often approached by teachers, who would like the support to develop these cases, but this is a resource full task, for both the teacher and the project team (of pedagogical advisors, (graphical) designers and programmers). CaseMaker should enable teachers, without a lot of programming skills, to develop rich multimedia web-based cases (by use of different learning strategies and using different media types).

Through our work, we have seen a need for supporting not only teachers in making cases, but also a need for supporting students in learning how to learn the most from cases and case teaching. Case-based teaching has a constructivist and experiential approach to learning. The main advantages according to literature are that students: 1) Acquire knowledge when they analyse the case. 2) Actively discuss it with peers. 3) Increase understanding of ill-structured and complex situations. 4) Bring practice into the classroom relating the case to own work-experience (Colbert, Desberg and Trumble 1996, Mauffette-Leenders, Erskine and Leenders 1997). However, during my empirical research and literature studies, it has also become clear that it seems difficult for teachers to create a theoretical frame around a case. I.e. motivating students to analyse the case by use of models, discuss how a theory apply in the given situation etc. (See for example Orngreen 2002, as well as Williams 1992 and Argyris 1980 for a seldom provided critical view on cases-based learning).

For “most case teachers the plenary discussion is at the heart of the case method”, (Heath 1998, p.16). My studies at CBS shows that at our business schools, teachers' signals to the students (explicit and implicit) that they expect the students to be able to participate actively in the discussion (whether it is a plenary discussion or the result of a group discussion presented in a report). They also expect that their students input to this discussion should be grounded in a high level analysis of the case. However, they seldom give any directions for how this high level performance could be reached, which relevant theories from the subject could be utilised, how to analyse the content, and how the student could benefit from collaboratively establish the analysis in smaller groups. The consequence is often that students draw on their own experiences, but do not practice critical reflections on the case, and only attend the discussions from a knowing and understanding the content, not an analysis or evaluation of the content according to the subject/curricula at hand. (Orngreen 2002 and 2003a.)

The overall objective of CaseMaker is thus to provide a value-added learning process, by offering an environment that supports both case development (according to varied learning objectives and teaching process) and case use (particular high level collaborative analysis and a sound practice-theory relationship). Choosing to fund the development of CaseMaker, is a strategy, which promotes what the management of universities and business schools asks for, namely empirical research-based education, as well as e-Learning activities.

Before I go into details about user needs and design suggestions, I must add that these design suggestions are just that: Suggestions based on our analysis, design considerations and first workshop with potential users and technical advisors (Danish company representatives). Results and feedback from these first workshops are now used for our further work on design specifications. The revised design will then again be discussed and probably used as prototypes in a simulated walk-through of case development and case analysis situations, prior to the production phase. A first version of CaseMaker will, depending on the implementation strategy, be ready in the end summer/late autumn 2004. It will at this point contain many, but perhaps not all functionalities described in this paper.

3. Context and user analysis

The user group is potentially very large. Ranging from full-time students of bachelors and graduate students, to part-time (paying) students of either an MBA programme or at a corporate training executive course. The courses taught and the cases used in these programs vary a lot, just as do the time used by students on the programme. We as designers of CaseMaker have to consider, what the needs of the teachers and the students of these different groups are and if the diversity influence the design.

Most universities and business schools have invested in licensees for or developed their own e-Learning platform, a so called Learning Management System (LMS). These are used
for both 100% virtual e-Learning courses and in support of traditional face-to-face education. The objective with CaseMaker, is not to develop just another e-Learning platform, which would enable teachers to publish available material and let students discuss that material. Such an activity (or e-tivity as Gilly Salmon names them, Salmon 2000) might as well take place over any LMS. Rather, CaseMaker should co-exist with the current used platform, using them e.g. for online dialogs - whether synchronous (chat) or asynchronous (forums). So though collaboration is a high priority for the project team, we do not at this point see any need to incorporate environments for direct dialog between students in CaseMaker.

If we succeed in creating a program that supports a wide variety of teachers and their needs, there is a high probability that we increase the number of teachers wanting to develop a multimedia and web case using CaseMaker. However, teachers as one target group could have a very diverse technological literacy level. Even though the majority of faculty members, who would feel interested in using CaseMaker, are probably the same who already uses the LMS, we can not be sure that they are able to implement a multimedia web case, even if it does not require actual programming. So there should be room for the teacher who wants to develop a relatively small and straightforward case and case learning process, as well as for the one, who would like to be able to construct a more complex case and learning process (keeping in mind that sometimes the same teacher may want to do both).

Students and teachers are seldom trained in using the case method. But where teachers sometimes have the possibility to attend case-seminars (like those conducted at CBS LL) or talk to colleagues about their approach, students are left to themselves, to find out the hard way (Heath 1998 and Orngreen 2002). We see that an application as CaseMaker could assist here, not only by use of written guidelines to students, but by designing a platform that by its nature invite to a systematic and reflective analysis, as well as collaboration with peers.

4. Inspiration from State-of-the-Art software

While working with the design of CaseMaker, particular three areas served as inspiration: 1) The many projects on development of multimedia cases, as stand-alone-environments. 2) The simulation or role-play games based on cases. 3) The qualitative data analysis software tools available.

4.1 Multimedia cases

When moving from developing paper-cases to using multimedia material, not only the media changes but also the issues that they mediate. Whether the case is a Harvard type case or more in line with a case study, when using multimedia material, particular in a web-format, the students often get a more direct link to the raw-data. Though the data can still contain the case developer’s commentaries on the case, it will probably also contain: Internet links to the company and/or its competitor’s homepages, the full reports of the annual accounts and balance sheets, (excerpt from) interviews etc. This provides the students with the opportunity to get a more refined and complex picture of practice.

The actual production of such media elements is a chapter in it self, and though not of special concern in this paper, a number of good advice can most certainly be given to teachers, in a sort of a developer’s-guide. The use of media does however, raise another issue of getting the case released (approved) by the case company, which has always been a delicate matter. According to good case teaching conduct and business ethics the case certainly needs to be released prior to its use. When moving from paper-cases to multimedia cases, it turns out that this issue becomes somewhat of a hassle, if the case uses a lot of company related information, which is not public available (such as video clips with employees or project descriptions etc.). It is more difficult for the manager to approve an interview clip of him/herself and of employees, for example criticising a project, than it is to approve a written interpretation of the same issue. It is also much more difficult to make any alterations to the material. For example, I learned in an EU project, where we developed 18 cases in the E-Case Series (ECCH 2003), that it took an average of 3 months to get such an approval in the larger well-known companies (Orngreen 2002). Though these were rather large cases, the issue of release and copyright, will be just as important in CaseMaker as in the stand-alone-applications.

4.2 Role-playing and simulation cases

Role-playing and simulations has for many years been used in conjunction with small case descriptions, where students act-out the roles
in the case. With the support of technology new ways of performing role-playing and simulations have emerged. Examples of simulation cases are: Web-TRECS (Parker & Swatman 1999) and DECT (Joyce 1999) from Deakin University (Australia), which both deals with the area of e-commerce. Students are able to act within an e-commerce company simulating and altering the size of different commerce variables, like selling and buying goods. Examples of Role-play cases are: Prof. Linda A. Hills from Harvard, who through the Managing Direct Reports (Hill 2001) and Coaching for Results (Hill 2000) applications, lets users act the role of a certain job-function. Even though these examples are based on small case descriptions, they to a large extend shifts the learning paradigm away from case-Learning towards more action based objectives. I.e. just-in-time actions in a simulated dynamic world as opposed to acquiring analytical competencies based on models and theories of real world happenings.

Interesting enough, there also exist generic role-play generators, supporting teachers in setting up role-plays, and conducting them online, similar to the idea of cases in CaseMaker. One of these is named Simplay.Net. (Simplay.Net 2003). While I was working with the E-Case Series (ECCH 2003), we several times discussed an idea similar to the part known as the Case-Developer in CaseMaker. The idea was to have a sought of generic framework supporting teachers in making cases. Seeing an early version of Simplay.Net, demonstrated late 2001, was one of the event that really let me to see that a similar idea within case-based learning was possible. To develop cases without having the resources, and at the same time allow students to collaboratively work on a case (Ip 2001). So when I almost one and a half year later was contacted by the CBS LL, who had a similar idea, I was only happy to participate.

Though we in the CaseMaker project team see the role-plays and simulations as stimulating the motivation and engagement of the students, we do not see CaseMaker as supporting dynamic case content. i.e. CaseMaker may use the concept of seeing the case as was it through the "eyes" of a manager, a sort of role-play; but the user can not act actively in the case and change the course of events. However, the case teacher may choose to use the sense of a simulation or role-play by releasing part of the case content over various periods; allowing the students to reconsider their analysis based on the new data available.

4.3 Qualitative data analysis software tools

The final aspect, which has certainly inspired to the kind of functionalities that I particular foresee of use for the students, are those of qualitative data analysis tools. In software programs such as ATLAS.ti (ATLAS 2003), NUDIST/NVIVO (NVIVO 2003) and HyperRESEARCH (HyperRESEARCH 2003) an explorative perspective on analysis is provided. This means it is possible to define and assign codes and write free text memos while going through the material. The tools allow for coding of several media types of: text, video/sound and graphics, but also for collaboratively assigning such codes and memos to the material, while keeping the individual perspective of seeing who defined what and where.

Since the tools are meant for research, coding can be performed on a very detailed level, assigning codes not only to all the material, but also to a specific word or line in a text-document. In ATLAS.ti one can even assign to a specific segment in an audio or video clip. This and other tools also permit for hyperlinking. That is, rather than just assigning two related segments with the same node/code, a relationship between existing data can be made.

Once all or part of the material has been coded, the user can choose to see the result through different forms of filtering. I.e. looking at all the codes assigned to a specific material, or all the material assigned to the same code. Similarly many of these software tools today allow for dynamic netviews, which is a graphical illustration of the codes and memos assigned to the material (netview being the expression ATLAS.ti uses for this function). I.e. in the graphical layouts, a visual perspective is given to how many and where are links established between the codes, memos and the material.

With respect to CaseMaker it is the functions of defining, assigning and filtering codes and memos that may provide rigour into the students’ analysis process, particular when these are established in a collaborative manner. These facilities would support the creation of a sound argumentation and interpretation process.
5. Design considerations

In the project we have developed a number of storyboards (visual illustrations of the system – see e.g. Orngreen & Pries-Heje 1999) and scenario descriptions (a narrative description of the system as it is intended to work – see e.g. Carroll 2000). We use these to clarify and document, which are the features CaseMaker shall include, and how shall they work. The screen layout of the storyboards presented here are not intended to present the visual interface in any way. The design is thus deliberately chosen to be of almost “bad taste”, to show that it is a mock-up of functionalities, not a running system.

CaseMaker can be seen as a suite of elements, which will support the whole learning process of case-based e-Learning. CaseMaker is divided into a kind of “student-domain” known as Case-User; and “teacher-domain”, known as Case-Developer. Each of these two areas has their set of functionalities and facilities available – see figure 1.

Figure 1: Elements in CaseMaker

5.1 Case-developer

When the teacher logs-on to the Case-Developer, the Planner interface begins. Here the case-developer can choose to work on an existing case, open a new case, or to look at case data available. We expect that the teacher already have a number of data available. Because material in one case often can be made into a similar case, but with a new perspective, or can be used as additional material in another case, we would highly recommend re-using material. However, as Roy Williams has pointed out, there is a paradox, which both teachers and students face, when it comes to sharing knowledge in a distributed learning environment: How can they be expected to share information and resources in a competitive, commercial market? (Williams 2003, p. 48) Though perhaps not commercial, there is a strong degree of ownership and competitiveness both among students and their work and researchers and their empirical research data. Williams solution is to work with a private and public domain (Williams 2003).

The CaseMaker project team imagine allowing data and cases to be private or public available to other teachers at the school, and we also contemplate to implement a third category, namely restricted access. I.e. a case or a case data element is restricted to be used by a group of teachers, from e.g. the same department or research centre.

Taking the development of a new case as an example, the case-teacher will from the planner proceed to the Organise Case area of the application. In the situation of a new case the first objective is to choose data, as illustrated in figure 2. Case data can either be inserted directly, by choosing existing material from the CaseMaker database (including uploading to this database from local disc drives) or by inserting a URL to the Internet site containing the data. These data will then appear in the case as is, whether it is a word®, pdf® or video document or it is an html-page at another site. (Arrow 1 in the figure).

It should also be possible to design a case page consisting of several data elements. By choosing to insert a new case page (arrow 2 in the figure), the case-developer has the opportunity to design the layout of a page, containing for example both a small 30 seconds video clip with the manager, as well as a commentary to the managers statement,
plus URL to the case company website and the competitors site (arrow 3 in the figure). This feature is planned to be implemented by use of drag-and-drop techniques. Once a case page has been made, it too will be saved in the CaseMaker database, making it possible for the case-developer to re-use this particular page as case data in another case.

**Figure 2:** Features of Organise Case in Case-Developer®

Besides choosing data for the case, the case-developer can in the Organise Case area choose to establish: 1) A front page, e.g. as an appetiser in the form of a pre-story / trailer or
just showing a case name and a picture of the case company. 2) A formalities page, clarifying the course, for which this case is intended, the number of people allowed in each group, deadlines for handing in case assignments, etc. 3) An assignment page, where e.g. a certain perspectives is asked to be applied in the case analysis. 4) An access rights page, where the case is provided with a password, and the developer have the opportunity to temporarily close access to the case, while the case is being updated with new/further/revised data or pages.

As content has been chosen to the case, the case-developer shall be able to structure this content, which is done through the Structure Case area. Here the case-developer can work with three structures, enabling the use of cases of very different characters:

1. Unstructured cases, where the case content is provided in an unformatted manner. The content is presented in one large table or list containing file name, date etc. This leaves it entirely up to the student to (re)structure and make sense of the issues presented, perhaps initiated through a teacher provided assignment.

2. Structured in themes, where the case content is provided in a menu structure, which the students can navigate through. The content is thus pre-structured into different issues, e.g. organisation, products, people, financial information etc., or just into a collection of events, which is of importance in this case. The student can then navigate within these menus.

3. Linear cases, where the case content is tied together in a timeline or story. (It is noteworthy that our first designs had timelines and stories separated as two structures (see Orngreen 2003b), but since both had the linearity in common, we have merged them together.) In timelines the material is presented in a chronological order. An example is when the students follow an implementation process in a company. This means the students can choose to view the material from time 1 to x, but they can also navigate back and forth in the content, starting perhaps at the centre of the timeline. In stories the material has a narrative plot, which is important in order to grasp the concept at hand or to motivate. The narrative may be chronological as in the timeline, but could also be jumping in time or telling a story backwards etc.. The important aspect is that the teacher would believe viewing material a prior to b and c is important. I.e. navigation wise, the students “are forced” to view the story sequentially, before being able to navigate back and forth in it.

Figure 3 illustrates the thematic structure (a) as well as the linear case structure (b) of Structure Case. Notice how it is possible to have varying release dates on the material, enabling the case developer to use the case in the stepwise longitudinal manner addressed in 4.2.
5.2 Case-User

The case-user first arrive at a management interface, named the Manager. To avoid too much administration with the constitution of groups, students can create their own groups and invite others to join. A group could even let a teacher join, if they e.g. need some guidance in how to proceed with their case analyses. Once students have chosen a case, they can (provided they have the correct password) begin working with the case in the Analyse Case area. Besides seeing the pages of formalities, assignments etc., they are able to analyse the case content in the way illustrated on figure 4. In this figure the top example is of a case page. Here an individual approach to the case analysis is chosen by the student, unlike the one underneath, which shows all group members keywords and comments to a specific case data. Searchable keywords and comments can thus be made to a specific piece of data or objects on a case page.

To improve the students’ development of case solutions and interpretations, the analysis can be viewed through different filters in the Summarise Case area. E.g. a filter could be to view all the material and all comments which have been assigned a specific keyword, or to view all the keywords and comments written by one of the group members. In this way the analysis will be able to contain some of the rigour known from qualitative data analysis and grounded theory coding practices. Here, the concept of keywords and comments are similar to nodes/codes and memos. (See for example Miles & Huberman 1994 and Strauss & Corbin 1998). In the Summarise Case area it should also be possible to assign keywords and comments to the whole case, as kind of conclusions or case interpretations.

Exporting these filtered reports or all available comments and keywords, is another facility, which should be available in the application. This is useful for a plenary discussion, but also in situations where students have to write an essay or even an examination report. In the latter example (of examination) it is important to be able to distinguish between case content and additional information, i.e. similar to the concept of required readings. For example, if the case uses an external link to a company homepage, in order for the student to view the company year reports, it is vital that the teacher can clearly communicate that year so and so is part of the case, and should be known to the student to the exam, i.e. is on a “need to know basis”, but that all other information on that homepage is additional and on a “nice to know basis”.

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Case-User

In the Face of Strong Opposition

In this interview M. Smith, gives a rare insight into…. Bla, bla bla, …………….. ………………….
………. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. 
………. ………………….. ………………….. ………………….. ………………….. ………………….. …………………..
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General Comments

In this interview M. Smith, gives a rare insight into… Bla, bla bla, …………….. ………………….
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Comments to keyword - Motivation

When trying to motivate his employees, Smith arrange an bla bla bla,…
……………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. ………………….. …………………..

Keywords

Problem
1. Resistance
2. Motivation

Topic
1. Keyword 1

Theory
1. Keyword 2
2. Keyword 3

Conclusion
1. Keyword 4
2. Keyword 5

Comments to keyword - Problem

Resistance: "How can Smith overlook that the employees would resist such a project?" - Jenny
Motivation: "When trying to motivate his employees, Smith arrange an bla bla bla…..." - Martin

General Comments

Use analyse Wizard

Figure 4: Features of Analyse Case in Case-User®

5.3 Flexibility through developer- and user-guide, and case history

CaseMaker should both in the Developer and User domains be as flexible as possible. With flexible I here refer to the way the application assist the teachers and students. It should be possible to opt in or out, whether a guiding hand is needed. The developer and user guides thus consist of both passive guidelines
(on how to develop and use cases) and more active tools, as templates and wizards. This is illustrated in both figure 2 and 4, where templates and wizards are seen as icons.

To speed up the process in beginning and primarily as inspiration, a number of pre-defined case page templates are provided to the case-developer. Wizards on the other hand assist in for example carrying out the case analysis, not on how to technically write a keyword, but rather on when, where and why keywords are used. Since using CaseMaker on your own, without the assisting wizard, is probably the fastest and most effective way, it is also our intention to learn developers and users not only to navigate and interact with the program it self, but also to learn about the best ways of organising and analysing cases, depending on the case at hand. Consequently, we foresee the wizards to be as translucent as possible. I.e. whenever a choice has been made in a wizard, the returning act in the Organise Case or Analyse Case area should be shown. This perspective on learning with the CaseMaker is action based (Vygotsky 1962) and based on situational learning (Lave & Wenger 1991).

Another aspect of flexibility is thought implemented by the use of a Case History function, which is so far only described in the case-user domain as it has let to some commotion with respect to the case-developer domain. The idea is, as shown in figure 5, to keep a complete case history of all activities within the group, as well as a log of the changes that may take place by the case-developer during the groups analysis work. This function not only makes it easy for one group member to spot the changes the other group members have made since the last time he logged on, but also enables students to analyse on a meta-level their own work process. It is in the case history that the group later can see, which keywords have been merged, which have been deleted etc. However, a complete different issue is whether such a case history should be available for the teacher, even if on a more statistical general level.

Figure 5: Case History in Case-User®

5.4 User workshop and technical panel

In a user workshop held very recently, the project group first gave a 5-10 min.
began. This gave us access to both the "unbiased" ideas of what a programme like CaseMaker should be able to, as well as the opportunity to get a first review of our design ideas. Unlike the user workshop, the technical panel was introduced to the storyboards and our design ideas from the very beginning, since we wanted the advisors to have a dialog on the issues of technical relevance in relation to the design as it appears now.

