



Learning environments for project management using the Internet as a medium

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1 Introduction

As far back as 1987, the Chairman of Apple computer, John Sculley, described the 'knowledge navigator' as

'a discoverer of worlds, a tool as galvanizing as the printing press. Individuals could use it to drive through libraries, museums, databases or institutional archives. This tool wouldn't just take you to the doorstep of these great resources as sophisticated computers do now, it would invite you deep inside its secrets, interpreting and explaining – converting vast quantities of information into personalized and understandable knowledge' (McFarland and Parker 1990:3).

The aim of this 'knowledge navigator' would be to guide the user through the exponentially increasing world of information and knowledge. It would facilitate adaptive teaching and personalized learning. It should become an articulate expert, an intelligent tutor, and a stimulating learning environment (McFarland and Parker 1990).

In 2001, are we any closer to this 'knowledge navigator'? This article intends to show how

we have attempted to meet this ideal. It has been a journey of many experiences, and while this ideal may be a long way off, some advances have been made and these experiences will be discussed.

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2 Computer-aided learning in education (CAL)

The use of computers has been suggested as a possible solution to the considerable education problems which face South Africa (Lippert 1993). Although instructional computing has been around since the early 1960s (Alessis and Trollip 1991), it has only been recently that technological advances in hardware and software have made it practical to develop useful computer-aided learning in education (CAL) lessons. Many of the early difficulties of CAL operating on mainframe computers have been overcome with the advent of powerful multimedia microcomputers. However, educators do not easily forget the very rigid first attempts at instructional courseware. The perceptions of these early attempts need to be overcome by good courseware, in proper instructional environments, that is relatively cheap to produce, administer, manage and update. In many ways, the Internet is an unsophisticated form of CAL offering resources through hyperlinks allowing researchers a form of experiential learning. By structuring these environments, CAL could be produced in a way that the perceptions and myths surrounding it are dispelled.

Extensive research has shown (Kulik and Kulik cited in Alessis 1991) that there have been only marginal improvements in learners' abilities when compared with traditional teaching methods. Significantly, though, recently developed CAL lessons have proved to be more effective than earlier lessons (Bangert-Drowns; Kulik and Kulik cited in Hannafin and Peck 1988). This seems related to the advances made in hardware and software technology. It also implies that CAL will continue progressing to a stage where it is accepted as an important educational tool. Many researchers would disagree with this, as there is argument that these results cannot be attributed to the use of computers – other factors may have skewed the results (Alessis 1991). Whichever is the case, CAL offers new dimensions to traditional 'chalk and talk' education, particularly through the use of multimedia.

Alessis (1991) identifies several areas of cognitive theory, which are important in the development of CAL courseware, namely:

- perception and attention – the learner's attention must be focused on the courseware presented;
- memory – proper storage of information for later retrieval and manipulation;
- comprehension – the interpretation of perceived information;
- active learning – learning through interaction;
- motivation – maintains attentions, relevance of the material, student confidence and student satisfaction;
- locus of control – the learner's feeling of control over the courseware (this is actually a combination of student and author control);
- transfer of learning – the ability to retain and use knowledge in the real world; and
- individual differences – learner-centred in determining pace and provision of additional help or information where required as all learners have different abilities and learn in different ways.

