DOCUMENT RESUME

ED 444 560 IR 020 216

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TITLE	An In Depth Look at How Learning in a Virtual Classroom Impacts on the Curriculum.
PUB DATE	2000-00-00
NOTE	7p.; In: Society for Information Technology & Teacher Education International Conference: Proceedings of SITE 2000 (11th, San Diego, California, February 8-12, 2000). Volumes 1-3; see IR 020 112.
PUB TYPE	Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Action Research; *Computer Science Education; *Computer Uses in Education; *Curriculum Development; Foreign Countries; Higher Education; *Information Technology; Student Role; Teacher Role; Teaching Methods; *World Wide Web
IDENTIFIERS	Computer Operating Systems; Learning Environments; South Africa; *Virtual Classrooms

ABSTRACT

Operating Systems IV is a subject taught to fourth-year information technology learners at Technikon Natal, a tertiary educational institution in KwaZulu Natal (South Africa). During 1998, the need to introduce elements of flexibility in this course was identified. As a result, a virtual classroom was used as a communal resource base and a construction site where learners collaborate. To date, two cycles of this project have been executed. The new Web-based approach to the course has led to substantial improvements in teaching practice. Furthermore, benefits have emerged well beyond the original aims of the project--the process that was set in motion at fourth-year level has begun to transform the broader curriculum. This paper reflects on the first two cycles of an action research project. It deals with the impact of the World Wide Web on a traditional curriculum. Changing teaching and learning methodologies are discussed. (Contains 16 references.) (Author/MES)

An In Depth Look At How Learning In A Virtual Classroom Impacts On The Curriculum

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[redacted] Operating Systems IV is a subject taught to fourth year IT learners at Technikon Natal, a tertiary educational institution in KwaZulu Natal, South Africa. During 1998 the need to introduce elements of flexibility in this course was identified. As a result, a virtual classroom was used as a communal resource base and a construction site where learners collaborate. To date two cycles of this project have been executed. The new web-based approach to the course has led to substantial improvements in teaching practice. Furthermore, benefits have emerged well beyond the original aims of the project - the process that was set in motion at fourth year level, has begun to transform the broader curriculum. This paper reflects upon the first two cycles of an action research project. It deals with the impact of the World Wide Web on a traditional curriculum. Changing teaching and learning methodologies are discussed.

1 Introduction

One of the many problems experienced in education worldwide is learners' inability to transfer knowledge gained in formal education to the work environment. Candy (in Jones, 1997) indicates that one of the main roots of this problem at on-campus institutions is the excessive use of lectures. Laurillard (in Jones, 1997:1) points out weaknesses in the lecturing approach: "...lectures are not interactive, adaptive and do not allow students time for reflection." The traditional lecturing approach does not promote a sense of collaboration. Passive, isolated learning is particularly limiting for students in the field of information technology (IT), where sharing expertise through teamwork is becoming a major requirement of the profession (Jones, 1997; Fowler, Gasen, Roberts & Saltzberg, 1996). In order to counteract this problem, one of the main trends that has emerged in education is the increasing use of open learning, which enables flexible learning systems catering for diverse learning situations. Computer-Assisted Learning (CAL) has a major role to play in this regard, since the use of the Internet for open learning has become a worldwide trend. According to Lewis (in Plomp & Ely, 1996:377) there are many definitions of open learning, however, what all open learning scenarios have in common is "...an approach which seeks systematically to widen individuals' choice over their own learning."

During an analysis of Operating Systems IV (a subject taught to fourth year IT learners at Technikon Natal), the need to introduce elements of flexibility was identified as part of this action research project. Since the beginning of 1998, when the project was implemented for the first time, two cycles of this project have been executed. Through the cyclical improvement of teaching practice (Cohen & Manion, 1994), the new web-based approach to the course has led to substantial improvements in teaching practice. Furthermore, benefits have emerged well beyond the original aims of the project - the process that was set in motion at fourth year level, has begun to transform the broader technikon curriculum.

2 Virtual Learning For Fourth Year Students

Since all learners studied full-time, but held part-time jobs in the IT industry, they required a flexible approach to the course. In addition, communication between the lecturer and learners was limited to face-to-face meetings during specified periods.

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Strang, H. R. & Howard, L. (2000, February). *The Matrix Planning Simulation: Preparing Preservice Teachers To Work with Unmotivated Students*. Paper presented at the annual meeting of the Society for Information Technology and Teacher Education (SITE), San Diego, CA.

2.1 Aims Of The OS IV Virtual Classroom

As a result of the specific conditions mentioned above determined during a needs analysis, the teaching team (which consists of the subject expert in Operating Systems and an educational technologist) developed the following aims in order to improve the course:

- a more flexible time-table;
- an easily accessible, shareable, up-to-date resource-base for the subject;
- an electronic communication facility.

Furthermore, the lecturer indicated the importance of active learner participation during the teaching process in order to facilitate transfer of knowledge.