The workshop and panel both provided interesting discussions, where many issues that we had not yet contemplated and even ideas to new or revised functionalities were given. The primary issues, which were brought to attention, were:

The students had an interesting idea of expanding the concept of case-developers to include students. I.e. allowing students to make material available to themselves through CaseMaker and then code this material. This is relevant when they have projects with companies, as is often the situation in for example the final bachelor and master exams. Both teachers and students were quite pleased with the possibilities of coding the case content with keywords and comments, though the teachers – being researchers – thought this feature should be available not only on a data level, but also on a word/frame level as in the qualitative data analysis software tools. The technical panel had a long dialog on the feasibility of this, and though almost everyone agreed that it was possible and they came up with different solutions, they also found that it programming wise would be a complex task.

Providing teachers with resources to develop cases within CaseMaker, educating teachers and students in case-based e-Learning, as well as getting good ambassadors was seen as the key issues for the success of the application by the teachers and technical advisors. Also, the idea of actively learning case-based e-Learning by use of wizards were by the technical panel considered a good and sound pedagogical idea, though they pointed out that wizards were not always easy to moderate or extend if necessary at a later point.

The students had clearly some restrictions towards the degree of openness in the system. Both with respect to whether it should be possible for the teacher to view their case history, and particular whether one group should be able to view another group analysis. The latter they were completely against and the former were only acceptable on a group, not individual level. (The competitive factor was certainly visible here – Williams 2003) This discussion let a project member to suggest that the analysis could be shared in a more visible/open way. The teacher could arrange the case process so that every group hands in a short written report of their results, which were then made part of the case data for everyone to see and learn from.

We had a long dialog on the issue of whether CaseMaker can be integrated directly into an existing platform of a LMS or content management system. CaseMaker had according to the teachers the potential to increase cross-institutional work. The same teachers also said they liked the idea of having not only private and public data, but also restricted data, enabling sharing with smaller groups. But the teachers at the same time mentioned that once a case was made in CaseMaker is should be possible to distribute it to other environments, thus bringing the issue of standards up. It was clear to the technical advisors from the beginning that the issues of standards and whether we should choose to integrate in an existing platform and which one, would be dominant in the project, once the design requirements are clearer. In order to reach this clarity, the advisors suggested that data models are drawn, focusing also on the more strategic demands the business school might have to suppliers etc. According to the technical advisors, copyrights were another issue, which needed more consideration. Copyrights, may both relate to a media element, but could also apply to a whole case.

6. In conclusion

The vision of CaseMaker, a project which is currently in the design phase, is to develop a case-based e-Learning environment, which supports:

1. Teachers in the development of cases and case teaching processes.
2. Students in individual and collaborative analysis of cases

Through a critical view on case development, case teaching and case learning a number of areas were identified in which case-based education could be improved. These areas are implemented in the current design functionalities of CaseMaker. I am aware that it is equally easy to design a poor case, to conduct poor case teaching or to perform a poor analysis of a case with CaseMaker as it is without. But the members of the project team do believe that it is also possible with this
framework and the tools described to easier promote and learn teachers and students some of the more in depth considerations regarding case learning objectives and carrying out a high level analysis of cases, which research has pointed out is necessary.

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Adaptive Learning Environments and e-Learning Standards*

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Abstract: This paper examines the sufficiency of existing e-Learning standards for facilitating and supporting the introduction of adaptive techniques in computer-based learning systems. To that end, the main representational and operational requirements of adaptive learning environments are examined and contrasted against current e-Learning standards. The motivation behind this preliminary analysis is attainment of: interoperability between adaptive learning systems; reuse of adaptive learning materials; and, the facilitation of adaptively supported, distributed learning activities.

Keywords: adaptive, e-Learning, standards, personalisation, interoperability

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1. Introduction

In recent years we have witnessed an increasingly heightened awareness of the potential benefits of adaptivity in e-Learning. This has been mainly driven by the realization that the ideal of individualized learning (i.e., learning tailored to the specific requirements and preferences of the individual) cannot be achieved, especially at a “massive” scale, using traditional approaches. Factors that further contribute in this direction include: the diversity in the “target” population participating in learning activities (intensified by the gradual attainment of life-long learning practices); the diversity in the access media and modalities that one can effectively utilize today in order to access, manipulate, or collaborate on, educational content or learning activities, alongside with a diversity in the context of use of such technologies; the anticipated proliferation of free educational content, which will need to be “harvested” in order to “assemble” learning objects, spaces and activities; etc.

There exist currently several systems which employ adaptive techniques to enable or facilitate different aspects of learning (Brusilovsky, 1999). An important observation one can make going over the related literature is that a dichotomy appears between typically commercial, standards-based e-Learning systems on the one hand, and (typically research prototypes of) adaptive learning environments (ALEs) on the other, with little, if any, standards compliance. It is argued that this dichotomy is, in part, due to the lack of sufficient support for adaptive behaviour in existing e-Learning standards.

In support of this argument, this paper explores the concept of adaptivity in the context of computational learning environments. Furthermore, it attempts a high-level assessment of the sufficiency of existing e-Learning standards for driving the convergence of the two strands of systems outlined above. The intention is to provide a preliminary assessment of the adequacy of existing e-Learning standards for specifying, and guiding the implementation of, adaptive behaviour within learning environments.

The motivation for seeking standardization in adaptive e-Learning is directly linked to cost factors related to the development of ALEs and adaptive courses thereof (e.g., higher initial investment, higher maintenance costs) and the low level of reuse possible in the field today (due to proprietary models and representations of system knowledge, adaptation logic, etc.) (Conlan et al., 2002a). Our rationale can be briefly outlined as follows:

- To protect the high investment necessary for the development of adaptive learning material, one has to ensure that the latter is not bound by proprietary standards and formats. This is a main prerequisite for enabling the transfer of such material to new environments.

- Taking this concept one step further, one may need to ensure that different learning environments can interoperate in the context of adaptation. A typical exemplary setup might involve one environment holding an individual user’s model and interaction / learning history, and another acting as a content repository.
At the same level, but worth individual mention, is the case of content discovery and aggregation. This introduces an entirely new dimension, as content “characterization” through metadata provided by its initial author / designer, can now be augmented with aspects relating to the use of that content by individuals and groups, and collected as part of the adaptation “cycle”. Furthermore, by combining findings from several compatible systems, which serve the same adaptive course to a multitude of users, it would be possible to make improvements to the course itself. These could be effected either in a fully automated way, or in a “semi-automated” one, in cases where it would be preferable that no modifications are made to courses without prior approval by human experts.

Departing from the “traditional” treatment of the learner as a solitary, mostly passive receptor of information, one would also need to account for adaptive support in the context of collaborative learning activities. Such activities may be carried out from within the same or “compatible” learning environments, which, in turn, points to a different level of interoperation requirements between such environments.

The rest of the paper is structured as follows. The next section, “Background”, outlines the main concepts of adaptive personalization in learning environments. The following section, “Adaptation and e-Learning standards”, starts with a brief account of the landscape of related e-Learning standards, and goes on to discuss how these can accommodate adaptivity, and where extensions or entirely new standards are required. Finally, the paper is concluded with an account of the main points put forward and their implications.

2. Background

2.1 What is adaptive learning?

The term “adaptive” is associated with a quite range of diverse system characteristics and capabilities in the e-Learning industry, thus making it is necessary to qualify the qualities one attributes to a system when using the term. In the context of this paper, a learning environment is considered adaptive if it is capable of: monitoring the activities of its users; interpreting these on the basis of domain-specific models; inferring user requirements and preferences out of the interpreted activities, appropriately representing these in associated models; and, finally, acting upon the available knowledge on its users and the subject matter at hand, to dynamically facilitate the learning process. The preceding informal definition should differentiate the concept of adaptivity from those of tailorability / configurability, flexibility / extensibility, or the mere support for intelligently mapping between available media / formats and the characteristics of access devices. Please note that in several places in this paper, the term “adaptation” is used as a synonym for “adaptivity”.

Adaptive behaviour on the part of a learning environment can have numerous manifestations. Instead of attempting to exhaustively enumerate all of these, we will provide a high-level categorization, which suffices for the analysis in the following section. The broad and partially overlapping categories that we will be referring to are: adaptive interaction, adaptive course delivery, content discovery and assembly, and, finally, adaptive collaboration support. Each of these categories is briefly qualified below, followed by an overview of the models and processes that are typically instated in adaptive e-Learning systems.

2.2 Categories of adaptation in learning environments

The first category, Adaptive Interaction, refers to adaptations that take place at the system’s interface and are intended to facilitate or support the user’s interaction with the system, without, however, modifying in any way the learning “content” itself. Examples of adaptations at this level include: the employment of alternative graphical or colour schemes, font sizes, etc., to accommodate user preferences, requirements or (dis-)abilities at the lexical (or physical) level of interaction; the reorganization or restructuring of interactive tasks at the syntactic level of interaction; or the adoption of alternative interaction metaphors at the semantic level of interaction. Although interface adaptations can be thought of as generally independent from the material or “content” delivered through a learning environment, this is not usually the case with learning activities - the major differentiating factor being the emphasis on ensuring and optimising “content” attainment in the former case, versus the emphasis on supporting a process in the case of activities. The dependency of learning activities on interface adaptations is a natural consequence of the fact that the interface encapsulates the
very “tools” for carrying out an activity, be it interpersonal communication, collaboration towards problem-solving, etc.

The second category, Adaptive Course Delivery, constitutes the most common and widely used collection of adaptation techniques applied in learning environments today. In particular, the term is used to refer to adaptations that are intended to tailor a course (or, in some cases, a series of courses) to the individual learner. The intention is to optimise the “fit” between course contents and user characteristics / requirements, so that the “optimal” learning result is obtained, while, in concert, the time and interactions expended on a course are brought to a “minimum”. In addition to time and effort economy, major factors behind the adoption of adaptive techniques in this context include: compensating for the lack of a human tutor (who is capable of assessing learner capacity, goals, etc., and advising on individualized “curricula”), improving subjective evaluation of courses by learners, etc. The most typical examples of adaptations in this category are: dynamic course (re-)structuring; adaptive navigation support; and, adaptive selection of alternative (fragments of) course material (Brusilovsky, 2001).

The third category, Content Discovery and Assembly, refers to the application of adaptive techniques in the discovery and assembly of learning material / “content” from potentially distributed sources / repositories. The adaptive component of this process lies with the utilization of adaptation-oriented models and knowledge about users typically derived from monitoring, both of which are not available to non-adaptive systems that engage in the same process. At this point, we would like to make an explicit distinction between the perspective of the individual learner wishing to locate relevant material within a (possibly constrained) corpus, and the perspective of the author or “aggregator” who undertakes the task of putting together a course from existing materials and targeting a specific audience – or, seen differently, collecting and tailoring material for accommodating specific user / context characteristics. Although adaptation may very well be suitable in both perspectives, in the context of this paper we will be focusing on the first one, i.e., the assembly and contextualisation of material that is intended for an individual learner. This allows us to consider the more complex scenarios that emerge when one’s personal learning and interaction history can be utilized to infer criteria for content selection and processing.

The fourth and final category, Adaptive Collaboration Support, is intended to capture adaptive support in learning processes that involve communication between multiple persons (and, therefore, social interaction), and, potentially, collaboration towards common objectives. This is an important dimension to be considered as we are moving away from “isolationist” approaches to learning, which are at odds with what modern learning theory increasingly emphasizes: the importance of collaboration, cooperative learning, communities of learners, social negotiation, and apprenticeship in learning (Wiley, 2003). Adaptive techniques can be used in this direction to facilitate the communication / collaboration process, ensure a good match between collaborators, etc.

2.3 Models in adaptive learning environments

All of the above categories of adaptation in learning environments are based on a rather well-established set of models and processes. The rest of this section presents brief accounts of some of the models that one typically encounters in ALEs.

- The domain model: Since most current ALEs are focused on adaptive course delivery, the domain-, or application-model is usually a representation of the course being offered. However, in those cases where more general learning activities are supported, the domain model may additionally contain information about workflows, participants, roles, etc. The most important aspect of adaptive-course models is that they are usually based on the identification of relationships between course elements, which are subsequently used to decide upon adaptations (Brusilovsky, 2003).

- The learner model: The term learner model is used to refer to special cases of user models, tailored for the domain of learning. The specific approach to modeling may vary between adaptive learning environments. Nevertheless, there is at least one characteristic shared by practically all existing systems: the model can be updated at interaction time, to incorporate elements or traces of the user’s interaction history. In other words, the learner model in ALEs, not only encapsulates general
information about the user (e.g., demographics, previous achievements, etc.), but also maintains a “live” account of the user’s actions within the system.

- **Group models:** Similarly to user / learner models, group models seek to capture the characteristics of groups of users / learners. The main differentiating factors between the two are: (a) group models are typically *assembled* dynamically, rather than *filled in* dynamically, and (b) group models are based on the identification of groups of learners that share common characteristics, behaviour, etc. As such, groups model are used to determine and “describe” what makes learners “similar” or not, as well as whether any two learners can belong to the same group. This dynamic approach to identifying groups and user participation in them is already used widely in collaborative filtering and product recommenders, and bears great promise in the context of e-Learning.

- **The adaptation model:** This model incorporates the adaptive theory of an ALE, at different levels of abstraction. Specifically, the (possibly implicit) adaptation model defines what can be adapted, as well as when and how it is to be adapted. The levels of abstraction at which adaptation may be defined, range from specific programmatic rules that govern run-time behaviour, all the way to general specifications of logical relationships between ALE entities, that get enforced automatically at run-time. The most widely known ALEs today (e.g., NetCoach (Weber, and Brusilovsky, 2001), AHA! (De Bra et al., 2002b), InterBook (Brusilovsky et al.,1998), etc.) use adaptation models that generically specify system behaviour on the basis of properties of the content model (such as relationships between content entities).

Although there would be probably little contention as to the enumeration of the models encountered in ALEs, the related literature reports a proliferation of approaches in their representation and utilization within different systems (Brusilovsky, 2003). It is argued that this is one of the major stumbling blocks that stand between adaptation and the e-Learning mainstream today. Awareness of this problem has given rise to several research efforts, aimed at standardizing as much of the adaptation modelling process as possible, on the basis of existing standards (see, e.g., the “Workshop on Adaptive E-Learning and Metadata” carried out under the auspices of the WM2003 conference - http://wm2003.aifb.uni-karlsruhe.de/workshop/w05/). The “reuse” of existing e-Learning standards and their “retargeting” for use in the context of adaptation, which is also a premise of this paper, is intended to: (a) facilitate the smooth and gradual transition from existing non-adaptive learning environments and courses to their adaptive counterparts, and (b) enable the graceful downgrading of adaptive content and activities when delivered over, or supported by, a “traditional” learning environment.

3. Adaptation and e-Learning standards

There currently exist numerous organisations, consortia, etc., that are working in the area of e-Learning standards. For instance organisations like the Dublin Core Metadata Initiative, the IEEE, the IMS Global Learning Consortium, the Alliance of Remote Instructional Authoring and Distribution Networks for Europe, the Aviation Industry CBT Committee, the Advanced Distributed Learning Initiative, etc. are dedicated to, or have committees and working groups active in, the establishment of e-Learning standards.

It is beyond the scope of this paper to enumerate all entities involved in the establishment of e-Learning standards, or the standards themselves. Instead, the authors have opted to make selective references to some of the standards, where such references are relevant to the ongoing discussion. Nevertheless, it should be noted that the core of standards that have been analysed and are referred to in the subsequent sections are the various specifications of IMS\(^1\), ADL SCORM\(^2\), the set of standards previously known as “PAPI”\(^3\) (henceforth referred to simply as PAPI), and the AICC specifications\(^4\).

In the following, we first delineate the main problems not addressed by today’s standards and then proceed to identify what we consider as necessary additions / enhancements to them, as well as point out requirements that necessitate the evolution of new standards.

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3.1 Adaptation-oriented “domain” modelling

Current standards and concepts for educational metadata focus on content-centred approaches and models of instructional design. Scenarios that concentrate on how to structure and organize access to learning objects are mirrored in concepts such as content packaging. Standards focus on search, exchange and re-use of learning material, often called content items, learning objects or training components. The Learning Object Metadata specification, in particular, aims at metadata to facilitate the generation of consistent lessons composed of de-contextualised and distributed learning objects (e.g., consistency in the level of difficulty). Its vision is to enable computer agents to automatically and dynamically compose personalized lessons for an individual learner. The IMS Learning Design specification goes a step further, by providing a conceptual model that enables authors to describe processes and activities including social interaction. The MASIE Centre Report (MASIE Centre, 2002) identifies four main uses of metadata today: categorisation of content, generation of taxonomies, reuse, and dynamic assemblies. All uses are directly or indirectly relevant to adaptation / personalisation.

As already mentioned, current, generic ALEs that support adaptive course delivery require an additional level of information about the entities that make up a course, namely the interrelationships between the entities (Brusilovsky, 2003). The primary goal in seeking standardisation in this dimension is to make it possible to have declarative definitions of relationships and concepts, leaving their procedural interpretation and implementation to each ALE. Using these, different systems may choose to provide different adaptive features or support different types of personalisation, much in the same way that systems differ in how they present standardised modules.

(De Bra et al., 2002a), for example, address the definition of higher-level concept relationship types and the automatic translation of instances of such types into lower-level adaptation rules for the AHA! adaptive e-Learning system. Some of the relationship types discussed therein denote direct relationships between concepts and learning elements (e.g., concept A is a prerequisite for concept B, element X exemplifies concept C), while others bear a clear adaptation / knowledge inference flavour to them (e.g., element Y when read provides knowledge towards concept D, or, element Y when read indicates interest in concept E).

At a lower level than De Bra, we also need to be able to define “assets” associated with “learning objects / elements” which can have standardised relationships to each other and to the enclosing object. Consider, for example, two mutually exclusive elaborations of a given concept, one being brief and the other detailed; contrast that with two complementary elaborations of a given concept, the first being a required brief reading, while the second being an auxiliary amendment to the first. This also implies the possibility to define learning elements that are (more or less) atomic chunks of learning material, distinct from “pages” and with arbitrary granularity (e.g., a paragraph).

Currently, defining relationships such as the ones described above, can be achieved through the use of Learning Object Metadata, if the following conditions are met:

- A “vocabulary”™ is developed defining the relationships between concepts, as well as the characteristics of these relationships (e.g., transitivity), so that their interpretation by application software is not open to interpretation.
- Every learning entity that is an individual “concept” has an associated LOM-compliant metadata record.
- The entity’s metadata specify the entity’s relationships with other entities, using the aforementioned relationship vocabulary and the entities’ identifiers.

This approach has the benefit of compliance with current standards, and requires only the introduction of a new, adaptation oriented vocabulary for relationships. A similar approach would be to introduce dedicated (optional) adaptation-specific constructs in the main course description. The latter, however, would evidently require modifications to standards commonly used to define courses, which may be considered a much higher (as compared to the above approach) “entry cost” for introducing adaptation in e-Learning standards. A third option would of course be to keep adaptation-related information / metadata separately than the description of the course itself. This has the benefit of rendering the two rather independent, but would most likely prove problematic in terms of course maintenance. This is especially the case as far

5 Alternatively referred to as a “value domain”, for which the “permissible values” are well specified.
as “synchronisation” between the two is concerned.

Thus far we have discussed the case of characterising relationships between existing course objects / elements. However, as pointed out in (Brusilovsky, 2003), some types of adaptation require a model that is different than (although connected to) the main course model. For example, a model of course concepts and their semantic relations may need to be maintained “separately” from the model of physical course-material organisation (e.g., files, navigation hierarchy). Apparently, whether the two are separate or not, there must exist associations from one to the other, so that the system knows which concepts correspond to given resources, and vice versa. Standardisation in this direction would evidently necessitate new standards: such concerns are beyond the traditional approaches to organising and describing course material and activities.