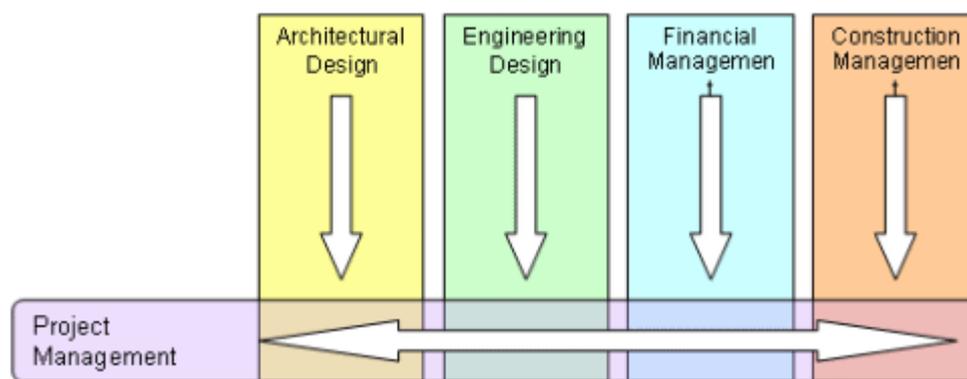
In our quest to develop a 'knowledge navigator', we would have to take cognizance of the lessons of the past and apply the advances in technology to contribute to the education of learners in the project management domain.

3 Project management teaching and learning

Project management is an interdisciplinary subject area, which has traditionally been taught as a postgraduate course. This usually implies that classes comprise learners from a multitude of disciplines, all with varying degrees of experience. The mindset of these individuals is often diverse, which in some ways simulates the problems that project managers face in practice where conflict of opinion is commonplace. The discussion in this article is based on classes comprising architects, civil engineers, mechanical engineers, chemical engineers, quantity surveyors, land surveyors and construction managers.

Because all of these disciplines are professional vocational degrees, the education of these learners has been specialized and focused within their domain. This does not simulate reality where they would be required to integrate horizontally with relevant disciplines to meet project objectives (Figure 1). Much of the management process is about this integration of 'functional line' managers into a systemic organization.

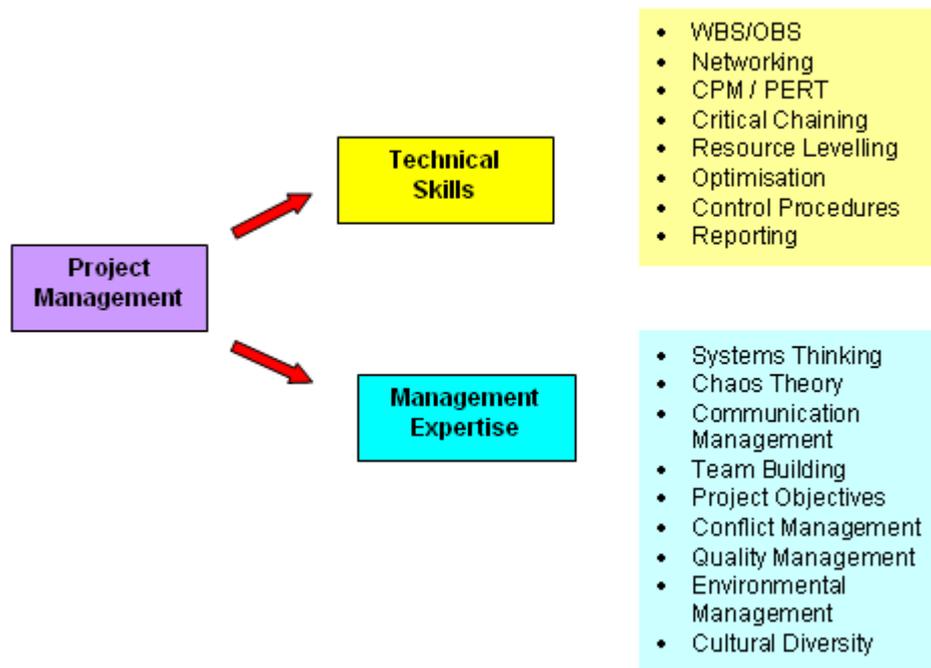
Figure 1 Horizontal integration with relevant disciplines



Broadly speaking, project management can be divided into two separate domains (Figure 2), namely:

- technical skills (operations research related); and
- management expertise.