The virtual classroom that was constructed as a result aimed to address the above issues.

2.2 Characteristics Of The OS IV Virtual Classroom

2.2.1 Learners Construct A Website

Vis a vis educational research, several warnings have been articulated with regard to incorrect Internet usage (Dowling, 1996; Duchastel, 1996). It is obvious that the Internet will offer no fundamental improvement to education if its use reinforces existing teaching paradigms. Laurillard (in Gilbert, 1997) points out that the mere transcription of teaching material into web pages serves no educational purpose: "Web-based teaching needs to be strategically integrated into the subject matter, teaching processes and learning experiences of a course." (Gilbert, 1997:3) Turoff (1995) states that the objective of using the Internet for learning must not merely be duplication of the characteristics and effectiveness of the face-to-face class but the improvement thereof.

The most rudimentary approach to WWW usage for teaching, is the "...go find out about Bengal tigers" approach, in which students are told to surf the WWW without guidance, to find information (Michelson, 1997). A somewhat more advanced method is the use of a website as a dumping site. This implies that lecturers provide links to on-line resources (lecture notes and external resources) and references to off-line resources. In this instance it is important to provide reviews of links. Accurate reviews enable learners to decide whether it is worth connecting to a remote site and they therefore do not waste time and money, downloading irrelevant information (Cronjé, 1997).

If active learning is a requirement in a resource-based learning environment (such as the WWW), students ought to be taught to build upon resources provided, to actively *find* their own additional resources (making effective use of search engines and bookmarks) and to *evaluate* resources for relevance and credibility (Berenfeld, 1997).

The most advanced use of the WWW for learning is the use of the virtual classroom as a construction site. Content generation by students leads to the active construction of knowledge. Berenfeld (1997:4) states that "...virtual publishing can authenticate learning by setting students' scholarship in the real world." Students can publish on the Internet in a wide variety of formats. The content can vary from text-based information such as links to useful sites to frequently asked questions (FAQs). Summaries of interviews with experts or write-ups of projects and more technologically advanced options such as interactive multimedia components are further examples. Projects in all these formats can be connected to broader knowledge bases through hypertext links.

OS IV learners had to deliver their group and individual projects in the form of web pages. The learners' home pages form the core of the OS IV knowledge base, which is shareable, easily accessible, cost-effective and continuously expanded every year. The OS IV virtual classroom therefore consists of learner contributions that are linked to the study guide, deadlines, instructions and core resources.

2.2.2 An Electronic Discussion Forum

In the constructivist paradigm knowledge is socially constructed (Merril, 1991). Providing students with collaborative problem-solving opportunities becomes important therefore. Turoff (1995) provides substantial research evidence that for mature and motivated learners, Computer Mediated Communication (CMC) can be more interactive and effective

than the traditional (physical) classroom. Collaboration on the Internet can take various forms: student-student collaboration; student-lecturer collaboration; student-external expert collaboration.

Regarding the constructivist learning environment it is important to focus not merely on end *products*, but to emphasise the *process* of problem-solving (Brehm, 1997) and to encourage learner self-reflection (Laurillard: 1993; McManus: 1996). Students must engage in metacognitive exercises which imply reflecting upon individual as well as group learning processes. Examples of how this can be achieved are, inter alia, on-line journals; student homepages; newsgroups; mailing lists (Gilbert, 1996) and e-mail discussion forums (listervs). The most common example of CMC is the use of electronic mail. CMC can be considered essential to a virtual classroom environment, as it personalises online learning.

The OS IV learners were given e-mail accounts and a listserv, in order to accommodate their need for flexible communication and problemsolving.

2.3 What Worked

The most significant benefits of this project have been the way traditional teacher-learner roles have changed, and the particular way in which learner and lecturer usage of the Internet has transformed the curriculum.

2.3.1 Changing Roles

Boundaries between teacher and learner began to blur. Learners were given the opportunity to teach one another. In the process, the lecturer also became the learner, benefiting from the expert-learners' knowledge. In addition the lecturer's role shifted from representative of the knowledge base, to virtual classroom manager, facilitator, mentor and guide.

2.3.2 Life-Long Learning Skills

Previously, the syllabus focused on teaching content only. In the virtual classroom, content was used to help learners acquire the life-long learning skills vital for final year students on the brink of finding jobs in the information technology industry:

- information literacy skills (learners learned how to search for, evaluate and use relevant resources);
- research skills (projects had to be written up from a research perspective);
- communication skills (learners were assigned roles and had to collaborate in groups);
- presentation skills (they had to present projects to the class).

2.3.3 Assessment

A **triangular assessment** method was used:

- Lecturer evaluation: the subject expert in Operating Systems and the educational technologist independently evaluated the project presentations and design of learner websites, while the subject expert evaluated the content of projects;
- Self-evaluation: each student had to allocate a mark to her/himself, based on her/his contribution to the group projects;
- Peer-evaluation: learners reviewed the content and presentation of peer projects.