Examples of ALEs that extend existing standards to support adaptive course delivery include OPAL, OLO and KOD, among others. OPAL (Conlan et al., 2002), which delivers content personalized to the learner's cognitive and presentation learning preferences using aggregation models based on ADL SCORM. OLO (Rodriguez et al., 2002) and KOD (Karagiannidis et al., 2001) (see Figure 1, (a) and (b) respectively) both address the topic of extending the metadata that accompanies “packaged” learning objects, with the intention to facilitate adaptation. Although the projects take considerably different routes, they are largely motivated by the same objective, to augment the “traditional” metadata with additional elements that are vital when one is to decide upon, and apply course-oriented adaptations. Furthermore, both projects attempt to “integrate” adaptation metadata with the traditional course information (e.g., KOD incorporates the adaptation logic –rules– in an extension to the organization element of IMS CPS).

(a) Open Learning Object and Inner Metadata (from Rodriguez et al., 2002)
3.2 Learner and group modelling

Learner modelling in existing standards is addressed at a rather coarse-grained level, although all related specifications have explicit provisions for the evolution of a learner’s model, or profile, over time. An example of specifications in this strand is the IMS Learner Information Package specification, which incorporates the results of “top-level” educational activities, in addition to relatively static information about the user (e.g., demographic).

Although this information is of paramount importance for e-Learning systems, the coarse-grained level of detail renders them of limited use in the context of ALEs. The main underlying problem is that ALEs require a “history” of the user’s interactions, in order to be able to tailor themselves to the particular needs of the individual user. Furthermore, this “history” is more often than not closely associated with the domain model itself (e.g., the course model). Consider, for instance, the very common desideratum (in ALEs) of basing adaptations on the user’s familiarity with a given concept. This requires the establishment of a new set of relationships, which codify a learner’s “status” with respect to a learning entity or concept. Such relationships may refer to directly observable learner behaviour (e.g., whether a learner has read, or has not read a node in the learning material), or to inferred status drawn from multiple sources, including results of exercises, etc. (e.g., knows, does not know, or is ready for).

Arguably, the only standard available today that has extended provisions for modelling fine-grained user activities is PAPI. The PAPI standard reflects ideas from intelligent tutoring systems where the performance information is considered as the most important information about a learner, and also stresses the importance of inter-personal relationships (Vassileva et al., 2003). The strengths of PAPI in relation to ALEs stem from its support for representing learner activities in quite structured manner and in as great detail as necessary. Further to the above, PAPI provides a variety of bindings (multiple codings, APIs and protocols), which facilitate its employment in different scenarios within ALEs.

Although PAPI might be more appropriate for modelling users in the context of adaptive ALEs (as compared, for example, to IMS LIP), it is far from being adequate in all its dimensions. Dolog and Nejdl (2003), for example, report on recent work carried out in...
the context of the EU/IST Elena project6, towards the development of the first version of a learner profile to support simple personalization techniques. To cater for omissions or weaknesses in each individual standard (as identified through scenario development and analysis), the RDF-based learner profile they propose is based on subsets of both IMS LIP and PAPI.

Whichever standard (or combination of standards) one might use as a basis for standardisation in ALEs, there exists an additional issue that needs to be addressed. Specifically, it would be necessary to agree upon ways of deriving portions of the learner model from the domain / course model (at least for as long as the learner is “taking” a course), as well as upon when and how such detailed information gets “summarised” into the more coarse-grained models that exist today. This is of particular importance in the case of ALEs that employ what are known as “overlay” models, to relate the learner’s current progress in a course, with the course model itself.

The discussion, thus far, has been restricted to the modelling of learner interactions in the context of encountering and assimilating course material. The conclusions drawn, however, are applicable to learner activities at more general scopes. For example, by recording users’ social interactions and allowing for their characterisation by the users themselves, it becomes possible to adaptively facilitate a wide range of interpersonal exchanges, as well as targeted collaborative work.

It may be argued that such learner “history” information is an internal concern of ALEs, and, since it does not need to be specified prior to the deployment of learning material, it is not subject to standardisation. This, however, would most likely preclude use of the aforementioned information in adaptive behaviour other than course delivery. Consider the following examples in support of this view:

- A newly created course is characterized by its authors as “fast” and “introductory”. Nevertheless, in practice, students need to spend three times the anticipated time and effort before they can get an acceptable level of familiarity with the material; additionally, upon completion, students are capable of solving problems from an associated repository at all levels of difficulty. It should be clear that selecting this course purely on the basis of its associated metadata might lead to serious mistakes (e.g., in the process of content filtering). Adding information from its actual use provides a more “informed” view of the course and has the potential to lead to better personalization as a direct consequence.

Maintaining detailed information about a user’s activities within an ALE also gives rise to a new opportunity in terms of group identification and modelling. Specifically, if one can refer to learner activities in a standardised way, then one can also identify dimensions of activities that should be used as predictors or measures for determining group membership. For example, one could identify that learners are to be grouped along the dimension “willingness to interact with peers”, which is to be inferred from (among other things) the user’s active participation in on-line discussion fora.

Unlike the case of learner modelling, group modelling as discussed in this paper is only cursorily covered by existing standards. In fact, PAPI seems to be the only specification that provides sufficient support for describing the characteristics of groups. However, the very features of PAPI that constitute its strengths in the case of learner modelling, turn into potential stumbling blocks in the case of group modelling: PAPI is mainly oriented towards the activities / performance of individuals or groups; however, it makes no explicit provisions for describing the characteristics / attributes that are shared between the group participants. As a result, semantic information over what actually qualifies a person as a member of a group can only be indirectly modelled.

### 3.3 Adaptation modelling

The issue of modelling the behaviour of any adaptive system has two complementary but distinct dimensions, which we will examine separately: the specification of adaptation logic, and the specification of adaptation...
actions. The former is responsible for relating information available in one or more models and assessing whether adaptations are required. The latter refers to specifying the very actions that need to be effected by the system for a given adaptation to be achieved.

Attempting to standardise the way in which adaptation logic is expressed would be, in the authors’ opinion, rather premature at this point in time. Existing approaches include simple rule-based engines, case-based reasoners, etc., all the way to powerful logic-based reasoning engines. Given this wide range of approaches in use, it is apparently unrealistic to aim at a single specification that could accommodate them all. On the other hand, developing a range of specifications should be undertaken only after evolution in the targeted approaches has reached a critical level of stability, ensuring validity and endurance of the specifications over time.

Unlike the case of adaptation logic, adaptation actions constitute a well-researched and rather “crystallised” field, especially as far as Adaptive Hypermedia Learning Systems are concerned (Brusilovsky, 2001). Furthermore, recent research (Paramythis and Stephanidis, 2004) has proven the feasibility of formalising and declaratively specifying (using an XML-based language) adaptation actions to be effected as part of an adaptation cycle. It is argued that such efforts could easily be extended, so as to arrive at a standard that allows for flexibility as far as adaptation logic in concerned, and defines a concrete way for coupling that logic with an extensible set of adaptation performatives for ALEs.

Of the existing standards, the only one that supports the explicit representation of dynamic behaviour on behalf of the system is the IMS Learning Design (LD) specification. In more detail, Levels B and C of the specification under discussion introduce the concepts of properties, conditions and notifications, which can be used to specify arbitrarily complex dynamic behaviours for a system. The main setbacks in employing the IMS LD for modelling adaptation in ALEs are rooted in the fact that specification of dynamic behaviour is achieved through the definition of programming flows (including condition variables), enriched with event semantics:

- The approach can be considered rather low-level: Specifying complex adaptive behaviours is tedious and error-prone.
- Conditionals may only refer to variables or states that exist in the context of a single IMS LD document (which makes it impossible to consult models external to the document).
- Dynamic behaviours cannot be defined at the system level (and applied in more than one contexts, or for more than one sets of learning materials / activities).
- The dynamic behaviour specified cannot be reused: there is tight coupling between the behaviour itself and the artifacts to which it refers.
- And, finally, the behaviour specification lacks semantic-level information which would allow an ALE to modify or affect it in any way.

Despite the above shortcomings, the IMS LD may be a very appropriate vehicle for introducing adaptive capabilities in non-adaptive e-Learning systems. Specifically, an adaptation engine can be introduced in an LD-capable system, which would effect adaptations by generating or augmenting LD specifications “on the fly”. In other words, such an engine would translate adaptation logic and actions into IMS LD compliant constructs, which would then be delivered to the user. By going through this process dynamically (at runtime), the system would also be able to incorporate into the generated constructs, current information derived from adaptation-specific models.

3.4 Standardisation at the level of adaptation components and services

The majority of ALEs are designed to exist as stand alone systems. As a result, little or no attention is paid to exposing or utilizing adaptation-oriented components services to / from the “outside world”. PLS (Conlan et al., 2002b) and KnowledgeTree (Brusilovsky and Nijhaven, 2002) are two of the few examples of departure from this rule. Both of the aforementioned systems are designed to source content and functionality (such as Learner Management, Collaborative Tools, Testing Services) externally, not encapsulating all functionality into a monolithic core. However, they take quite different approaches to this sourcing.

PLS utilises a standards-based API (based on ADL SCORM 1.1) to interface with other compliant systems. In this way it can integrate with a Learner Management System (LMS) and pass user and assessment information back and forth between the systems. The PLS service is based on the notion that an adaptive
content provider should be a service provider rather than a repository for extraction of content. Communication between PLS and a learning portal (or LMS) is achieved by enhancing the SCORM Runtime Communication API as used in SCORM v1.1.

The KnowledgeTree framework, on the other hand, is intended to facilitate interoperability and reuse at the level of distributed, reusable learning activities (with the emphasis being on learning activities, as opposed to learning objects). KnowledgeTree, like PLS, goes into the realm of run-time communication and interoperation standards, seeking to standardize the ways in which different specialized subsystems supporting aspects of the (adaptive) learning process can communicate and exchange information that would allow them to be aggregated into a “whole”.

KnowledgeTree considers the standards-based model as not appropriate for adaptive distributed content and argues for a 3-component model (portal – content – student model server) (See Figure 2). PLS is structured to work within existing courseware management systems (CMS) that are completely static and thus consider adaptive services to be the main providers of adaptivity. It is assumed that the adaptive selection and structuring of content can only be done by a service. In contrast, KnowledgeTree allows for different kinds of portals – some can be as static as existing CMS, but some can be adaptive. In this vision, an adaptive portal can provide different adaptive support such as, for example, as adaptively selecting the best of existing static or adaptive content and adaptively arranging it for the student.

The two ALEs discussed above, despite taking two alternative routes to enabling service-, or component-based reuse of adaptation-oriented functionality and content, call our attention to important omissions in existing standards. Specifically, existing specifications necessarily refer to interchanges between components involved in the “traditional” interaction cycles between ALEs and their users. Adaptation, being outside this interaction cycle cannot be covered by these standards. Rather it introduces a new, distinct set of communication goals (or “reasons” for communication), as well as requirements in terms of the exchanges between system components. To compensate for this fact, we would need to engage in efforts to either: (a) enhance existing service-level specifications to explicitly account for the notion of adaptivity / personalization (PLS model), or (b) introduce new specifications that are “vertical” to, and independent from, existing ones, and are specifically intended to enable adaptation-oriented interchanges between those components / services that participate in the various phases of the adaptation cycle (KnowledgeTree approach).

4. Conclusions

This paper has attempted a preliminary assessment of the adequacy of existing e-Learning standards for supporting the introduction of adaptation techniques in e-Learning systems. The analysis, however cursory due to space limitations, has pointed out that existing standards do have some provisions for adaptation, but require substantial extensions to accommodate common practice in ALEs. Our findings can be summarised as follows:

In terms of domain modelling (i.e., modelling of courses, or learning-related activities), existing e-Learning standards do not suffice to capture the rich semantic structure that underlies static learning materials, or single- / multi-participant processes. Several alternative approaches are possible for integrating such semantic-level information into the metadata structures that typically accompany learning materials, as has been clearly demonstrated by recent research efforts. Of these approaches, the ones that seem to be most promising are those that seek to formalise / standardise ways for semantically articulating relationships and properties of the “units” from which materials and activities are composed; alternative adaptation methods and techniques can then be devised on the basis of the available information. More restricted in scope and...

Figure 2: Main components of the KnowledgeTree distributed architecture – portals, activity servers and student model server. Adapted from (Brusilovsky and Nijhavan, 2002).

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The modelling of individual learners as users of an ALE is also not sufficiently covered by what is already available. The “PAPI” set of standards seems to be a step in the right direction, but is not adequate by itself. Not only that, but it is currently “competing” against a host of other related specifications, which may be more likely to adopt by organisations that seek to comply with a series of standards / specifications that come from the same body (e.g., IMS LIP is more likely to be supported by organisations complying with IMS specifications in general). ALE-oriented standardisation (not to mention “de-fragmentation” of learner profiling work) would greatly be facilitated by the convergence of these specifications, with (portions of) PAPI providing explicit support towards adaptation. The modelling of groups of learners, on the other hand, is still in an embryonic stage in terms of standardisation. Although there exist today ALEs that do identify and represent such groups on the basis of learners’ performance, preferences, interests, goals, etc., the representations used are intended only for internal “consumption”. Although PAPI can be used to convey information about groups of learners, it lacks the expressive capacity to capture the very information that would be of particular interest in ALEs: the common attributes / characteristics of learners (derived, e.g., from their history of interaction with the ALE) that have resulted in their being classified as a group. Specifications that address this shortcoming would have to be developed anew.

Adaptation modelling in the context of ALEs is a more complex issue, because it potentially involves both adaptation “logic” and the “actions” that result from the application of that logic in relation to the various static and dynamic models maintained by an ALE. It has been argued that seeking standardisation at the level of the “logic” might be futile at present, mainly due to the proliferation of approaches that exist currently, and the vast differences between them (e.g., formalism used, computational models, etc.) A more realistic goal might be the standardisation of adaptation actions (i.e., the “things” that can be adapted within an ALE, and the “ways” in which they can be adapted). This would enable the employment of widely differing approaches to “logic”, while unifying, to some degree, the representation of modifications that can be adaptively effected in learning materials, computer support for inter-personal activities, etc. Furthermore, IMS LD has been discussed as a potential standard for instantiating adaptation logic and actions, at a given point in time and for a given user, or group of users. As in the case of group modelling, standardisation efforts in this direction would have little to build upon currently.

Standardisation at the level of adaptation components and services has only recently been addressed (at the level of de facto standards) in the context of research efforts. Two different approaches were presented and discussed in this paper: the extension of specifications that deal with the interchange between components of LMSs, and the introduction of new specifications that are explicitly intended for enabling the exchange of adaptation-oriented information / services between the major parts of an ALE. It is argued that these two approaches are not necessarily contradictory, or, for that matter, mutually exclusive. In fact, they seem to have complementary advantages and drawbacks: the former signifies an only partial departure from existing specifications, but fails when it comes to distinguishing between functionalities that can be exposed as services from specialised sub-systems; the latter, while addressing the problem just mentioned, must be approached very carefully in order to ensure that it does not interfere with, or render unusable, lower-level specifications that are already in wide use. Given the above, it is argued that a combination of the two approaches would be the better grounded alternative for any future endeavours in this direction.

In closing, we would like to touch upon a few topics that we feel are inevitably intertwined with any effort to expand upon current standards and specifications in the direction of adaptation / personalisation. To start with, it is argued that extensions to standards / specifications should happen in a way that keeps the “entry cost” of employing adaptation facilities in the development of e-Learning
materials, to as low levels as possible (mainly in terms of invested resources). An example of what would constitute, in the authors’ opinion, a gradual and non-taxing path towards such employment, would be as follows. Authors should be able to provide an existing course with “traditional” metadata to an adaptive system, and get basic adaptation facilities (resulting from a “default” interpretation of the course structure and material by the system). Later on, authors could progressively add “adaptation metadata” as a stepwise approach to enabling / providing more advanced adaptation features.

Secondly, it is important that future extensibility of (new or enhanced) standards is seriously taken into consideration. It can be anticipated that the progressive uptake of adaptive methods and techniques in e-Learning systems will give rise to new adaptation patterns, and an even wider range of approaches than are in use today. Where possible, therefore, new standards / specifications should provide all the necessary extension points that would allow for the progressive enrichment of the respective models.

Finally, the adoption of the new standards or extensions proposed in this paper is, in our opinion, highly dependent upon the development of authoring tools that facilitate the creation of compliant resources. The creation of high quality-, standards compliant-learning material is already a quite demanding goal. The introduction of adaptation facilities will inevitably impose an additional “burden” on content creators. In order to bring the related cost / benefit ratio to non-prohibitive levels, it is necessary to have tools that: can assist authors in converting “static” material; support the authoring of adaptive content; enable the specification of adaptively supported activities in ALEs; etc.

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Evaluating e-labs’ Experimentation

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Abstract: This communication discusses preliminary results on an experimentation of e-Learning with MIS students, mainly in order to cope with the logistics of lab organization. A learning management software was installed which changed completely the learning process, from content to logistics. Students have expressed their satisfaction with the e-Learning approach. A comparison was computed on their performance improvement in order to assess the usefulness of the learning. Despite its limits, the study has encourage the course coordinator to implement the software use on a broader basis.

Keywords: e-Learning, laboratory, tutor, learning management

1. Introduction

In order to survive, the Higher Education Institutions of the 21st Century will increasingly rely on various forms of electronic delivery and communication inside a marketplace that requires education to be flexible.

Hall (2000) contends e-Learning will take the form of complete courses, access to content for “just-in-time” learning, access to components, any courses and services, and the separation of “courses” to acquire and test knowledge vs. content as an immediate, applicable resource to resolve an immediate, perhaps, one time only problem.

Learning is and will continue to be a lifelong process, that could be accessed anywhere at anytime to meet a specific need or want. Hall (2000) added that more links to real-time data and research would become readily available. Given the progression of the definitions, web-based training, online learning, e-Learning, distributed learning, internet-based learning and net-based learning all speak of each other (Gotschall, 2000; Hall & Snider, 2000; Urdan & Weggen, 2000).

L’École des Sciences de la Gestion (ESG-UQAM) is making progress on enhancing the Information and Communication Technologies (ICT) infrastructure for its learning, teaching and lab logistics.

e-Learning is a very effective method of learning and lab’s logistic (Hall, 2000; Mosterman and al., 1994) for adults who have busy schedules or live in remote areas are unable to attend an every day traditional school. Two independent research studies conducted by Researchers at Colorado State’s AACSB-accredited business school compared distance students to their campus counterparts and to executive MBA cohort students on 12 specific competencies. Results found distance students reported higher measures on technology than the executive MBA group. The study looked at several levels of learning: social, procedural, explanatory, and cognitive. The results determined that online learning allows for greater explanatory and cognitive learning and residential study highlights and improves social and procedural learning. (Kretovics, M and McCambridge, 2002; Empirical study, 2001).

More and more computer learning will be done in different time and format. University undergraduates will expect to find higher dependence on technologies. Wider participation from a broader cross-section of society will also drive institutions away from ‘one-size-fits all’ mentalities. Universities are making a lot of progress in enhancing learning Information and Communication Technologies (ICT) infrastructures, teaching, and labs’ logistics. (O’Hagan, 2002; Paulsen, 2000; Keegan, 2000).

Management students must become literate in MIS theory and must be able to use spreadsheets and software database. For non-english students good texts are uncommon and learning relies mainly on labs, traditionally given by graduate students. Two difficulties are frequently observed : labs availability (Wagner and Tuttas, 2001) and educational quality (IHEP 2000).

2. e-Learning labs at ESG UQAM

Historically, laboratorites were planed in order to satisfy sporadic needs, not to deal with
Internet’s incredible pressure on labs’ usages. The demand for workstation has exploded and reserving a lab for a group is very difficult nowadays. As more and more courses are given in labs; it also implies to decide when to reserve in order to accommodate day and night customers.

Recruiting graduate students to teach those labs is also a difficult task as they are expected to be software experts, pedagogic experts, group management experts ... but paid as low as possible. Unfortunately after every session many of them quit for many reasons, including the fact that they graduate. This forces the director to recruit, form, and supervise new assistants.