Figure 2 Two domains of project management



Most project management courses teach these components separately. The traditional teaching approaches to these two domains are quite different. Typically, technically orientated courses have been taught using an instructivist medium where drill and practise are important in developing competence. Management courses typically encourage critical analysis of complex scenarios in order to make meaningful management decisions based on relevant theory. This was the starting point and rationale behind using separate computer assisted learning models for teaching project management. It was decided initially to use an instructivist approach to the teaching of technically orientated content and later a constructivist approach to assist teaching management expertise. It was never the intention to rely purely on a computer aided learning model for teaching in this domain.

4 Experiences of using the Internet for teaching project management

4.1 Instructivist or behaviourist approach

The authors' first attempt at CAL in project management was based on the Blooms's 'mastery model of learning (1985). A system was designed which would provide learners with instructional material so that they could master the content at their own pace. A minimalism approach was adopted where learning material is structured in a highly modular way (a structure of small self-contained units). In this way learners choose units useful to support their activity rather than be constrained to a predefined learning sequence. This method was conducive to the concept of hypertext and hypermedia. This model would free up expensive contact time with the learners.

In this model, learners were provided with a starting page of technical course content and were able to proceed backwards and forwards through the lesson using hyperlinks. It was never intended that this would be the final model but it was seen as a starting point where students would get used to using the Internet for learning purposes and educators could also get used to the format that would be used in future models. In essence, this structured modular approach was the beginning of a knowledge base that would be used in future models.

Findings

- Students used this model rather like an 'electronic page turner'.
- In reality, it became a method of disseminating course material. In practice, learners found that reading the material from the screen was difficult and they tended to print it out for their files.
- Learners were able to pre-read technical information so that the lectures could be utilized for discussion and explanation. However, there was little motivation for learners to do this and they would rather access the information when required for assignments, tests and examinations.
- Instructors could update course material easily and this was immediately available to learners. However, there was no indicator for the students to know that materials had been updated and therefore to determine if they had the latest and most relevant information.

Conclusions

The findings were not altogether unexpected. This was really intended to be a first step in providing a knowledge base of course material. No real practical learning took place through this medium, but it started introducing students to a new method of instruction through the Internet.

4.2 Guided exploratory approach using sanctioned course content

The initial model was now adapted to provide a more student centred learning environment. Learners would login to a database, which made sanctioned course material available to them. This material was structured using a 'map' to guide the students through the material. Learners were not restricted to this course material and were able to take the exploration points on each page to widen their knowledge. The 'map' provided the learner with the instructor's intended route through the material, however, learners were able to learn in an order most appropriate to them. If they explored outside the 'map', it was very simple to get 'back on track' by selecting the 'map', selecting their point of departure and resuming learning by using the usual navigation buttons of 'next' and 'previous'

A form of assessment was also provided through multiple-choice questions and this was recorded for an entire 'map' (module). It pinpointed the learner's assessment of each page covered by that 'map'. From this, it was immediately possible for the learner to evaluate where there were weaknesses in his/her knowledge and revise such pages. The evaluation process would retest the learners as many times as they liked, but would only record their last performance and therefore gave their most recent knowledge assessment.

Another feature of this system was to allow the learner to enter personal notes on each page and thus provide reminders or specific notes for that learner. In addition, a history of the pages in a 'map' viewed previously was kept. This allowed learners to see if they had been to the specific content previously and, if so, how many times.

Findings

The results of this approach were somewhat disappointing as learners used it in much the same manner as the earlier model. Learners seldom used the exploration points and only accessed material when compiling assignments or studying for tests and examinations.

Administratively the model was simple. Once the course material was established, it was connected using a database to form the 'map'. The database would automatically pick up the exploration points from keywords. During the course, no assessment was required by the instructor as this was completed by the system (through multiple-choice questions) and could

direct the learners to the appropriate information when they could not complete the question correctly. This assessment was recorded as a progress indicator only for the learner and administrator. It could not be used for individual learner assessment as the authenticity of the mark could not be guaranteed.

Learners did have an option to e-mail the instructor and this was the only form of feedback supplied by the system. It was found that learners did not make use of this feature for academic purposes but rather used it to find out administrative details and register complaints.