Clearly, a new approach was needed and e-Learning introduction was decided on an experimental basis. The University of Quebec in Montreal has installed software management training which changed completely the learning process, from content to logistics.

The University of Quebec in Montreal support and encourage the effective and timely use of digital technologies and resources in the learning and teaching process. In doing so, it seeks to achieve its institutional goals and to attain the vision to be locally, nationally, and internationally competitive and collaborative in an increasingly technology-enabled environment. New teaching models that incorporate e-Learning is already being explored at the University of Quebec in Montreal to deal with the increase of students and to respond to changes or improvements in the development of specific skills subjects.

The University is also committed to explore Continuing Professional Development opportunities:

- Distributed and off-campus learning situations are increasing. E-Learning offers flexible solutions to managing this change facing limited staff time, resources and improve labs’ logistics.
- Short courses and continuing education within the University are likely to tap into e-Learning in order to expand its share of this market. E-Learning can potentially facilitate collaboration with other universities.
- Undergraduate courses with an increasing intake of part-time and overseas (distance) students with differing needs are likely to increase their use of technology and to provide more flexible support.

- Development of North American e-universities will open up many new possibilities for higher education institutions in marketing and purchasing education, for which the organizations must be ready with both technical and cultural aspects.

This communication discusses preliminary results of e-Learning experiences aimed at alleviate the logistics of lab’s organization for MIS students in University of Quebec in Montreal, the second largest business school of Canada.

E-Learning appears to be an inescapable tool in employees training of today’s modern society. E-Learning offers a multitude of tools such as course content, platform management, and systems for creating interactive contents.

Academic and professional literatures promise many benefits to be derived from e-Learning systems. The Training Magazine’s 1999 statistics (Industry Report 1999) report that companies are shifting from on-site classrooms to on-line learning. There are many reason for moving from traditional learning to a system of e-Learning that include cost factors (Urdan & Weggen 2000), training materials which are available anywhere and anytime (Downes, 1998), the changing nature of work and the move to a knowledge economy (Broadbent 2000), the move from “just-in-case” to “just-in-time” learning (Urdan & Weggen 2000), the growth in the internet & technology (Urdan & Weggen 2000) and value-added services; giving less work to the labs’ staff and diminishing the congestion with labs’ reservations (Sloan Consortium 2003). An E-Learning labs has been developed by research groups at Arizona State University to support teaching activities related to semiconductor device theory to overcome the limitations of a traditional and conventional device simulation laboratory (Vasileska & Kaur 2003). Another study (Beasley and Smyth, 2003) showed that students didn’t use the Virtual Learning Environments (VLE) in the ways intended, and the result was not necessarily a negative finding because students found it to be a valuable resource.

The project supposed defining a precise content definition, programming an appropriate micro-content modular approach, and organizing a meaningful environment in order to sustain the theoretical teaching. Students were enrolled in a predetermined sequence,
measured at all steps and they progressed through the lessons under limited access. Prerequisites concepts had to be understood before changing lesson.

3. The EPC Campus platform

An adequate training platform named ‘EPC Campus’ was chosen from the few companies offering a bilingual version of tutorials. The accepted solution contained a learning management system (LMS), named I-tutor. It offers knowledge skills evaluations in order to determine the ideal training plan to be established. High quality training programs in office automation, accessible at all times and final training exams for a complete report on all acquired skills.

I-tutor, the learner’s management system, assures a simple and efficient follow-up of the training plan:

- Access control for each user
- Numerous educational and statistical reports
- Easy communication for the learners
- Personalized course catalogue
- Printed accreditation certificates

Training plans developed by EPC allows a significant decrease in average training lengths as it promotes a great flexibility by shorter training periods, allowing the time saved to be used for the actual work itself. In order to succeed with a high quality e-Learning course contents, EPC has based its educational approach on traditional training proven successful for decades. Strongly believing in this concept, the group of courses replicate a traditional method:

- To explain
- To show
- To have learner perform the task (with or without assistance)
- To evaluate

Believing in the success of the training plans, this method is appealing, and it is definitely one of the major arguments to support the high satisfaction of users. Good navigation interface in an LMS facilitates “lurking” and “super-lurking”. Many students enjoy and learn from e-Learning’s application. Lurking should be allowed and provided for in a good e-Learning environment. A good LMS facilitates compensation measures taken to remedy the “dehumanised” online-networked environment.

4. Data and measures

An instrument was designed and administrated to the summer term enrolled student in order to analyze their performance and satisfaction using the e-Learning approaches. A Likert Scaling is used and rated on 5 items from “strongly disagree” to “strongly agree”. The measures are:

- **Ergonomics**: Many authors (Stamatis & al, 1999; Nunes & al, 1996; Eisenstadt & al, 1998) have discussed the benefits of ICT course delivery for learners, tutors and institutions. E-Learning System failure will result on E-learner dissatisfaction and non-use, this mean loss of customer in the case of e-Learning faculty service provider. That's why E-Learning system quality criteria concerns Technological and Delivery Systems equipment requirements and specifications. Variables related to the system quality criteria include: Ease of Use, Speed of Access, Level of Graphical Realism, Audio/video Output and Flexibility.

- **Contents and Pedagogy**: Putting content online (Minton & al, 2003) for e-Learning is a totally new challenge for many searchers. Course content is a central feature in any e-Learning course. However, an e-Learning program is much more than simply the content, just like a traditional course which is much more than the course notes and textbooks. Choosing the type of content to be used depends on the other aspects of the e-Learning program, and the pedagogy (Khurram M, 2001; Kalpesh H.P, 2001) that informs it. Good and pleasing content is necessary, but impressive multimedia material is not the answer (indeed may be distractive in some cases), but the answer is the use of a suitable e-Learning environment.

- **Quality training, Performance and Student Satisfaction**: E-Learner satisfaction is referred to as the ‘how was it for you?’ question! Whatever e-Learning system provided, should always ask the learners for their reactions. Include questions about the style, pace and quality of the learning.

The participants (students) were administered 2 questionnaires. The first one measured only students’ performance before using the e-Learning tools and the second one measured students’ performance and satisfaction. This data has been collected during the 2003 summer class. The students were asked a

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series of questions to measure a number of variables in order to find quality through e-Learning tools and to conclude about their distance education experience and performance.

The survey was undertaken to investigate and promote a better understanding of the importance of degrees in the labs and readiness of e-Learning. The students were asked to evaluate the ergonomics, content, interactivity, pedagogy, and their appreciation as for the results of online-training using the ‘EPC Campus’.

A total of 50 respondents between the ages of 21 and 42 years old, (61% men and 39% women) who were currently students attending the same mandatory course of computing information management and on average at the same level in there curriculum.

5. Analysis and results

When asked to assess the quality of the EPC Campus content, the vast majority of respondents agreed on the excellence of the contents as it can be seen from Table 1.

Table 1: Appreciation of EPC Campus contents

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPC Campus content</td>
<td>4.5</td>
<td>4.5</td>
<td>4</td>
</tr>
</tbody>
</table>

More specifically, students were asked to quote their appreciation of the EPC Campus to deliver EXCEL training. This training was important to succeed in an assign. The respondents expressed their satisfaction as shown in Tab 2.

Table 2: Appreciation of EPC Campus to deliver quality training on Excel

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality training on Excel</td>
<td>4.46</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

In order to better understand the potential impact of the technical environment on the satisfaction, the assessment of the virtual campus was mandatory. It can be said that the students appreciate the EPC e-Learning approach as it appears in the following Table.

Table 3: Appreciation of e-Learning as a pedagogic tool

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-Learning as a pedagogical approach</td>
<td>4.58</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Finally, the students were asked to assess the ergonomics of the EPC campus. The appreciation is good as the reader will see in Table 4.

Table 4: Appreciation of the Courseware Ergonomics Design

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ergonomics Courseware Design</td>
<td>4.38</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

As we can see on the Tables above, the percentages were very significantly; more than 95% of the respondents are totally agree and satisfied with their e-Learning labs new experience.

In the summer term 2003, 50 students passes a test on excel. 2 months later after their first experience using e-Learning tools on Excel module, students pass an exit test.

We used a paired sample test to know if is there a significant difference between the two tests? As the samples are paired, the two-tailed test is appropriate.

Stating the hypotheses:

$H_0: m_d = 0$ (The E-Learning tool is not effective)

$H_1: m_d \neq 0$ (The E-Learning tool is effective)

The Statistical Test will be evaluated at the 1% level based on probability and the alternative is two-tailed.

Table 5: Paired Samples Test – After and Before using e-Learning

|               | Mean | Std. Deviation | Std. Error Mean | 99% Confidence Interval of the Difference | t   | df | Sig. (2-tailed) |
|---------------|------|----------------|-----------------|------------------------------------------|-----|----|----------------|}
| After Elearning | 61.16 | 11.440 | 1,618 | 56.82 | 65.50 | 37.803 | 49 | .000 |
| Before Elearning | 61.16 | 11.440 | 1,618 | 56.82 | 65.50 | 37.803 | 49 | .000 |

Based on the Tab 5, we reject the null hypothesis because 2-tailed Sig = 0.000 <0.01. And if we use the critical value of the t-student $t_{0.01;49} = 2.4049$. So the Decision: Since $t = 37.803 > 2.4049$, we reject the null hypothesis $H_0$. 

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As we can see on the paired Samples Test, students performance increase with the e-Learning tool. On the other hand, students with bad scores on the first test get good and same marks on the exit test as students with good scores.

Table 6: Student performance

<table>
<thead>
<tr>
<th>Tests Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>22</td>
</tr>
<tr>
<td>29</td>
</tr>
<tr>
<td>36</td>
</tr>
<tr>
<td>43</td>
</tr>
</tbody>
</table>

6. Discussion

In total, students were very interested and satisfied with their experience during the last 2003 summer class. Students have passed 2 tests on Excel. The first one before using the e-Learning tool and the second one at the end of session. Students exit test obtained good scores on Excel. Using the paired sample tests and a statistical analysis we have concluded that the students performance average increased. This new enriching experience was appreciated by the teachers, labs' staff and students as we can see on the results analysis of tests and the questionnaire.

From the teacher’s point of view, management students surpassed the expected logistic benefits. Indeed, instructors understood students’ difficulties and focused on the real problems instead of adopting a general approach in class. The software produced many reports on each student and on the group, allowing a better understanding of e-Learning and potentially needed adjustments.

Students have expressed their preferences for e-Learning approaches over traditional classes with graduate assistants. The most appreciated features were that each student could progress at his or her own pace.

These results are preliminary and must be considered as such, yet encouraging enough for permanent use in this course; learning uniformity among different groups becoming also possible. Further research is definitively needed but clearly, the project has already delivered greater students' satisfaction and performance and has lowered the logistics constraints on labs' reservations.

The students stated in the feedback discussions that they now find themselves able to learn without the assistance of the professor. If students did not understand something about the course, they can ask the e-Learning tools without any embarrassment and without disturbing the whole class. The survey reveals that students are very satisfied with the quality and the effectiveness of their e-Learning labs programs. At the same time, a substantial majority of survey respondents (95.6%) have made efforts to gauge the effectiveness of their e-Learning labs programs.

This work arise many questions: on what is the educational value of remotely controlled laboratories versus traditional ones?. In the same time, more research must be done to know if it is possible to use the new E-Learning tools to target explicit student difficulties, resulting in a higher level of student achievement?. On the other hand, future research’s must be done to measure the efficiency of lab’s logistics, then the reservation and student learning time consuming for courses. We need to made other tests to know if there is a difference in performance if we change the course matter (excel to access), and what’s happen if we vary or change the homogeneity of e-learners groups.

In conclusion, the granting of e-Learning at University of Quebec in Montreal will bring through this technology good labs’ logistics, quality and performance.
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Abstract: The academic environment is undergoing a major shift, as increasing numbers of schools are ready to offer courses using mobile technology for economic and other reasons both from an instructor and student perspective. The mobile learning (m-learning) approach would necessitate changes in pedagogy, educational roles, curricular content, and classroom practices. In addition, it would also require different system architecture because it would demand massive integration of software systems. This paper presents a method for exploiting web services architecture for m-learning.

Keywords: Mobile education, e-learning, M-Learning, Web services

1. Introduction

Emerging technologies are leading to the development of many new opportunities to guide and enhance learning that were unimaginable even a few years ago. There are already about one million courses on the internet, 30,000 of them compiling with a scientific definition of online, 22,000 of these are listed on the telecampus portal, with many of them making didactic use of the World Wide Web (Anonymous 1998). The e-learning includes online learning, web-based training, virtual universities and classrooms, digital collaboration and technology assisted distance learning. The WebCT kernel alone was used by 5 million students in more than an hundred thousands courses, developed by 40,000 university and college faculty at over 1,000 institutions in 50 countries. The acceptance of e-Learning or web-based learning is due to growing availability of commercially available Learning Management Systems (LMSs) such as WebCT, BlackBoard, Learning Space, IntraLearn , Top Class, eCollege, Click2learn, Authorware, LearnLinc ,Virtual-U, Web Course in a Box, UniLearn and WebBoard (Abernathy 2001).

Handheld computers, the wallet-sized organizational devices used by business professionals to keep track of appointments, contacts, e-mail, and the Internet, have found their way into classrooms. Using m-learning environment, teachers eliminate the need to write assignments on the chalkboard because they can "beam" instructions to students' handheld devices (Kaasinen, Aaltonen et al. 2000). With the advent of mobile devices such as portable handheld computers becoming the norm in business and in our daily lives, it is inevitable that the educational environment will realize that using these mobile devices on campus would enrich the learning experience of students (Abernathy 2001) (Ed 2001). Educators understand that mobile handheld computers and wireless connectivity at schools can enrich the learning experience of students. Using mobile devices such as Palm handheld computers connected to web servers on campus, students can truly experience the freedom and productivity of mobile handheld computing (Bunnell 2002). Wireless laptops, Palm devices and graphing calculators will free teachers and students, turning any place into a classroom Students can access real-time information about their class curriculum, school events, after school sports and even test scores. An m-learning architecture based tool would enable students and teachers to quickly and easily access course curriculum and data whenever and wherever they need to. Time-crunched students and professionals place high value on the ability to access data anytime anywhere -- and wireless access is the future for all types of data transmission (Daniel and Cox 2002). Palm handheld-based learning programs would help students to solve and submit student homework assignments with lot of flexibility and may create a better learning experience in and outside the classroom. By the end of 2003, predicts Stamford, CT-based Gartner, 107 million Americans will own a Web-enabled cellular phone and 8 million will have a Web-enabled PDA (Training 2002) (Guardo, Arjona et al. 2001).

The paper presents the details of web services architecture that could be used for m-learning. The proposed architecture would provide students and teachers the opportunity to obtain any and all class related material on their Palm handheld computers through a web services architecture. The paper presents an architecture that can help to develop "one stop" oriented integrated software. Integrated software will provide an access to a central
home page that allows for synchronous group meetings, instant messaging, and a gateway to other real-time audio/video applications such as Microsoft NetMeeting, Netscape CoolTalk, or CU-See-Me.

2. M-Learning – A new paradigm in education

As our society is entering a knowledge-based, Internet/Web-driven economy, college education becomes a necessity for any individual who wants to be competitive and successful, regardless of his or her age, gender, and race (Fisher, 1997; Holstein, 1997). Over the last two decades the number of American college students over age 40 has more than tripled. Two-thirds of the older students are women; some of them have returned to school after their children are grown, giving them time to develop a career ("Older Students," 1996). Today, most full-time college students work part-time; many part-time students work full time, commute, and often have families to support. Students have found that going to college in the traditional way is difficult. They need innovative ways to help them study and work more efficiently in this competitive world (Zhao, 1999). To meet student needs, many universities offer self-, or i-paced, online courses on the Web with related technologies and applications software; studies indicate that i-paced online learning can be effective (Shea and Boser, 2001). M-learning is one step more in the same direction (Abernathy 2001).

The evolution in education and training at a distance can be characterized as a move from d-Learning (distance learning) to e-Learning (electronic learning) to m-Learning (mobile learning). With the successful development of Bluetooth, WAP (Wireless Application Protocol), GPRS (General Packet Radio System) and UMTS (Universal Mobile telecommunications System), the technological structures for wireless telephony and wireless computing are now firmly in place. M-learning, or mobile learning, involves delivery of digitized content to either wireless phones hooked into laptops or personal digital assistants (PDAs). The wireless technologies of the mobile revolution have seen the worldwide proliferation of wireless communication devices (Landers 2002). The idea behind m-learning is that it allows on-the-go professionals to connect to training courses anytime and anywhere. M-learning can include anything from job aids and courseware downloaded on personal digital assistant to Net-based, instructor-facilitated training via laptop (Abernathy 2001). M-Learning, allows users to access IT courseware modules via the Palm operating system. The Microsoft and Cisco certification courses, covering telecommunications fundamentals, TCP/IP, UNIX and JavaScript, are already available in m-learning format (Report 2000). Mobile technology enables schools to extend learning beyond the walls of classrooms. Palm handsets can be loaded with applications, such as financial calculators, reference books, literature books, coursework organizers, and word processors etc. The schools have already started experimenting with this technology to develop new ways to enhance the educational experience of its students and the teaching experience for its faculty. Stanford University Law School has recently experimented with Palm devices; other PDA applications are also in use around campus, with positive results. Washington's American University is implementing a plan to become the first totally wireless university (Reuters 2002). The University of South Dakota is supplying Palm Pilots to first-year law and medical students (Ed 2001).

This technology provides students and teachers the opportunity to obtain any and all class-related material on their Palm handheld computers through a simple process of point-and-connect using infrared. The intersection of mobile computing and e-learning includes anytime, anywhere resources; strong search capabilities; rich interaction; powerful support for effective learning; and performance-based assessment (Abernathy 2001).

There are two familiar approaches to the issue of mobile learning. The first points out that since the dominant mode of access to the Internet will soon be through wireless devices, e-learning simply becomes m-learning, without any particular changes in content. The new approach stresses that m-learning will characteristically aim at specific kinds of knowledge, namely knowledge that is location-dependent and situation-dependent. The way e-learning is changing to m-learning is shown in Figures 1 and 2 (Landers 2002).
The application of new, mostly mobile, technologies to distance learning involves new problems that require new and innovative solutions from both pedagogical and technological points of view. The same system that provides teacher-student communication provokes an excessive demand on teacher’s response capacity, thus changing the pedagogical tools (Elena, Miguel et al. 2001).

2.1 M-Learning - A paradigm shift

The use of information and communication technologies in education and training has undergone several paradigm shifts over the last three decades (Bransford et al., 1999). E-learning (learning supported by digital "electronic" tools and media) and m-learning (e-learning using mobile devices and wireless transmission) have emerged. Handheld devices are emerging as one of the most promising technologies for supporting learning and particularly collaborative learning scenarios; mainly because they offer new opportunities for individuals who require mobile computer solutions that other devices cannot provide. M-learning is a new paradigm that creates a new learning environment. Mobile learning is unique because learners can access the course material, instructions, and other course related applications anytime and anywhere. This increases daily attention to learning material, makes learning pervasive, and may boost the learner’s motivation for lifelong learning. Moving from stationary to mobile learning allows ad hoc collaboration and informal interaction between students (BRA, 2002, Wierzbicki, 2002). Mobile-learning is learning supported by mobile devices, ubiquitous communications technology, and intelligent user interfaces. The unique elements of mobile learning are; the facility to communicate with individuals or learning communities, either transient or well established, at any time or location; the ability to provide learning content dynamically dependent on a learner's location, wider context and the device being used by a learner, and the ability to record discrete acts of a learners ‘learning episode’, as they move through space and time, for later use and to provide recorded elements of previous learning episodes at any time or location (Rekkedal, 1999, Sariola, et al., 2001, Szucs, et al., 2001, Kynäslahti, 2001, Szucs, Wagner, and Holmberg, 2001). It is envisioned that with m-learning, the boundaries between the social arena and the formal learning arena, the classroom, diminish as students also take mobile telephone into use in classrooms. The teacher is put in a position in which the information that exists within the four walls of the classroom competes with information from ‘outside’ the classroom - beyond the teacher’s control. Thus, the classroom culture is bound to change (Rekkedal, 1999, Koschmann, 2001, Bransford, et al., 1999, Gay, et al., 2002). We also hold the view that learning is an individual process that can be supported by adequate interaction and/or collaboration in groups (Askeland 2001). Mobile learning technologies present a challenge to the school – a challenge to access and utilize alternative learning arenas (Rekkedal, 1999). Mobile
technologies are referred to as handhelds, Personal Digital Assistants (PDAs) or Pocket PCs (PPCs) (Quinn, 2000, Sariola et al. 2001, Nyíri 2002).