Conclusion

It was clear from this experience that learners needed to be motivated to learn in an IT environment and this indicated the need for an interactive component. Learners appreciated this model as a structured reference source. This would be fine for the technically oriented courses (operations research) where drill and practise were necessary to develop competence and the main learning component was still developed in lecture theaters by means of face-to-face contact. It would never be appropriate for the management and integration components of project management.

4.3 Constructivist approach using instructor guided discussion forums

Previous attempts had been directed towards instructivist methods of instruction relating to technical components of course material. There were large areas of teaching where this approach was not suitable and a growing body of knowledge in using constructivist approaches of learning utilizing the Internet was becoming available. It was decided to use a collaborative learning environment for a number of reasons:

- learners could harvest the knowledge of the entire community;
- learners could draw inspiration from the wealth of viewpoints contributed;
- instructors would have ample feedback to improve basic learning materials;
- instructors would be freed from having to repeatedly answer the same questions;
- instructors need not have to comment on submissions one by one; and
- the instructor is not the only evaluator – more eyes were more likely to spot more problems and offer more creative insights (Horton 2000).

A number of systems were evaluated, including WebCT, but it was decided to develop our own system to incorporate the existing knowledge base developed from earlier attempts at CAL. Of the existing collaborative learning environments, it was decided that a discussion forum would be the most appropriate for our learners' circumstances for the following reasons:

- The learners came from different disciplines with varying levels of experience. Their commitments were completely different and it would therefore be very difficult to set up a synchronous learning environment as would be necessary when using videoconferencing or chat. Discussion forums would allow learners to access the discussion at times that were most suitable to themselves.
- Horton (2000) contends that learners are more likely to contribute to a discussion forum than in a traditional classroom. This is important in management type subjects where the viewpoints of the various disciplines often contradict each other. In project management, it is particularly important to understand each stake holder's viewpoint and to make management decisions that suit all stakeholders. By using a discussion forum for this purpose, more learners should participate and the time for discussion is

not limited by the designated lecture periods.

- By posing a question and evaluating the feedback from learners, the instructor can continue probing the question until he/she is satisfied with the depth of responses. This is not possible in the evaluation of a written assignment unless the assignment is continually redone until such a level is attained.

- Research has shown that learners feel that their participation in the class discussion group made them write more coherently, they also participated more outside normal work hours and thought more carefully before responding to questions. They also felt as well connected to the instructor as in face-to-face classes (Horton 2000).

- A number of factors contribute towards this increased participation of learners in a discussion forum:
 - Once learners become accustomed to the use of electronic communication, they communicate more freely. This leads to more lively conversations, which in turn leads to even more collaboration – fewer questions go unasked, fewer ideas are held back.

 - Because learners are generally anonymous, they are free of bias and stereotyping. Race, gender, age, background appearance and disabilities matter less than knowledge and creativity. Anonymity empowers people to participate more fully and confidently in collaboration.

 - In the absence of face-to-face contact with an instructor, the learners compensate in two ways. First, they are forced to seek out their own sources of information and to evaluate them critically and monitor their own learning. Secondly, they rely more on fellow learners. They form study groups, participate actively in discussions and take more responsibility and authority for themselves.

- The attitudes of learners indicated above are extremely important in teaching learners to learn. Lifelong learning takes place when learners are placed in a teaching model that teaches them to learn. Stouch (1993) recognizes that collaborative learning environments require development of communication skills, observational and reflection skills and planning and consequence skills. These are essential skills in project management and therefore reinforce this methodology of teaching.

The model developed a threaded discussion forum using active server pages (ASP) and sessions to keep track of the system. Questions were posed as a discussion thread. The question could incorporate multimedia and hyperlinks to the knowledge base for reference and related material.