Handheld mobile computing devices allow for exploratory activities not bound to a special location, for example field trips, without losing the potential for taking electronics notes and retrieving information of various types. Such notes, ranging from data collections and digital images to handwritten annotations, can be easily exchanged and downloaded. If combined with wireless transmission, these activities can be continuously monitored and coordinated between places. But even in classrooms and training settings with more or less fixed locations, the use of mobile and wireless technologies may lead to substantial changes as this can bring the technology to the background and to set the focus more on inter-personal relations and on the task at hand (Roschelle et al., 2002). A number of evaluation studies among distance and online learners demonstrate that students emphasize flexibility (Rekkedal, 1998, 1999). The various other shifts that may take place in m-learning environment are illustrated in following tables:

### Table 1: Various Pedagogical and other Changes for M-Learning Environment

<table>
<thead>
<tr>
<th>Current e-Learning Methods</th>
<th>Pedagogical Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Text-based and Graphic based instructions</td>
<td>M-Learning (Wireless)</td>
</tr>
<tr>
<td>Lecture in classroom or in internet labs</td>
<td>More Voice, Graphics and Animation based instructions</td>
</tr>
<tr>
<td>Learning occurring in the field or while mobile</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instructor to Student Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current e-Learning Methods</strong></td>
</tr>
<tr>
<td>Time-delayed e-mail (students need to check e-mails or web sites for communication)</td>
</tr>
<tr>
<td>Passive communication</td>
</tr>
<tr>
<td>asynchronous</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student to Student Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current e-Learning Methods</strong></td>
</tr>
<tr>
<td>Face-to-Face</td>
</tr>
<tr>
<td>Audio-teleconference is quite common</td>
</tr>
<tr>
<td>e-mail-to-e-mail</td>
</tr>
<tr>
<td>Private Location</td>
</tr>
<tr>
<td>travel time to reach to internet site</td>
</tr>
<tr>
<td>Dedicated time for any group meeting</td>
</tr>
<tr>
<td>Poor communication due to group consciousness</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feedback to Students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current e-Learning Methods</strong></td>
</tr>
<tr>
<td>1-to-1 basis</td>
</tr>
<tr>
<td>Asynchronous and at times delayed</td>
</tr>
<tr>
<td>Mass/standardized instruction</td>
</tr>
<tr>
<td>Benchmark-based grading</td>
</tr>
<tr>
<td>Simulations &amp; lab-based experiments</td>
</tr>
<tr>
<td>paper-based</td>
</tr>
</tbody>
</table>

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### Current e-Learning Methods

**Assignments & Tests**

<table>
<thead>
<tr>
<th>Current e-Learning Methods</th>
<th>M-Learning (Wireless)</th>
</tr>
</thead>
<tbody>
<tr>
<td>in-class</td>
<td>any location</td>
</tr>
<tr>
<td>Dedicated time</td>
<td>24/7 Instantaneous</td>
</tr>
<tr>
<td>Restricted amount of time</td>
<td>any amount of time</td>
</tr>
<tr>
<td>standard test</td>
<td>individualized tests</td>
</tr>
<tr>
<td>poor feedback</td>
<td>Richer Feedback</td>
</tr>
<tr>
<td>delayed feedback</td>
<td>instant feedback</td>
</tr>
<tr>
<td>fixed-length tests</td>
<td>flexible-length/number of questions</td>
</tr>
<tr>
<td>More text-based tests and</td>
<td>More audio and visual animation based tests and assignments</td>
</tr>
<tr>
<td>assignments</td>
<td>In-Field tests /experiments</td>
</tr>
</tbody>
</table>

### Presentations, Exams and Assignments

<table>
<thead>
<tr>
<th>Current e-Learning Methods</th>
<th>M-Learning (Wireless)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical and text based</td>
<td>Practical oriented exams direct on site hands-on based</td>
</tr>
<tr>
<td>Observe and monitoring in lab</td>
<td>Observe in the field and monitoring from remote location</td>
</tr>
<tr>
<td>class-based presentations</td>
<td>1-to-1 presentations with much richer communication</td>
</tr>
<tr>
<td>Use of one language</td>
<td>Auto translation for delivery of instructions in many languages (languages translator)</td>
</tr>
<tr>
<td>Individualized, component-based group work</td>
<td>Simultaneous collaborative group work</td>
</tr>
<tr>
<td>paper-based assignment delivery</td>
<td>electronic-based assignment delivery</td>
</tr>
<tr>
<td>hand-delivery of assignments at a particular place and time</td>
<td>E-delivery of assignments at any place and time</td>
</tr>
<tr>
<td>Instructor's time used to deliver lectures</td>
<td>Instructor's time used to offer individualized instructions and help</td>
</tr>
</tbody>
</table>

The convergence of computing and communication is a process that is turning phones and mobile terminals into powerful multimedia units. The XML-based Synchronized Multimedia Integration Language (SMIL), for instance, would be very useful for the distribution of sophisticated multimedia content. These forms of interactive multimedia offer new possibilities to learn, think, and communicate. The future online interactive m-learning based courses will have more multi-media based materials, tests and assignments. The present web-based asynchronous delivery method normally involves primarily text based material. This would change with the new m-learning paradigm. It should also be emphasized that we assume that the m-learning students normally will have access to a desktop or laptop computer with Internet connection for offline learning. This means that the equipment and technologies used when students are mobile are additions to the students’ basic equipment used when studying at home or at work.

#### 2.2 The teacher-student relationship in M-Learning environment

Mobile technology is changing the basic paradigms of when, where, and how school instruction can be delivered. The implications for the teacher-student relationship, standards, assessments, accountability, and traditional geographic boundaries are fundamental issues with which state and local boards of education will have to wrestle (Mioduser, et al., 2000). The teacher-student relationship has always been, and will continue to be of value. What will eventually happen in the mobile learning model is a 'blended learning' - an intelligent combination of e-learning and instructor-led training. The student will have access to multimedia learning tools, and all the information available on the Internet. The teacher will act as a guide to the student on how best to use these tools to get the information that is required. Constructivism is the main pedagogy used in online learning. This approach is used in the form of discussions, constructivist activity and conferencing to enable the learner to build an understanding and the meaning of the issues and to construct new knowledge on the basis of information (O'Reilly and Morgan, 1999, Mioduser, et al., 2000).

For effective teaching in a m-learning environment, teachers and students both need to understand the nature of the social relations, the quality of the interaction, and of
communication will ensure communicative competence, which includes the exchange of information, knowledge, experience, and development of skills. Teachers need to understand the complex relationships of cognitive tasks, socio-emotional aspects of learning, and the social context of learning, in order to create those social spaces for reflective learning by students. Online learning and specifically m-learning is very different from the traditional face-to-face instructor-led teaching method. The m-learning model is compared with traditional method of learning and is shown in figure 3 and figure 4. As shown in these figures, the learning space or classroom concept of traditional method is changed in m-learning environment. This certainly will have effects on student-teacher relationship and social issues.

![Diagram of Traditional Method of Learning](image1)

**Figure 3:** Traditional method of learning

![Diagram of M-Learning Environment](image2)

**Figure 4:** M-Learning model

Learning is a complex activity that puts students' motivation and physical condition to the test. Teaching resources, teacher skills, and curriculum all play a vital role in a students' learning process. The power dynamics of online education and particularly

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m-learning will be altered (Mioduser, et al., 2000). The ‘space’ in which the students are learning is their own space, not a classroom. The time of study is the student’s own choice, not the school’s. The major resource for generating new insights is not the teacher but the combined intellectual resources of the student group and the resources available on the Internet. Power rests more in the student group than in the teacher (LaRose, and Whitten, 2000).

Students perceive the benefits of m-learning as, ease of access to continuing professional development. The authors conducted a short survey of teachers and students to know their experiences with online- and specifically m-learning as compared to the traditional face-to-face method of learning. The students expressed that their experiences with the m-learning environment were more communication-rich and more effective. However, the teachers’ perspective of the same experience was very different. The majority of teachers opined that teaching online is more time demanding than teaching face-to-face. In addition, teachers miss the social engineering component of student-teacher relationships (Bonk, and King, 1998, Higgison, 2000).

Another aspect of the m-learning environment will be a shift in the learning paradigm. There are many aspects of the college experience that are significant to the development of a student into what we consider a well-rounded, college-educated individual. It is for this reason that colleges have Student Development and Student Services offices, to provide educational, cultural, social, and other activities to complement student learning and round out the college experience. In a m-learning environment, building such developmental components in a learning experience is a challenge (Higgison, 2000).

From a modal perspective of online mobile delivery, the shift is toward learning communities with less emphasis on the tutor as ‘sage on the stage’ and more on the guiding and facilitative functions. Online communication lends itself to dialogue and negotiation as it allows both the student and the teacher to test understanding, which might be evidenced offline in the form of body language or signs of attention. Online, the teacher does not know what a student does or does not understand unless they asks. Some research into email communication for learning purposes has found that the lack of relatively "immediate" response to students’ emails is a major de-motivating factor (Ting-Toomey 1999; Carroll, 1987 in Ting-Toomey, 1999). Given this, online tutors cannot assume to fully understand phenomenon like "silence" and other related issues such as humor. It would be wiser to check and ask. This can be done in the online group environment, or behind the scenes in individual emails, faxes, or telephone calls. Asking learners to reply, or to give the reason for their silence, should be done regularly, but with tact and explanations as to why the subject was raised (quality control, checking all is well, etc). Learners are often not aware of the impact of their silence on other participants in the group or on the tutoring/learning process. To avoid issues causing a block to learning in an online or m-learning environment, teachers and facilitators need to address a number of issues (McKenzie, 2000).

- Teachers should give due consideration in designing contents in multiple formats ensuring access to disabled, blind and the visually impaired students.
- The learning materials should be based on multiple perspectives and ways of doing things.
- Teachers should making rules, norms, expectations, learning content and skills explicit; explain the reasons for doing things; check to see that students have really understood and what is expected of them.
- Teachers should suggest where students could get appropriate help, including online resources.

## 3. Web services architecture for M-Learning

Web services are the next big thing in distributed computing. Unlike existing distributed technologies (such as CORBA, J2EE, COM, and DCE), Web services are descendants of text processing systems rather than binary communication protocols (Mateosian 2002). XML is derived from document processing technologies, not distributed computing technologies. Web services are asynchronous messages that exchange XML documents across a network. Web services also are responsible for mapping the XML documents into and out of executable programs, objects, databases, and legacy applications. The executable programs are not part of the definition because they are not included within the specifications that define the core Web services technologies. Web services are not executable. They are instead
The rush toward mobile services reflects a shift in the nature of computing: rather than a device-centric world with a PC at the center, the consensus is that we are moving toward a mobile person- (or identity-) centric universe where a multitude of devices (PCs, laptops, PDAs, phones, tablets, etc...) can access user-specific data from any location (Mateosian 2002) (Bunnell 2002). Fortunately, with the emergence of Web services the task may become easier. Web services are the next wave of distributed enterprise computing. They provide a layer of interoperability that allows applications to be described, published, located, and invoked irrespective of underlying architectures. Web services are driving the next generation of mobile computing applications by providing a thick abstraction layer that masks the operating systems for any given device from the developer (Dostan 2001). Web services architecture is a set of emerging protocols and standards. It offers a different approach to enterprise integration and development. Architecturally, Web services are typically made available by use of a common transport mechanism, namely SOAP, through which agreements and binding can be universally facilitated. The directory, or repository, is accomplished through UDDI. The interface is described in WSDL, and the transport is managed seamlessly using SOAP, allowing users to communicate with the outside application regardless of what platform, system, or standards are being used behind the scenes (Gottschalk, Graham et al. 2002) (Editorial 2002) (Gibbs 2002). This concept is visually represented in Figure 5.

**Figure 5:** Logical architecture of a web service built on the flexible services architecture

Developers can build standard interfaces to existing and new systems using SOAP and they can describe the process of accessing the data using WSDL. These let each user access data in another user’s database without custom programming on an application-by-application basis. The re-use of Web services functionality cuts development time. A developer only has to identify the user’s data to access and link to the corresponding WSDL interface, using existing development tools. Presently, web service models are using four standards: Soap, WSDL, XML, and the UDDI protocol. These comprise the basic capabilities necessary to build the discrete elements of a services-oriented architecture (Gottschalk, Graham et al. 2002). Web services architecture will offer many benefits in systems design such as: encouraging modular system architecture; changing underlying program logic without greatly affecting interfaces; hiding underlying system complexity via standard interfaces; extending and enhancing legacy systems without changing underlying code; and offering platform- and vendor-neutral applications. Largely due to these many benefits, web services are gaining momentum (Dostan 2001).

### 4. Flexible services architecture for M-Learning

The designing principle for m-learning architecture has to be on the premise that the technology and the developing tools had to be integrated within the principles of the open,
component based, modular architecture which will permit the reusability of the modules in various training scenarios and operations, with wide acceptable standards, are to be used to permit the interoperability with the existing hardware and software (Elena, Miguel et al. 2001).

In accessing a course from a wireless handheld device, the system would know how to assemble the objects that can be downloaded and then send them to the handheld device. In addition, e-learning information intended for a handheld unit must be formatted to suit that device. Considering the above principles for designing architecture, the authors propose the web services oriented Flexible Services Architecture shown in Figure 6 for an m-learning environment (Miller, Sharma et al. 2002).

![Figure 6: Flexible services architecture for web services](http://www.ejel.org)

The goal of many schools is to develop a student-centered, network-centered, mobile computing oriented flexible environment that can allow students to access the content whenever they need it, in whatever form they need it. M-learning can include anything from job aids and courseware downloaded on personal digital assistant, to Net-based instructor-facilitated training via laptop. The proposed m-learning architecture that is web services architecture based is open, scalable, and global, with plug-and-play capabilities. With the goal of creating a plug-and-play m-learning applications environment that supports interoperability among different vendor solutions, the framework of the architecture is an open, standards-based model (Morgan 2002). A scalable architecture delivers appropriate performance as broadly as possible, while providing the flexibility to increase the level of sophistication of the overall learning solution as it matures. The
4.1 Application layer

The application layer consists of various services for students and instructors. These services include: library services, admission services, fee submission, grade sheet, and language translation, etc. All different applications. These services are created by instructors and administrators for students use. The students are the receivers of these services. The interaction between students and instructors and administrators is at the application layer. The other layers below application layer will be completely transparent to students.

4.2 The integration through web services standards layer

At this layer, the integration through web services would integrate all the contents and applications that may already be available in different formats. Web services architecture used for this type of purpose would cause the whole integration process to be similar to plug-and-play, and would provide enough flexibility to allow content independent of devices. The architecture ensures availability, scalability, and performance, as well as the ability to simultaneously deliver data, voice and video. It also manages security, quality of service and content distribution. The application integration layer provides access to all the internally built systems, authoring tools as well as the third party authoring tools supported by IT, such as DreamWeaver, Microsoft Word, OutStart, gForce, or PowerPoint. It enables e-learning providers to register entire learning applications as binary large objects (BLOBs) or to register structured objects. Structured learning authoring tools enable the author to assemble learning objects, including text, graphics, assessment items, executable files, videos, etc., into a lesson template.

4.3 The delivery devices layer

The delivery devices layer is used to deliver the content using internet enabled multiple devices a. The flexible services architecture support all-purpose personal communicator systems geared to societies "on the go" including multifunction cell phones, e-mail capability, PC, Web surfer, fax, video-television, picture phone, AM/FM radio, and global positioning systems. All-purpose devices that are compact, wireless, and use a single, lifetime identifier code so that a person can be reached anytime, anywhere, will capture the fancy of communications era consumers. The content can be customized automatically depending upon the type of device.

4.4 The human layer

The human layer consists of learners, administrators and instructors. This layer signifies that on one hand instructors and administrators will be creating services, therefore would have interface with application layer, and on other side, there would be a direct interaction between instructors and students for communication, feedback, or other learning components, thus there would be interface through end user layer.

To implement the above flexible services architecture for m-learning, the m-learning technology environment may include mobile device such as: pocket PC, mobile phone, and portable keyboard. This m-learning device will have the power of a desktop that gives access to Microsoft Pocket applications such as Internet Explorer, Outlook, Word, Excel and Microsoft media player. Among this software would be Microsoft Reader with a Clear Type kind of software. Microsoft Reader with a Clear Type kind of software program would be helpful to read e-books or content in *.lit file format (MS Reader file format). The software would also provide opportunity to read e-books, Pocket Dictionaries, etc. to downloaded from the Internet and synchronized to the Pocket PC via the PC. One can synchronize the device with one’s desktop PC to read e-mail, view attachments, update the calendar and the device can easily connect to a mobile phone via cable, infrared, or wireless technology for online browsing. Learning content and the communication component of a learning environment include resources (articles on the web, references to other resource materials), online access to the discussion forum with the possibility quick access for reading in the Forum and writing.
contributions, and e-mail for individual communication with instructor and fellow students and for submitting assignments. Assignments may be submitted as text-based e-mail, voice-based mail or as Word or Text or voice attachments.

Although, one can use the various readymade software packages available in the market for this purpose, however, the prototype of this framework is developed to demonstrate the powerful features of web services based architecture. The prototype web service code is written in the programming language C#. The communication is all done through SOAP, which is a subset of XML. The database used is SQL Server 2000 database, which is a relational database management system. The experience of developing this web service model is unique from other software development projects. The end user is usually known prior to development as well as the device/application that will be used. In this case, there was no specifically defined user, therefore multiple devices and consumers had to be considered. From a development standpoint, the challenge is to build a dictionary database. Setting up a database that can contain audio, video and text data, and to allow data to be retrieved quickly upon request is a challenge. The most difficult task of developing such a service is how to handle the multimedia files. One can store the multimedia files in the database as binary data, but every time somebody requests them, the program must build a temporary multimedia file, which is expensive from a processing standpoint. Also, if the consumer were using a cell phone, such multimedia files are unusable making this development effort pointless. To access data from a cell phone would require at least 2 interfaces, one for the cell phone, and one for a multimedia device. This opposes the idea of "transparency" where everybody accesses the service in the same way. The authors created "virtual files" for this purpose, and then passed around the URL to those files.

There could be number of different ways the m-learning model could be implemented.
1. Mobile Internet service
2. Online access via mobile telephone to the entire course
3. ‘Download-on-demand’ version

The authors are planning to experiment mobile internet service model. Using Mobile internet service model, students easily could access and download the entire course content anytime anywhere in their mobile device. The Mobile learning service can provide interactive and personalized content and applications to handheld device or Internet-enabled mobile phone real-time via wireless connection or desktop synchronization. Due to web services architecture and use of XML, it can deliver any format of file (html, pdf, reader, etc.) and the backend format will be transparent to the users. This allows the students to use the materials actively. The students would be able to 'make the materials their own' while studying and these functionalities may help students organizing the materials cognitively to support learning and remembering. Students can also download content for offline considerations such as studying mainly offline, communication and discussion with fellow students, group assignments, and communication with the instructor - including submission of assignments with correction and feedback.