Learners were then able to respond to the question individually, but the questions were of a broad enough nature to elicit conflicting opinions. Learners were expected to contribute to part of the question and were rewarded with credit points for their contributions. Learners were not awarded credits for information that had already been contributed to the discussion forum. This forced learners to read others' contributions before submitting their responses. The longer the thread continued, the further and wider learners had to seek information for their contributions. Learners were also rewarded credits for successfully arguing against other learners' responses, thereby stimulating discussion around contentious issues.

Findings

The instructor felt that this approach achieved the best results prior to any kind of qualitative

or quantitative analysis. However, the examination results did not reflect the type of improvement that the instructor (facilitator) anticipated. There was no base from which to compare as the subject content has been substantially revised from previous years and all learners took part in the new course. During the running of the course, it was clear that the learners had engaged actively and appropriately in the project and collaborative work, and very good results were achieved in this area. The examination was based on a series of case studies in which the learner had to identify the problems, diagnose remedies and anticipate outcomes of decisions taken. At this point, it is not easy to identify why, in hypothetical situations, the learners were unable to apply what they clearly could in practical situations. A possible reason for this is that the method of examination was not appropriate to the subject area. If this is the case, it is not a problem easily solved, as learners have to be able to demonstrate their proficiency individually without the collaborative environment they had become accustomed to in the course.

At completion of the course, less material had been covered compared to that of face-to-face lecturing. However, the instructor's and learners' opinion was that a deeper, life-long learning had taken place and that this was more beneficial than a superficial understanding of a wider subject area. This opinion was reflected in the competency levels of the practical assignments. The model is effectively a teaching model which teaches students to learn.

The majority of learners found the environment innovative (compared to what they were accustomed to) and interesting which motivated learning. Courses run on this basis were not long enough to determine if this effect is long lasting. It is possible that the perceived improvement can be put down to the high levels of motivation due to curiosity which would not be sustained over a long period.

Learners expressed several criticisms. Technical difficulties with the hardware at times made the concept of working when it is convenient impossible. This frustrated the learners but the problem was solved by provision of reliable and robust hardware.

The mindset of many learners had to be shifted rather dramatically from 'chalk and talk', where there were handouts available, to this constructivist approach, where learners were expected to investigate and be guided through the course. Because of this, some learners felt that they did not know if they had learned anything and what they should be studying for the examination. Allesis (1991) identifies this as an important area of learning, namely that the learners have confidence in their own abilities and that of what is being constructed. This aspect therefore needs addressing.

Conclusions

This methodology improved the performance of learners significantly. For the first time, learners were utilizing the Internet for learning as opposed to 'electronic page turning'. This collaborative environment provided a medium that could not be duplicated in a lecture theatre and 'real' learning took place.

However, the examination results did not prove that this had been achieved. While the structure of the examination can be debated as to its merit, one thing remains and that is that prospective project managers must be able to communicate effectively in a written format by analysing case studies. There is a feeling that the way the discussion forum was delivered can be changed to accommodate this apparent weakness – instead of asking broad questions in the discussion forum, it would probably be better to provide full case studies. The instructor then directs the appropriate questions to identify the issues and problems, then asks for interpretations etc. In essence, the instructor guides the learner through the case study while learners justify their responses with relevant theory. At completion, learners would be

expected to pick up the points and arguments from the collaborative work and rewrite this as an assignment answer to the case study in a logical format. This approach is currently being implemented and it is too early to determine if it will rectify this weakness in the teaching model.

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5 Conclusions and recommendations

This article has attempted to show the process and preliminary findings of the University of Natal Property Development Programme's experiences with the Internet as a learning tool in a subject area where technical and managerial competencies are being developed. From the lessons learned, it was found that technical competencies are supported well by an instructivist drill and practise type of instructional medium. Management expertise can be developed through a more constructivist approach using collaborative learning. We feel that this can be well supported by an instructional type of medium such as a 'map' of the knowledge base relevant to the discussion thread. However, as soon as this happens, learners are discouraged from actively seeking their own information and sources.

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