5. Conclusion

M-learning offers a unique opportunity for teachers and students in different kinds of learning environment settings. The unique feature of this mode of learning is that it enhances flexibility for students; however, it demands new pedagogies, and new approaches to deliver a course. If appropriately facilitated, m-learning helps learners in a great way by providing virtual classrooms on their mobile devices. Teachers will ultimately spend more time for course-delivery and follow-up as compared to traditional classroom method. In addition, teachers will have to provide a rich learning resource and environment, which in turn, contributes to the quality of learning. To keep up with these changing phenomenon and to continue to effectively facilitate m-learning, it is imperative that online teachers learn about and adapt to the changing environments, when and where appropriate. Web services provide a means of integrating applications via the Internet. By using XML messaging to exchange data, Web services allow companies to link applications and conduct e-business regardless of the computing platforms or programming languages involved. Web services are quickly becoming the way to develop systems, for obvious reasons. They eliminate the major problems associated with network and distributed software, and they can provide a new source of revenue for companies that provide the service. The proposed web services based flexible services architecture could become a new direction for developing web services applications for mobile education.
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The Development of Language for Implementing IT Within a Learning Organisation

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Abstract: This paper explores the role that language can play in the development of technologies or other processes within an organisation. Examples and lessons from the literature of the learning organisation are looked as a key in the development of language. The paper uses a practical example of a customer complaints management system to demonstrate how the theoretical insights discussed in this paper can be put into practice. Finally the authors propose that a common organisational language can be developed. Then the design and use of IT for learning within organisations can be achieved.


1. Introduction

The learning organisation implies being able to learn within complex structures (Appelbaum and Gallagher, 2000) as well as alter routines that mental and structural forces (Senge, 1990) place upon an organisation. This paper acknowledges the difficulty in this area and briefly discusses the terms that have been used interchangeably throughout the literature. The main contributors to the area of the learning organisation and organisational learning, such as Argyris and Schön (1978), offer only one perspective while others such as Senge (1990) and Pedler, Burgoyne and Boydell (1997) offer alternatives. Therefore, for organisations to implement learning technologies many perspectives must be examined. The paper then explores the role of language and how language can play a role in the learning organisation.

Appelbaum and Gallagher (2000) note the increase in an organisations change in structure to meet the current demands of business. The resulting changes, driven by information technology and involved schemes such as business process re-engineering (BPR) (Hammer and Champy, 1993), resulted in downsizing and the loss of individuals who possessed valuable knowledge. If these individuals can place their knowledge in the technological domain and recreate and develop new forms of knowledge then organisations may find they can become more innovative and competitive than relying on just the ‘T’ factor of information technology. For this to be achieved, more emphasis has to be placed in systems thinking and the use of language. Thus, if organisations fail to address the individual, the organisation and the technology equally in their systemic interrelationship, they may find little value in pursuing learning technologies for developing a learning organisation. A case study is used to show how the theoretical debates discussed in this paper can apply in practice. Finally conclusions are drawn from the case study.

2. The learning organisation and the role of language

The survival instinct of an organisation usually takes the form of profit generation even though not all organisations’ prime motive for existing is to make a profit. However, the organisations that do look to make a profit can view learning as a way to enhance their competitiveness. Garvin (1993) concurs as he feels, that to continuously improve, organisations need to commit to learning as a lack of learning increases the chances of copying old practices that may not be suitable in the current environment. Viewing the world differently may present new opportunities for individuals within organisations to increase the competences of the organisation. This may result in a more efficient performance compared to competitors. As the world becomes more complex the aspect of certainty becomes distant so learning has been changed to respond to the changing environment (Choueke and Armstrong, 1998; Garratt, 1999; Lee and Bennett, 2000). It is not a simple matter for individuals to decide to adopt the philosophy of a learning organisation. The main factor in developing a learning organisation comes from the culture, which allows the learning to take place (O’Keeffe and Harrington, 2001). Here lies the first problem, as all individuals who share a culture understand what the underlying values of the culture entail. Therefore, all individuals who are to participate in a culture of learning

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have to understand what a learning organisation is.

The simplest definition of the learning organisation can be described as “one that facilitates the learning of all its members and continually transforms itself” (O’Keeffe and Harington, 2001 p137). The main problem with the research about the learning organisation is that a precise definition has not been agreed upon. What is agreed is that the terms ‘the learning organisation’ and ‘organisational learning’ is not the same thing (Reynolds and Ablett, 1998). Organisational learning can be described to be taking place where the behaviour of individuals is changed (Reynolds and Ablett, 1998). Reynolds and Ablett’s (1998) view of the learning organisation are an organisation in which once learning has taken place, a change in the organisation occurs. The previous statement on the description of a learning organisation is similar to the opening quote of this paragraph, from O’Keeffe and Harington (2001).

The focus so far has been on defining a learning organisation but we now turn our attention to how individuals use language to interact with each other and add meaning to their view of the world. The role of language mainly focuses on the work of Maturana and Varela (1980, 1987) and Bohm (1999). Our attention is then turned to the use of language within the learning organisation.

2.1 An alternative conceptual perspective on the role of human language

The traditional view of cognition and language is based on the metaphor of inside - outside. The outside, or real world, is considered to be the source of information, and the inside, or the brain, is considered to be an intelligent processor of this information, with the mind embedded within it. In this metaphor our observations are merely representations of the outside that are thought to represent the truth and the brain, and the mind within, is the machine that works on these observations to extract knowledge. Mingers (1989) states that a large proportion of the cognitive science is based on the assumption that the human mind works by “manipulating objective representations of the environment”. Language is therefore used to describe an objective world. Words stand for real things that exist as a true reality independent of the individual observer.

In contrast, more modern views of cognition such as those of enactive cognitive science and autopoiesis (Maturana and Varela, 1980) have moved away from this distinction between inside and outside. Cognition is conditional to embodiment and the ability of an individual to differentiate is thought to be a consequence of that individual’s specific structure. Thus, the act of cognition is a matter of interacting with the world in the capacity in which one is able to interact, and not simply an act of processing what is objectively to be ‘seen’.

However, since our distinctions are generated through our interactions, then the content of our knowledge is not simply a mapping of reality, but our way of living and understanding it. The knower is the ultimate point of reference. We apply divisions and distinctions in our thinking about the world. However, this fragmentation does not have an absolutely objective existence, as our distinctions are epistemological qualities not ‘true’ realities.

As humans we exist in language. However, language should not be regarded as a system of symbols that are composed into patterns that stand for things in the world (Bohm, 1999). Language did not evolve just to take in an outside world. Therefore, it cannot simply be viewed as a tool to reveal that world. Language is a venue for action, coupling the cognitive domains of two or more actors (Maturana and Varela, 1987). Therefore, it is often preferential to discuss languaging as an act rather than language as a symbolic notation.

Social systems exist for their members within the operational coherence of languaging together: ‘Human agreements decide what is true and what is false. It is what human beings say that is true and false; and they agree in the language they use. That is not agreement in opinions but in a form of life’ (Wittgenstein, 1967).

2.2 Language and the learning organisation

The use of language is a very important issue in every aspect of our lives. It is especially important in the understanding of how to coordinate activities within an organisation. If an individual (Person A) communicates with another individual (Person B) on how best to tackle a problem, but the second individual (Person B) attaches a different meaning to the communication, compared to the first individual (Person A), then they do not share the same
language even though they can communicate together. Here may lay a problem with the understanding of the learning organisation. Senge (1990) concurs as he feels that every individual must share the same viewpoint of the system under discussion.

The discussion of Argyris (1999) on logical paradoxes can be used as an example of the problems of language and attaching meaning to that language. A logical paradox can be described as a contradiction embedded in the actions that are communicated (Argyris, 1999). Argyris (1999 p92) uses the example of a statement that reads, ‘I am lying’ which can be taken as true. Argyris (1999) then points out that if the statement is true then no ‘lying’ has taken place and the statement becomes false (Argyris, 1999). The main reason paradoxes like the example just given occur is due to the fact that individuals create meanings that are inconsistent, but have disguised the fact that they are doing so (Argyris, 1999). If these paradoxes are occurring within organisations then the same language is not being shared either through design or through other factors. Therefore, this use of language has to be understood and shared for a learning organisation, at least in the minds of the individuals of the organisation, to be brought into existence.

Krippendorff (1995) discusses the features of design and notes that designers are more concerned with the end product than on how the idea for the product occurred through the communication mediums of speaking, presenting and disagreeing. It may be theorised that Krippendorff (1995) was specifically talking about the design of physical products that are sold to a consumer. However, this issue can also be applied to the design of an organisation and the design and use of information technology. The focus is mainly upon the end in itself, for example, how a newly designed organisation will better function or what benefits a new information technology system will bring.

Little attention is focussed upon the discussions on how about firstly a newly designed organisation or information technology system came into the discourse of all individuals involved and secondly, how this discourse evolved to create the new organisational form or information technology system that is now in place. Krippendorff (1995, p138) states ‘Notwithstanding dictionary definitions, I see discourse as a particular way of languaging, as a social phenomenon with a life of its own’. From the definition on discourse, through Krippendorff (1995), a learning organisation therefore must develop a discourse that is given a life that all individuals can develop together which becomes embedded in the culture of the organisation.

3. Information technologies in learning organisations

Lee and Bennett (2000) feel that through the impact of globalisation, organisational restructuring and information technology has forced organisations to learn to operate in new ways. It may be thought that these new technologies are being implemented as a solution to the ever-increasing pressures of globalisation. However, Mingers (1989) feels that the environment is not responsible for changes to an organisation (such as the requirement of new technologies) but may select specific states that are offered by an organisation’s structure. If the organisation has developed the right technologies and uses them in an appropriate manner, the organisation will be able to interact more successfully with the current environment compared to its competitors. Therefore, the rapid development of new information and communication technologies (ICTs) are playing a role as the infrastructure that is creating networks and providing an opportunity for organisations to learn (Pemberton and Stonehouse, 2000) to interface with the environment. These technologies may provide the raw data that individuals may require but it is up to the individuals themselves to analyse the data. Analysis can be described as having three dimensions: namely synthesis, hypothesis and implication (Westney and Ghoshal, 1994). The synthesis dimension can be described as assembling data to make a complete picture (Westney and Ghoshal, 1994). Hypothesis refers to using the data to create ‘what if’ scenarios, while the implication dimension refers to future and possible actions of competitors (Westney and Ghoshal, 1994). From the analysis of the data it then has to be communicated throughout the organisation.

Technologies such as software packages, the management of documents, e-mail and intranets are just some examples of tools organisations may employ to enhance learning (Pemberton and Stonehouse, 2000) and communicate data. However, allowing all individuals to have access to the data that flows through these technologies may not provide the required learning. Henderson
(1997) notes that deciding what may be classed as true is very difficult for individuals but is exceedingly more difficult for groups such as an organisation. The individuals may observe and interpret the same data differently (Henderson, 1997). Therefore, an organisation focusing upon the technological factors to create a learning organisation will find disappointing results as all members may interpret the same information differently.

Technology allows the capture and placement of data into another context (Zuboff, 1988). If the organisation does not have a shared language then the data may just remain as data that has been transformed from one state to another, with no function for learning to take place. Thus, the traditionally established metaphor of ‘the transmission of information’, in which communication represents something, which is generated at a certain point and carried through an information channel, or conduit, and delivered to a receiver, is misleading. It presupposes that what happens to the receiver (listener) is predetermined by the perturbing agent, not by the structure of the receiving entity, while the phenomenon of communication depends not only on what is transmitted, but what happens to the person who receives it. Communication, therefore, is a matter of mutual orientation, primarily with respect to each other’s behaviour, and secondarily with respect to some subject. (Whitaker, 1996). Language as we have argued is a venue for action, a way of life (Wittgenstein, 1967) and not a means for transmitting information

The understanding of language as a place for action presupposes that a language has to be developed prior to the technology, that is to say language has to emerge in the conversation for action. Through the applications of hardware and software the language of the organisation can be institutionalised to suit the organisation’s requirements. While institutionalisation is important, it has to go hand in hand with the possibility for further developing the language and thus the institutionalised practices. In an attempt to understand the problems discussed in this paper, a practical project presented itself within a manufacturing organisation. The organisation is trying to develop a customer complaints management (CCM) system to manage complaints the organisation receives. The initial and current development of this project is where our attention is now turned.

4. The development of a Customer Complaints Management (CCM) system

Throughout this paper an emphasis has been placed firstly on the statement that language must be developed before any technology and secondly, through the use of information technology organisations have to learn how to operate in new ways. Therefore, we have stated that for organisations to implement and use learning technologies the use of language must be developed between individuals. Both the authors of this paper are half way through working on a customer complaints (CCM) project, within a manufacturing organisation. The organisation is hoping to use a technology solution to record, manage and solve its customer complaints. A presentation from a leading technology company has already taken place. The customer service department is currently responsible for handling customer complaints but the planned system is being designed so that any individual who receives a complaint can input the problem into the technology.

The need for a system to handle customer complaints was highlighted through the company’s annual International Organisation for Standardisation (ISO) audit. An element of the ISO accreditation requires a system to record and handle complaints; this is currently not in place. Through the findings of the ISO audit the senior management have empowered a team to tackle the problem.

An initial brainstorming meeting was held where the first author attended to get a better insight as the current thinking and direction the project might take. Initial discussions on the various software packages that might be suitable were discussed and a brief bullet list on what constitutes a customer complaint was drawn up. However, it is noted that momentum for the project had not gathered pace and was still waiting to develop. It was at this point that the first author asked to join the project team with the initial emphasis on exploring the use of language to develop what can be classed as a learning technology. The project consists of individuals from customer services, workshop, repair shop, shipping, planning, and technical support departments.

4.1 Methodology

The literature on the learning organisation and language has been discussed. However, in order to develop, more effectively, a shared language that all participants in the team can
use to develop the technology it is important to reflect on the guiding methodology that is currently used. Checkland and Scholes (1990) soft systems methodology (SSM) is looked at, by the authors, as a methodology that is rigorous and flexible enough to allow the type of data that would be suitable to develop a shared language, as well as help in the development of a suitable technology. However, it should be noted that the methodology has been applied but each of the stages Checkland and Scholes (1990) advocated have been further developed to encompass the creation of dialogue and the development of a shared language. It is not feasible to go into greater detail about what the soft systems methodology contains, but information can be found through Checkland and Scholes (1990) or online Couprie et al (no date). Figure 1 shows a diagrammatic representation of the further developed SSM methodology used by the authors of this paper.

Figure 1: The Further developed SSM methodology Adapted From Checkland And Scholes (1990)

The SSM methodology contains a seven-stage process. It should be noted that the bold type displayed in figure one is Checkland and Scholes (1990) original stages of SSM. The authors feel by developing the methodology to encompass the stages as they are displayed in figure one will provide a learning environment to develop solutions to problems that the organisation may face. Checkland and Scholes (1990) explanation of the SSM approach seems to be mainly practitioner led. The SSM methodology displayed in figure one has tried to remove this emphasis and place it in an increased joint collaboration between all participants (including researchers). Therefore, the use of co-operative inquiry (see Heron and

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Reason, 2001) is looked at as a technique to allow this collaboration to happen jointly. At present stages one and two have been completed.

4.2 Initial approach

As has been mentioned, the project is only half way completed. This section will therefore discuss what was developed initially while the next section (current research progress) will go into more detail on how the data has been collected so far. Using the SSM approach stage one the problem situation unstructured (Checkland and Scholes, 1990) emerged from the ISO audit and the initial discussions and debates that the team held. It should be noted at this point that the methodology was not brought to the project team’s attention. It was felt that more work should be completed to prove to the project team the commitment the first author had to the project. Secondly, it was felt that bringing in techniques from academia, so early, might deter some of the team members from finding value in the approach. It can be summarised that this stage of the methodology (stage one) occurred through a two-week ethnographic study that took place from the 4 August until the 15 August 2003. The main purpose of the ethnographic study was to gain a better understanding of how the organisation worked from written to unwritten rules and any power relations that might exist as well as collect documentation.

4.3 Current research

At present the research has just finished stage two of the SSM methodology, the problem situation expressed. It was through this stage of the methodology that the methods and techniques that were used helped to develop a shared language. To help the team express the problem situation a technique called the appreciative inquiry method (AIM) (West, 1995) (for a more detailed description see Troxel, 2002) was firstly conducted. Two sheets that had the statements “What is a customer complaint?” and “Reasons for handling a customer complaint” were handed to each participant in the format shown in figure 2.

![Figure 2: The Appreciative Inquiry Method Adapted From West (1995)](image)

Each participant was given both statements and had to identify what they felt could explain ‘what a customer complaint was’ and ‘the reasons for handling a customer complaint’. Anything a participant thought of was written on the sheet stemming from the initial statement. Categories that are similar could be grouped together. The purpose of this technique is to get each individual’s perspective on the problem area. The statements are designed to be open so that each individual’s personal and work experiences could be captured in a different format than an interview or open discussion could. The data that was collected from this stage fed into the next stage of the data collection method, which were the semi-structured interviews.

Each interview was conducted by the first author through his interpretation of the problem area as well as the statements received from the AIM work sheets. Each interview was designed to allow enough flexibility so that each participant could interpret the question any way they felt. However, it must be mentioned the questions were not so totally vague that participants had to ask for clarity.
Each interview lasted between 20 – 45 minutes. The interviews took two weeks to conduct with two interviews commencing each day. The interviews were transcribed and analysed by the first author. From the analysis of each interview a ‘rich picture’ (figure 3 is an example) was constructed (see Checkland and Scholes, 1990 or Ryan, 2001 for a quick description).

![Rich picture of a research project](image)

**Figure 3:** A rich picture from the research project

All interviews were kept anonymous, were not placed in order the interviews were conducted, and were referred to only by a number. A brief summary accompanied each rich picture along with both AIM work sheets that had all of the participants’ statements grouped accordingly. The interviews and the AIM worksheets were then placed into a document and were then fed back to the participants. The initial reaction to the work was good with one participant stating, “This is more comprehensive then we could have achieved” (researcher’s diary November, 2003). It was emphasised that the document is designed to be a discussion tool. It is hoped that participants can look at each picture in dialogue with other team members about whether they agree or disagree with the view. The dialogue that will be created can then be the start of a shared language, which will be used to develop the appropriate technologies.

5. Future work and discussion

This paper has tried to give as much detail as possible on a project to develop a customer complaint management system within a manufacturing organisation. The project is just one aspect of the first author’s PhD work, which is looking at learning technologies within learning organisations. It can be argued that the techniques used to try and create a shared language have problems due to the first author designing, conducting and analysing the interviews. The outcome of this research can be argued to be the first author’s interpretation of events that have taken place (c.f. Kemmis, 2001). The authors acknowledge this problem. In answer to this problem the work produced is not designed to be a definitive guide as to how the project is to move forward. The document was designed to be used for a discussion tool.
Future plans include encouraging each participant to present their own rich picture to the group. If an individual feels strongly that a picture does not reflect what that individual believes then they can present their own view. This was another reason why each picture was kept anonymous so more focus could placed on what the picture was trying to communicate rather than who said what.

The future direction of the project remains to be discussed. The conclusion of the project has been announced as April 2004. Therefore, it leaves the project team just under three months. Up until this point the project has mainly been researcher led. It is envisioned the second phase of the project will be where all participants (including the researcher) will take the project forward together and not consider the researcher as the project leader. The outcome of the project will provide an insight into how a co-operative approach to implementing technology, as well as a focus upon the language developed, can be of value to an organisation when compared to other methods.

As technology is being implemented to solve business needs it is vital that a shared language is developed before any technology is implemented. In order to explore these problems the authors have expanded the soft systems methodology (SSM) as developed by Checkland and Scholes (1990). It is hoped that the methodology, as espoused by the authors of this paper, that the issues of language and the development of a learning environment can be created and used as a way to tackle problems an organisation may face. The practical case of a customer complaint management system has been used to demonstrate how the ideas discussed in this paper can relate in practice. At current the project has reached the halfway point (or stage two of the methodology).

The authors believe that unlike technology artefacts individuals speak to each other and construct themselves in language, which is continually changing (Krippendorff, 1996). If this language is not developed together the use of technology to solve problems can only cloud the issues that are attempted to be solved.

6. Conclusion

This paper opened with a discussion on the learning organisation and the role of language. The paper has identified that the role of language has been under-researched. It has been argued that language, as stated by such authors as Krippendorff (1995, 1996, 1997) and Whitaker (1996), is very important in creating a learning capability. Language is viewed as the meaning we create to our worlds and as a venue for action (Maturana and Varela, 1987). Language is used to co-ordinate activities within an organisation but is also used to create a shared view of the same system (Senge, 1990). It is the difference in viewing the system as the same through the use of language, which is causing logical paradoxes that create inconsistent meanings (Argyris, 1999). When individuals share inconsistent meanings of a problem and then come together to try and solve the problem, the outcomes that are not expected occur.

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Designing Competency Based e-Learning Initiatives

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Abstract: This paper deals with issues related to drawing up plans and putting into practice e-learning initiatives in complex and demanding business environments such as organizations that require recurring training, to optimize their learning processes in terms of cost reduction and efficiency gains. We view the issue of initiating and executing such an e-learning initiative both by the “process” and “product” perspective. Towards this end, our approach consists of conceptual tools and proposes a way of working supporting:

- Depicting and tracking personal competencies facilitating capturing of individuals’ informal knowledge and implicit and explicit evaluation
- Providing dynamically optimal recommendations to learners for individual learning paths, learning content and learning programmes

We propose that in order to achieve competency based delivery of learning, solutions should imply a learner centric approach taking under consideration the formal and informal knowledge that learners posses. Going a step further, we present a first attempt of modeling the whole evaluation cycle from the initial set up of required professional profiles and how this is tied to a given work position, to the final optimal recommendations that a solution should provide/deliver based on personalised evaluation of the competencies that learner has achieved or he/she wants to obtain.

Keywords: Personalised learning, e-learning process, learning delivery

1. Introduction

This paper aims at providing an approach for facilitating the design process of mainly large-scale e-learning acts with the purpose of serving the requirements and needs of organizations with geographically distributed employees and short learning curves, for enhanced learning delivery based on the competencies that their employees posses as well as on the anticipated training level they need to obtain. Customized and track learning on individual participant basis, and flexibility greater than the one offered in traditional Learning is one of the major goals of our research.

We present a framework for supporting large scale e-learning initiatives in big distributed and highly demanding organisations by viewing the issue from two different perspectives:

- the “process” perspective: the initiative set-up and execution i.e. the way of working towards an e-learning initiative lifecycle (goal setting, requirements elicitation, analysis and design, implementation, feedback and so on)
- and the “product”: the learning delivery to the final-users i.e. the final outcome of the process and its quality (personalized learning, quality of learning etc.)

The proposed framework will entail from the process viewpoint

- a set of well documented conceptual tools for the analysis of the professional knowledge and skills and of the production of professional profiles in the working environment for identified specialties.
- A consistent methodology for the evaluation and the professional improvement through educational processes, on the basis of the knowledge and skills of each employee, as well as
- A way of working for applying the proposed conceptual tools in real life projects,

while form the product viewpoint it tackles issues of personalised learning improved in quality.

Personalised learning will be achieved by enabling efficient evaluation of the employees using “traditional” evaluation techniques (online evaluation) as well as knowledge management techniques (tracing of learning behaviour patterns and informal knowledge) [Leo 1997, James 2003] This evaluation leads to the definition of workers’ basic deficiencies, as regards skills and knowledge (gap analysis) in relation to a required professional profile for a given job-position. The coverage of the detected deviations will be supported by dynamic recommendations for the subsequent learning process progress [Petropoulos, Xini 2003]. Domain specific and language
independent taxonomies are defined and employed in order to map the training subject to the required job profiles that need to be obtained through the training sessions as well as for the appropriate recommendations, which will be dynamically directed to the learner.

The rest of the paper is organised as follows: Section 3 presents the background of this research and the motivation we had for tackling competency based e-learning delivery.

In Section 4 we describe the learner centric approach for competency based learning delivery by defining the corresponding processes.

Section 5 deals with the appropriate evaluation methodological framework for the evaluation of the knowledge and skills of the employees, adapted to the frame of individual companies’ requirements.

Then section 6 goes in detail describing and sketching a conceptual architecture for the “product” perspective.

Finally section 7 presents the conclusions drawn from the work presented and proposes topics and steps for remaining and future work.

2. Background

The motivation for the work described in this paper and the methodology that was developed came as a straightforward requirement from research and development projects in different market sectors that our company is involved in. The approach followed by many of our customers, medium or larger organizations, with respect to e-learning services targeted to their personnel is rather technology oriented, focused primarily on providing the necessary technology platform and ensuring participation of their employees - trainees. They rely heavily on the functionality and evaluation characteristics that proprietary solutions offer. This in turn yields a misconception of the derived training results as well as a lack of methodological tools in order to measure efficiency gains, cost savings, individual professional improvement, groups’ performance enhancement, and organization advancement [Davenport, Prusak 1998].

Retroactive analysis of the different cases led us to establish a set of criteria for measuring the level of achievement of the objectives of a total competency based learning delivery solution from the perspective of personalized delivery of knowledge, human resources continuous evaluation, evolution tracking and improvement. This analysis was mainly based on the study of the deficiencies as well as the strong points of a variety of project cases. The criteria set were:

- **Personalisation**: If the systems offer services of personalized learning, access to knowledge and the degree that the system offers these services. We also examine whether the system is in position to construct, maintain and update a personal learning profile in a formal way, which is going to be consulted every time a knowledge intensive task is performed.

- **Evaluation**: Whether the system offers explicit or implicit evaluation mechanisms (on line tests, quizzes versus tracking of behavior, intelligent mechanisms).

- **Evolution tracking**: With this criterion we examine whether the solution under consideration captures and measures the progress of the individual learner within the learning environment using a formal way.

- **Human Resources (HR) support**: This criterion is highly interconnected with the previous one, and it is defined for examining whether the e-learning solution is in position to provide valuable and exploitable information concerning the trainees (e.g. evaluation) as well as useful directions for HR development (identified gaps of the staff, suggestions for knowledge provisions-training, knowledge assets etc.).

3. Competency based learning delivery

We propose a learner centric environment as schematically represented in **Figure 1** below.

In order to achieve dynamic evaluation of the employ’s learning paths according to the skills he/she possesses and the required ones that are the actual target of the training, a learner centric approach is proposed comprising as building blocks four main elements:

1. **The existing profile of the learner**: It describes the employees’ skills and current employment tasks

2. **The Required Profile**: It describes formally the skills that should be developed, enhanced or updated according to the training plan

3. **Explicit Evaluation Results**: These are the actual results that the employee
achieves through normal evaluation of tests and learning exercises

4. **Learning Behaviour Patterns:** These are the patterns that the employee generates in the learning process involved.

![Diagram of Learner-centric approach]

The four elements represent the corresponding conceptual entities that are captured and then processed in the proposed environment.

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3.1 **Process definition**

Inititally, a sampling research is suggested with structured questionnaires and processing of the filled questionnaires for example through the use of multi-criteria analysis, in order to define the professional profiles [Siskos et al. 2000].

The sampling research (apart from the general nature data) shall focus into two basic sectors:
- To the definition of general professional profiles, and
- To the evaluation and modeling of the human force on the basis of objective criteria

Collected data constitute the initial input and are then processed using the methodological approach of multi-criteria analysis for the assessment of criteria and indicators [Mendoza et al. 1999]. This analysis supports the definition of the satisfaction indicators of the employees regarding their professional role, as well as their objective evaluation on the part of their companies. With the aid of these indicators, the degree (grade) of overall satisfaction, and the satisfaction indicator of the individual factors are evaluated.

Given that the most important criteria for the placement and choice of personnel for the employers today are the “competence of knowledge”, and the “professional experience”, these elements should be verified, along with the degree of response to the market needs.

The collected and analyzed data should be modeled to form the conceptual basis for subsequent use. Several approaches may be employed for the modeling task such as Enterprise Knowledge Development tools [Loucopoulos et al. 1997].

Among the general professional profiles that are generated, some will be selected and adapted to the needs of the company in order to define the degree of compatibility with the
requirements of the market. These profiles are
categorised based on the specialties that the
learning initiative aims to train. In this way two
different models for the selected categories of
profiles are generated, consisting of
certified characteristics, knowledge and skills for each
selected professional specialty. These, we
conventionally call «ideal professional profile»
and «required professional profile» in contrast
to the real professional profile of each
employee and are both compliant with IMS
Reusable Definition of Competency or
Educational Objective RDCEO information
model [IMS-RCDEO(a)2002]

The whole procedure should be manageable
by a sufficient toolset, that does not only
evaluate the present knowledge level of the
employees, but also use knowledge
management techniques in order to chose the
most appropriate among the available training
sources for the implementation of the required
professional profile.

In this way a dynamic planning of an ad-hoc
«personalized» program for the development
of the human resources is generated. In turn,
this leads to overall management of knowledge
and skills, at the organisation level as well as
at the level of the knowledge background of
the employees, resulting to the faster and
more effective coverage of the existing working
positions, the rapid management of human
resources and the more effective management
of the professional evolution of the employees.

The evaluation cycle starts on the basis of the
detection of knowledge and skills of each
employee (definition of the real professional
profile) in relation to the required profile of its
category. This evaluation constitutes the basic
pre-evaluation for the classification of the
employee in some professional profile. The
procedure of the evaluation is implemented
and ends up whether in the detection and
certification of a gap between the required and
real professional profile, or in the interruption
of the procedure. The interruption occurs either
in the case that the employee is considered
insufficient in relation to the characteristics of
his role and must be placed in another
position, or in case the evaluation results show
that the employee is under-employed in
relation to his qualifications and possibly he
must be granted a higher level of work.

The definition and analysis of the gap should
be implemented continuously through
electronic applications for evaluation,
specialized data (positions requirements –
position owners), processing of the data,
informal knowledge tracing mechanisms
(learners behaviour patterns, taxonomies,
reasoning), classification of the data, grouping
of the personnel according to the differences,
representation of the results of processing and
other similar techniques so as to produce
utilizable and valid results.

The management of the differences that may
occur, being positive or negative, will be
conducted on the basis of the required
professional role or the future professional
improvement of the employee through the
provision of training programmes. This training
will aim to provide to the learner
supplementary knowledge and skills in order to
approach the required professional profile
tailored for the respective job position.

In the frame of the previous analysis of the
evaluation system, the following are involved
accumulatively:

- Management of the data related to
  working position (role, tasks, actions,
  communications, demands, etc.).
- Management of the CV data and
  profiling data of the personnel
  (education, training, experience, skills)
  [EURES 2003].
- Definition of the gap between the
  present situation and the required one
  (as regards knowledge, experience and
  skills of human resources).
- Monitoring of the evolution / development of the human resources.

At the same time, the evaluation focuses also
to the dynamic and effective management of
parameters like:

- Classification of the training into
categories and levels
- Training resources availability.
- Creation of training improvement
  programs by combining existing training
  units.
- Indicators of personal and professional
  satisfaction of employees and companies.
Having in mind the abovementioned data and in order to be able to implement the IT tools that can support the overall approach, the proposed actions are the following:

- Analysis of knowledge and skills according to the professional profiles selected
- Classification of knowledge in distinct parts of the knowledge subject
- Connection of skills with particular measurable results that the employee must achieve whether during the training or during work
- Creation of data collections with categories of questions, exercises, case studies and papers that will be presented or assigned to the employee according to the evolution of the training, during training
- Evaluation of the answers to the questions— exercises or the results achieved in case studies and work assignments
- Focusing on several questions categories, exercises categories, case studies and work assignments.
- Tracing and analysis of informal knowledge, i.e. knowledge not declared in the employees' formal CV.

The deducing mechanism of the proposed evaluation information tools will have input data derived from the training process of the employee, as well as data derived from his professional evolution and working and learning behaviour. Thus with the proper combinations it is feasible to define the level of knowledge and skills of the employee as compared to the required professional profile.

4. Evaluation methodology

4.1 Personnel' skills

The proposed approach uses a consistent methodological framework for the evaluation of the knowledge and skills of the employees-learners, adapted to the frame of individual companies’ requirements. The framework provides the mechanisms enabling evaluation of the employees knowledge, and individualised paths for upgrading the knowledge and skills of the employees, according to the defined requirements of their professional role.

4.2 Gap analysis

An integral part of the methodology is based on the evaluation of the gap between the requirements of the role of the working positions and the competencies (knowledge, training, experience, skills) in workers occupying these working positions. This Gap Analysis leads to the following:

- Estimation of the degree of knowledge, experience and skills (competency analysis) of the workers in relation to the requirements of their role - job description and their objectives for personal evolution (within the working settings)
- Definition of the required education / training
- Monitoring of the learning process and the “behaviour” of the learner

4.3 Evaluation cycle

This information provides the specified approach of a dynamic adaptation of the employees to the requirements of their professional role and consequently of the more general management of learners' knowledge.

The described procedure is recursive, aiming, on the one hand, to the better utilization of the human resources on the part of the company and, on the other, to the global satisfaction of the employees purposes regarding their continuous professional improvement.

Finally, the total evaluation is conducted on the basis of three distinct but fully supplementary levels, i.e.: the employability of the employee, the satisfaction of the employee’s goals in connection with his professional evolution derived from the attendance of the training program, as well as from the total evaluation of the employee and his professional evolution by the employer company.

Evaluation is divided in two categories:

*Explicit Evaluation*: These are the actual results that the employee achieves through normal evaluation of tests and learning exercises (LMS Evaluation tests, exercises, formal trainees’ evaluation results etc.)

*Implicit Evaluation* based on the informal knowledge traced from his learning behavior and on-the job processes that he/she is carrying out, strictly related to the training subject (Learning Behaviour Patterns).

Diagrammatically, the frame of Estimation and Evaluation of the Employees Knowledge and Skills is presented in Figure 2.

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5. Conceptual architecture

The product perspective is assessed with a proposed conceptual architecture depicted in Figure 3. The conceptual architecture is an attempt to provide high-level view of an integrated solution that performs the required processes of the evaluation framework. It presents the main functional components that can achieve the competency based learning delivery to the end-users, the learners.

Our approach considers a main precondition:

- There are Proprietary KM Environments (PKME) in the target organisation, which usually play specific role in a training process. These can consist of Learning Management Systems, KM Supporting tools, Intranets, Organisations’ file
servers, Communication and Collaboration tools, a combination of them and several other applications that the organisation may have in its possession. The data generated by these PKMEs may play significant role in the implicit evaluation of the learners' training process and usually are strictly connected with their tacit knowledge.

5.1.1 Sources adaptors

In order to trace the learners’ behaviour during their training process, our approach considers all potential internal and external sources that the learner uses as the depicted Proprietary KM Environments (PKME).

The PKMEs of an organisation used during a training process are generating data according to the learners’ usage behaviour and their training patterns. Those data may well describe the tacit knowledge of learners generated through the training process and are considered as preliminary knowledge entities that need further processing in order to add value in the evaluation methodology.

The role of sources adaptors is to provide the appropriate interfaces for Knowledge Feeder in the process of collecting specific data related to learners training process strictly connected with their informal knowledge.

We differentiate between two types of sources with respect to the adaptors:

- proprietary applications/tools or content sources that comply with standards as for example a Learning Management System compliant with LIP standard that the organisation may possess [IMS-LIP (2001)].
- Applications or tools that may not be standards compliant, usually applications and tools developed in house or that serve individual and/or specific organisation’s needs.

In the first case adaptors are set in order to collect data elements from PKMEs in a certain structure while in the second, adaptors have to be built in order to provide the relevant data in a specified standard compliant format.

5.1.2 Knowledge bases

These form an integral part of the proposed environment and are consisting of LMS repositories, Human Resources repositories, learning content repositories, competency/skills and other relevant RDCEO [IMS-RDCEO(a)] compliant repositories.

Moreover they are including registries that are used by discrete components in the form of native XML databases such as a registry for the publishing and description of Knowledge Feeder Web Services and the RDF registry for the Domain Specific Taxonomies.

5.1.3 Knowledge Feeder

The role of Knowledge Feeder is triple. It collects existing evaluation data, it collects learners’ data from the knowledge bases and the most crucial it collects usage data from the PKMEs through the specific adaptors.

Knowledge feeder may consist of a set of Web Services for these three different categories and implements their choreography in order to provide the appropriate output to the Evaluation Engine.

It is the main component that interacts with the interface and interacts also bi-directionally with the Evaluation Engine and Recommender components.

5.1.4 Evaluation Engine

The Evaluation Engine forms the core engine of the environment. Its role is to provide implicit and explicit evaluation results according to the proposed evaluation methodology in a way that learning gaps and deviations from learning paths are identified in an adaptive and progressive manner. The evaluation engine implements the core algorithms for the evaluation process:

(i) It receives the test results, exercises and training performance evidence from the Knowledge Feeder and performs the explicit evaluation

(ii) It receives from the Knowledge Feeder data representing learner’s behaviour and performs light reasoning with respect to the relevance/irrelevance of learner’s behaviour patterns to the training subject. This is achieved by identification of Subject categories in these patterns and their mapping to predefined domain specific taxonomies. It proceeds with distance calculations and uses the outcomes for performing the learner’s implicit evaluation.

(iii) It combines Implicit and Explicit Evaluation results with retrieved content from ad-hoc or existing competency/skills repositories and correlates with the required profile and/or the training subject goals.
(iv) It implements and performs the required Gap Analysis.

The Evaluation Engine interfaces with the Knowledge Feeder in order to get the appropriate input and also for calling specific Web Services needed during the Evaluation procedure.

It provides as output to the Recommender component the Evaluation and Gap Analysis results.

5.1.5 Recommender

The Recommender component has the role to identify potential corrective activities that the learner should take in order to fulfil the training process goals.

It receives input from the Evaluation Engine and interfaces with the Knowledge Feeder for retrieving learning objects [ARIADNE, 2003] and/or Internal or External Sources that have to be provided to the learner as a consequence of the Evaluation and Gap Analysis results. The identified internal and external sources are passed to the interface forming a close feedback loop for adaptive and progressive learning process assessment.

5.1.6 System Interface

The interface implements the learners’ interface to the whole environment as well as it implements the service request client for the Knowledge Feeder Web Services.

6. Conclusions and future work

In this paper we attempted to present a framework for supporting e-learning initiatives by viewing the issue from two different perspectives i.e. the “process”: the project set up and execution and the “product”: the learning delivery to the final-users. From the process viewpoint we suggested a way of working towards setting up an e-learning solution together with a set of conceptual tools in the direction of enhancement of learners profiling and feedback mechanisms in a recursive process. From the “product” viewpoint we proposed a conceptual architecture that takes advantage of informal knowledge tracing mechanisms, achieves enhanced evaluation and provides personal learning paths. While we attempt to provide a complete and integrated approach during our research several research issues have been raised which constitute the basis of further study, analysis and research. Such issues which are still open for research are: the approach for modeling professional profiles i.e. What makes a knowledge modeling approach appropriate for modeling such initiatives?; the mechanisms of tracing informal knowledge i.e. Is capturing of tacit knowledge feasible? How can we approach such a necessity?

We intend to apply the proposed approach in a series of ongoing related projects. These case studies will provide the evidence needed to evaluate the methodology per se and identify the potential for further improvement and advancements. Comparative results from different application domains may also provide insights for peculiarities and characteristics that exist in the individual learner’s level and are totally hidden or difficult to extract when assessing a solution for a specific industry sector.

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A Change Process at German University – Innovation through Information and Communication Technologies?

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Abstract: In this article, we describe the current situation of virtual universities in Germany and pursue the question of whether innovation processes taking place throughout the entire higher education landscape. Our study shows that the integration of ICT not only changes the medial characteristics of the learning environment, but also results in innovations on the micro-, meso- and macro-levels of higher education. The empirical basis of our inquiry is a program sponsored by the Federal Republic of Germany, which promotes the utilization of ICT in universities.

Keywords: ICT, Higher Education, Innovation

1. Introduction
In the past few years, information and communication technologies (ICT) have become more widespread in all parts of society. They have also become more prevalent in educational institutions at various educational levels, from elementary schools up to universities. Our paper examines the question of whether ICT instigate innovational processes at institutions of higher education. Our thesis is that the integration of ICT not only changes the medial characteristics of the learning environment, but also results in innovations on the micro-, meso- and macro-levels. The micro-level is the level of teaching and learning. The structure of the university is considered the meso-level. The macro-level is the policy level.

In this article, we describe the current situation of virtual universities in Germany and pursue the question of whether innovation processes taking place throughout the entire higher education landscape.

To show the extent of this change process we apply selected results of our investigation to the situation of challenged students at university. We support the hypothesis that this innovation can reveal numerous opportunities for challenged students to better participate in the process of knowledge acquisition and communication.

The empirical basis of our inquiry is a program sponsored by the Federal Republic of Germany, New Media in Education – Universities, which promotes the utilization of ICT in universities with an enormous financial budget of approximately 400 million euro. One hundred project coalitions with a total of approximately 540 individual projects in nearly every field of study have been supported between 2001 and 2003. Due to the sheer size of such a program in this field, the support program is considered a novelty internationally, as well. The question is, if the government representing the macro-level can initiate a change process within the universities with such a top-down program.

Our project (Concepts and Elements of the Virtual University) uses this unique database to evaluate the current state of the (partially) virtual university, and to determine the trends in further development.

2. Innovation and change processes in higher education
In modern societies, the systems of higher education are in a process of change (Castells 1996, WBEC 2000
[http://www.ed.gov/offices/AC/WBEC/FinalReport/]). According to the definition of innovation, change processes can solve problems by introducing new products, as well as new processes (see Duden 1994). Applied to institutions of higher education, the question arises, which problems currently exist and have to be solved on the process and product levels in general? In current literature on higher education, there are reports of difficulties at traditional universities. The problems seem to exist on different levels and are primarily related to a rapidly changing world. A modern university in a global world will have to stand comparisons with international standards (see Stichweh 2001). Encarnação et al predict that traditional universities will probably play a secondary role in the educational landscape of the future, as they will no longer be able to compete with the global activities of the consortia of virtual universities, neither financially nor qualitatively

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(Encarnaçãos, Leidhold, & Reuter 2000 [http://www.wissenschaftsforum-saar.de/docs/2003-05-13-Scene2005Deu.pdf]). According to Encarnaçôos’ scenario, in the future, students will conglomerate their studies modularly, by choosing university events, which are distributed all over the world. Therefore, it will be possible to take the world’s best course for each topic (see ibid.)

From the didactical point of view, it is of considerable importance that many authors connect the virtualization and globalization of learning to a modification of the instructional paradigm. For instance, Linda Darling-Hammond from Stanford University prognoses that learners supported by ICT are becoming citizens of the world, as well as competent writers, researchers, mathematicians and scientists. Teachers will assume the role of coach, directing students to the resources they need to solve problems (see Darling-Hammond cited in Tergan, & Zentel 2002 [http://www.iwm-kmrc.de/kevih/workshops/plattformmal/Tergan.pdf]). The statements vicariously show the high expectations for the innovation potential of ICT. In addition to the vision of networked learning communities, many authors expect a change of the instructional paradigm.

In order to validate these expectations, we have to take a deeper look at the change process, which is observable in the research field of higher education. ICT has a key function for various dimensions of this change. The ‘driving forces’ of change include, for example, the integration of the Internet into instruction, the improved possibilities in the use of multi-media, a world-wide educational market, speedier innovation cycles and increasing competition in the educational markets. These global developments lead to a greater flexibility in education and require lifelong learning. They increase the customer orientation and vary the extent of educational opportunities being offered. They also have led educational providers to offer new forms of organization. However, a term like ‘virtual university’ embraces a great variety of opportunities within higher education, some more widespread than others. Which of these forms will succeed in the long run is not yet decided. Current practice appears to embrace the following forms (see Brockhaus, Emrich, & Mei-Pochtler 2000):

- **Corporate university**: The term covers a broad range of different models of continuing education including new (virtual) forms.
- **International educational consortiums**: International corporations have joined forces with renowned universities. Their customers will be students from all over the world who participate in ‘virtual’ seminars and form (virtual) communities with other students.
- **University networks**: Within university networks, those who elect to cooperate will exchange content presentations with the aim of sharing resources.
- **Virtual universities**: In the future, distance-teaching universities will offer – this we can assume – the complete subject range of a traditional university in ‘virtual’ form.
- **Alma Mater Multimedialis**: Increasingly, the traditional universities will integrate some online components into their on-campus courses, using different possible forms. Such online components may be add-ons to traditional lectures and seminars, offering some kind of reinforcement, or part of a ‘mixed mode’ course model with on-campus and Internet components. The established universities will be less likely to offer distance education in its pure form.

International experience gained so far with ICT in the higher education sector would suggest that *Alma mater multimedialis* is now the most common form of ‘virtual’ structure and will remain so in the future. On the one hand, it reaches many students while maintaining a high quality and intensity of the teaching presentations. On the other hand, it conforms to the desire of students between 18 and 24 years to be part of a ‘real’ learning community (see Brockhaus et al. 2000 p. 19).

An international study on ‘Models of Technology and Change in Higher Education’ (Collis, & van der Wende 2002 [http://www.utwente.nl/cheps/documenten/ictra pport.pdf]) raises the following question: ‘Which scenarios are emerging with respect to the use of ICT in higher education and how can future developments be predicted and strategic choices be based on that?’ (ibid. 8). One of their main findings is that regular on-campus enrolment is still the prevailing situation in most institutions of higher education. This is referred to as ‘Back to Basics’. But many universities and colleges have begun to integrate multi-media elements into their regular courses and enable students to study without the restrictions of personal

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attendance and of time. This may lead to some form of ‘Global Campus’. Many universities and colleges are already heading in a direction, which the study calls ‘stretching the mold’. This ‘relates to increased flexibility with or without changing the underlying pedagogical model within the institution’ (ibid. 12). One interesting result of this study is that, internationally speaking, there is very little difference in the use of ICT in higher education in different countries. An investigation of the change in institutions, of the use of ICT in teaching and as a medium of instruction, and of the role of instructors showed that differences were less significant between different countries than within these countries themselves.

To get a clearer picture of this process of change in Germany, we have undertaken an evaluation of existing concepts for integrating ICT into higher education. We want to investigate the extent of the change, as well as the sustainability of these effects.

3. Methodological and empirical background

Our study is based on „New Media in Education“, a program funded of the Federal Ministry of Education and Research (BMBF), which includes 100 projects involving 541 partners, and the expectation is that the projects will stimulate ‘virtual’ teaching substantially. This is the largest sponsored program ever launched in this sector in Germany (http://www.gmd.de/PT-NMB/). Our project kevih is concerned with the supporting research for this program. Our aim is to establish and analyze the present state of ‘virtual’ teaching at German universities and other relevant institutions in order to identify the potential for development and to assist both universities and political decision-makers.

In our evaluation study, we have analyzed project proposals for the sponsored program. Our method was to first draw up a list of criteria that covered all relevant factors for an evaluation. We then went through all written proposals, quantified the data, entered it into a database and processed it. The complete report of this study is downloadable at http://www.iwm-kmrc.de/kevih/infos/Virtuelle_HSLlehre_Teil1_eng.pdf (see also Wedekind et al. 2002 [http://www.iwm-kmrc.de/kevih/projekt/ICT-kevih.pdf]) for an overview of the study). Recently, an online survey was conducted, in which the current developments in the participating projects were investigated. Our focus and interest lie in the project guidelines, meaning their regional scope, professional disciplines and target groups, as well as the available topics, the extent of the implementation of multimedia and telemedia elements, and media competency. The complete report of our second study is downloadable at http://www.iwm-kmrc.de/kevih/infos/Virtuelle_HSLlehre_Teil2_eng.pdf

4. Findings

In this section, we describe selected results from our two empirical studies. It is structured in the different levels described above: the micro-, meso-, and macro-level. At each level, we try to identify innovations in products, as well as processes. Percentages, given in the following paragraphs, refer to the total number of 100 projects. Multiple mentionings were possible.

4.1 Innovations on the micro-level

Starting on the micro-level, we explore the potential of new media in the realm of teaching and learning. In this connection, it is of interest, which objectives the projects pursue with the integration of ICT at the university-level. Analyzing the project requests, we discover that the projects aim to enhance the availability of contents (85%), to make teaching objects more illustrative by using visualizations and animations (82%), and to improve the motivation of the students (74%). In total, 74% of the projects expect an improvement of quality by using ICT. In order to carry out these goals, contents are provided in all projects. The degree of innovation is shown through the kind of contents generated. In many projects, the content is visualized and made interactive by multimedia applications like simulations (72%), animations (63%), or hypermedia (53%) (see Fig. 1).

A few years ago, most projects coping with ICT at the university-level were limited to supplying information to students, such as the download of lecture notes, literary references, appointments, etc. (Lewin, Heublein, Kindt, & Föge 1996 [http://www.his.de/Service/Publikationen/Kia/pdf/Kia/kia1996.pdf]). Thus, the innovative part of these ambitions dealt only with the better availability of contents. The data represented above show that now the formats and - relating to the technical animation - also the clarity of contents change. Self-learning processes are thereby supported.
Further innovative products, which evolve by the integration of ICT, can be constituted on the level of teaching and learning forms. Whereas the main forms of instruction at traditional German universities are presentation-based, such as the lecture or the term paper, we investigated whether the implementation of new media would be accompanied by an increased implementation of new forms of teaching or learning.

Figure 2 shows that, in addition to the traditional presentational teaching form, the projects also implement problem-based learning and exploratory forms of learning (i.e., case-based learning, project learning).

In comparison with traditional university learning forms, a clear expansion of the methodical scope appears to be emerging, which certainly benefits the quality of instruction. The more problem-based and exploratory orientation of instruction corresponds with the growing requirements for students to study independently, an ever-increasing demand due to the rapidly changing information society. Terms, such as Lifelong Learning.
Learning and Learning on Demand are cited as catchwords, representative of the changing educational and work domains. In addition to new products based on the utilization of ICT, new processes emerge, which expand the possibilities for cooperation among teachers and students. In this context, the possibilities of net-based communication are relevant, which can be realized by e-Mail, Chat or Newsgroups, for example. Figure 3 illustrates the forms of net-based communication at the virtual university. Implemented tools span the entire range of network-based communication. The integration of simple telemedia elements like chat or e-mail is frequently mentioned. More complicated applications, such as video conferencing or application sharing, are planned on a much smaller scale.

**Figure 3: Telemedia applications (n=89 projects, multiple items possible)**

The projects use these tools to cover several functions within the instructional process. In 77% of the projects, communication is a component of the learning environment. Net-based communication proceeds between instructors and students, as well as among students themselves. In 49% of the projects, net-based cooperation is intended. 26% of the projects use the net to implement coordinating tasks. As a result, the leeway in designing the instructional process has been expanded by extended temporal resources and the independence of space. New operational sequences of cooperation between instructors and students, as well as between students themselves, are possible.

### 4.2 Innovations on the meso-level

Innovations can also be observed at the university level, or meso-level. In our survey, the projects indicate that in addition to the traditional university facilities, such as libraries and continuing education centers, there is also a cooperation with media centers. This means that the integration of ICT on the micro-level requires structural changes that ensure the activities will be sustainable. The development and relocation of central university facilities to support instructors with the planning, conception and implementation of (partially) virtual functions is currently being intensively discussed (i.e., Kerres 2001, Dittler, & Bachmann 2003). In addition to this new media center product, processes on the meso-level are also changing. 41% of the projects indicate
on the application that they outsource portions of the project work to external partners. In Figure 4, the respective sections are named.

![Figure 4: Outsourcing (n=41 projects, multiple items possible),](#)

It turns out that the integration of ICT in instructional learning contexts results in numerous tasks, the nature of which go far beyond the conventional demands placed on scientists, requiring the consultation of external experts. This generally interdisciplinary cooperation requires a greater structuring of the planning and development processes than would be the case with traditional types of events.

### 4.3 Innovations on the macro-level

The macro-level is the policy level that extends beyond the university itself. On the one hand, it is surely the level in which changes occur only slowly. On the other hand, an important impetus can be given by the government. The sponsored program, which is investigated in this paper, is an example of such a top-down action.

In the project requests, we can identify indications that innovations take place at the macro level. One such indication is the establishment of courses of study, which can be accomplished at more than one university in different countries (see Fig. 5).

It is obvious that, similar to international developments (Brockhaus et al. 2000), university instruction is primarily enhanced by virtual elements. Nevertheless, there are at least 10 projects planning a complete course of study. Without ICT the only possibility to perform a distance study would be through the Open University. Due to the increasing integration of ICT in traditional universities, new possibilities for distance studies will emerge.

Another innovation on the macro-level is closely connected to the last point mentioned above. According to the criteria of the ministry, nearly all funded projects (92%) cooperate across state boundaries (cooperation was one of the central prerequisites to get funded). Beyond this, in our online survey, 30% state that they cooperate with international partners. The national, as well as the international, cooperation requires new processes of coordination between the partners to organize the instructional process. It implies e.g. the assimilation of curricula, which, at least in Germany, are different in every federal state.
Figure 5: Granularity of products (n=100 projects, multiple items possible)

5. Implicit Potential for Challenged Students

We want to exemplify on the special target-group of challenged students how far-ranging the innovations of ICT at university can be. Therefore we use selected results of our investigation and apply them to the situation of challenged students at university. Their situation is characterized by problems and hurdles that hinder the actual goal of successfully completing their studies (Boehmler 1996). Depending on their particular disability, challenged students have to live with varying limitations: from stairs that cannot be negotiated by the physically challenged, thereby blocking their access to lectures, to blackboard diagrams drawn too small for the visually challenged to decipher.

One possibility for improving the situation of challenged students, which has been neglected up until this point, is that of the increased integration of ICT into traditional university-learning. ICT in the form of prosthetic aids has enjoyed broad implementation, especially for the visually and mobility challenged, clearly expanding their ability to participate more fully in society (Coombs, 2000 [http://www.rit.edu/~nrcgsh/arts/dublin.htm]). Albeit there are some studies relative to distance learning and challenged students (Ommerborn, & Schuemer 2001 [http://www.fernuni-hagen.de/ZIFF/ommsch4.doc], Schmetzke 2001 [http://www.rit.edu/~easi/itd/itdv07n2/axel.htm], Stewart 1999 [http://www.dinf.org/csun_99/session0179.html]), the potential of ICT as an instructional medium in traditional learning environments -- beyond the use of simple CBTs -- has not been sufficiently explored. We support the hypothesis that the utilization of ICT can reveal numerous opportunities for challenged students to better participate in the process of knowledge acquisition and communication.

To determine this opportunities, we must specifically analyze our investigative data on the situation of the virtual university in terms of its relevance for challenged students. Even though the project proposals and our online-survey contain no explicit references as to which measures would be advantageous for challenged students, the implicit potential for this target group is, nevertheless, ascertainable from the data.
5.1 Multimedia
Multimedia study materials can present information in various modes (visual, auditory) and codes (various symbol systems). Examples of multimedia products implemented in the virtualization of a university are shown in Fig. 1. Multimedia products span an enormous range, from simple PowerPoint slides to intelligent tutorial systems. The implicit potential of Multimedia for challenged students lies in its redundancy. The more redundant the presentation of information (i.e., visual and auditory), the greater the potential for challenged students to process information in accordance with their respective capabilities (Coombs 2000 [http://www.rit.edu/~nrcgsh/arts/dublin.htm], Ommerborn, & Schuemer 2002 [http://www.fernuni-hagen.de/ZIFF/behfs3.pdf]). Simulations are especially meaningful, since they allow challenged students to experience various phenomena in a plot-oriented fashion.

5.2 Network-based communication
In network-based exchange processes (see Fig. 3), communication conditions are fundamentally altered. Typical reference stimuli for face-to-face situations, such as the conversation partner’s appearance, facial expressions or gestures, are reduced in network-based communication (i.e., video conference) or are simply not conveyed (purely text-based communication). Effects of this media-generated anonymity include the blurring of differences in status and roles in conversations, resulting in a democratic effect on communication, which can then lead to uninhibited behavior (Sproull, & Kiesler 1986, Dubrovsky, Kiesler, & Sethna 1991). This anonymity provides challenged students the opportunity to appear and operate as equal communication partners, without the stigma of a disability.

Reduced output speed during text-based communication can be an impeding factor for students with limited motor capabilities. Communication via synchronous communication tools, such as chat or application sharing, often proceeds too quickly for them. The more free the communication situation (time and place), the better the chance of compensating for problems caused by a disability.

5.3 Didactic organization
The expansion of the methodical scope induced by ICT (see Fig. 2) is a decisive advantage for challenged students. Representational forms of instruction reduce the opportunities for instructors to address the specific needs of individual students. Both tempo and representational form are tailored to “normal” students. The concerns of the challenged students become very difficult to assimilate in this scenario. In contrast, problem-based and explorative forms of instruction enable the students to be actively involved in the teaching-learning process. With these forms of instruction, students can much better regulate the tempo for advancement and choose for themselves what information they need in order to acquire the knowledge desired.

6. Conclusion
The integration of ICT in instructional contexts changes the learning environment to a greater extent than traditional media would, because of the computer’s universality. The implementation of ICT enables not only the visualization of information, but the combination of computer with online capability is an essential part of the learning environment. This combination induces innovations on all university levels. Figure 4 summarizes the innovations.

<table>
<thead>
<tr>
<th>Innovative products</th>
<th>Micro-level</th>
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<td>Establishment of media support centers</td>
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<td>Innovative processes</td>
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Figure 6: Innovations induced by the integration of ICT in institutions of higher education

Figure 6 clearly illustrates the emergence of changes on every level, which expand the possibilities for instruction and study. It is important to note that innovations on the lower
level can only establish themselves long-term, if the appropriate basic conditions are created on the upper levels. In other words: innovations in higher education will fail, if they are not sufficiently institutionalized (Levine 1980). In contrast to the above-mentioned prognoses, the innovations are closely linked to the traditional university. Therefore, no independent virtual universities originate within the framework of the funded program, but rather partial areas/segments o. subareas are virtualized based on the traditional universities. The innovations expand the spatial and temporal flexibility of instructional events and make information access easier. Expanded flexibility leads to new event forms, which constitute themselves from the interplay of real and virtual components (Blended Learning). This corresponds with the results from the above-mentioned international study by Collis & van der Wende (see Collis, & van der Wende 2002). The integration of ICT at universities does not, therefore, lead to a radical change of the institution. This was also not the objective of the sponsored program. Their integration does lead, however, to greater didactical and organizational diversity. The reason for this lies in part in the narrower bandwidth of virtual communication. Despite the possibility of an audio-video conference, virtual communication can only produce a limited connection between people: the „aura“ of a professor is still not transmittable via media. In this respect, the traditional, „real“ event remains the first choice for the socialization of young students into the alma mater.

Also in relation to the asserted innovations in the area of didactics is a certain level of scepticism appropriate. It remains questionable whether the changes will really be implemented broadly. The introduction of all media into the instructional context has raised hopes for a change in the didactics in addition to new pedagogical conceptions. Regardless of whether radio, television or language lab, none of these media has fulfilled expectations whether the changes will really be implemented broadly. The introduction of all media into the instructional context has raised hopes for a change in the didactics in addition to new pedagogical conceptions. Regardless of whether radio, television or language lab, none of these media has fulfilled expectations of whether radio, television or language lab, none of these media has fulfilled expectations of whether radio, television or language lab, none of these media has fulfilled expectations of whether radio, television or language lab, none of these media has fulfilled expectations.

By applying our data to a special target group like challenged students, we could show the potential within the process of innovation experienced by the university as a result of ICT integration. Even if those students with disabilities are not the primary target group of these integrative efforts, they still profit from the resulting intrinsic possibilities.

Tendencies, which alleviate everyday student life should be continued in a purposeful manner. Their execution should not, however, be technologically driven. Rather, it is necessary for participants at all levels to actively and jointly develop the university’s future through the use of ICT.

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