Examination-based assessment is being replaced by **continuous assessment**:

From the traditional written examination occurring at the end of a semester, no inference has resulted that real learning has occurred in the OS IV virtual classroom. The exam has largely assessed the memorising abilities of learners. Learners who excel in examinations are not necessarily the best candidates. In contrast, the course in its new form lends itself to continuous assessment (in line with the principles of Outcomes-based Education). Learners continuously demonstrate competence by doing research and developing and presenting projects individually as well as collaboratively. It is therefore more appropriate than an exam at the end of a semester to ascertain at the end of each

practical module whether learning has occurred. As a result the end-of-semester examination has become redundant for this course. The OS IV lecturer is currently in the process of motivating for a continuous assessment model. The proposal was recently well received at a faculty board meeting.

2.4 Weaknesses, Problems And Recommendations

2.4.1 Closed Learning Systems Of Other B Tech Subjects

Learning flexibility was restricted by the traditional structure of learners' other subjects. While the OS IV course was run in open learning mode, other subjects were still taught in face-to-face mode. Learners were still required therefore to visit the campus on a daily basis.

2.4.2 Not Enough Use Of The Listserv

As learners saw each other in person every day, there was little need to make use of the listserv. Therefore the discussion of problems could not be captured in electronic format and kept in the form of "frequently asked questions" for future years.

2.4.3 Acquisition Of Internet Literacy At Undergraduate Level

Although the focus of the project remained on the subject Operating Systems, it was necessary to train learners in various aspects of Internet and World Wide Web literacy. Time problems were therefore encountered. Learners recommended that general Internet literacy skills should be taught during undergraduate years.

3 Virtual Learning For First Year Students

As a result of the above recommendation made by learners at the end of the first implementation cycle of the OS IV virtual classroom in 1998, the lecturer initiated a virtual classroom for first year students. A website was designed and implemented in 1999, for the subject End User Computing.

3.1 Aims

3.1.1 Acquiring Browser Literacy At First Year Level

End User Computing is a general Computer Literacy course. Learners can access relevant course materials on the intranet, using a web browser such as Internet Explorer or Netscape Navigator.

3.1.2 Improving Team Teaching

A team of four lecturers has been teaching the End User course, to over a thousand learners from numerous academic departments. Two significant problems were experienced as a result:

- Effective communication between lecturers has been difficult. Lecturers could not easily discuss common problems, or gain access to one another's course notes.
- It is a requirement that all students write a uniform examination, and it often happened that some lecturers had covered certain aspects of a syllabus while others had not.

The End User Computing virtual classroom aimed to overcome these difficulties.

3.2 Characteristics Of The End User Virtual Classroom

3.2.1 An Intranet Site

Course notes and multimedia lessons were made available to learners on the Technikon intranet, through the use of a web browser. Learners would not have the need to browse beyond the perimeters of the intranet site. There would therefore be no need to budget for Internet access.

3.2.2 Multimedia For Different Learning Styles

Quintana (1996) discusses the many benefits of Internet-based WWW education to the learner and the institution. Most of these benefits are related to easy construction of, and access to, a variety of open learning opportunities. He points out that another major advantage of the Internet is that one can use it to devise a variety of ways to learn and pitch it at learners' various learning styles (visual, auditory, inter-personal, intra-personal, linguistic-based and mathematics-based). Although the End User website is currently largely text-based, the plan is to use multimedia components to illustrate the subject content.

3.3 What Worked

During its first implementation in 1999, the End User virtual project highlighted crucial positive and negative aspects. Some of the benefits are:

3.3.1 Customised Course Content

In the past a variety of textbooks were used, in order to cover the syllabus. As the semester progressed, the End User website developed into a customised environment that addressed the syllabus directly.

3.3.2 Collaborative Teaching

Lecturers have had the opportunity to learn from other team members' teaching styles and approach to topics. In addition, other Technikons have expressed an interest in using the customised course content developed during this course.

3.3.3 Quality Assurance

Individual lecturers' contributions to the collaborative website have been visible to anyone on campus and this may well have had a positive influence on the quality of the work.

3.4 Weaknesses And Problems

All problems encountered were related to an inadequate infrastructure:

3.4.1 Bandwidth

Students were highly motivated by this mode of learning. As a result, too much traffic on the network brought the system down several times.

3.4.2 Firewall

Initially students were able to get out onto the Internet and therefore the need for a secure firewall arose in order to keep them within the boundaries of the intranet.

3.4.3 Access To Student Workstations

The already overloaded open access laboratories were unable to cope with the demand for student workstations.

5 Conclusion

"...Once we free ourselves from the mental limits of viewing this technology as a weak sister to face-to-face synchronous education, the potentials to revolutionize education and learning become readily apparent..." (Turoff, 1995).

During the year 2000, the project will be implemented for a third time at fourth year level (OS IV) and a second time at first year level (End User Computing). Other Technikons have expressed an interest in becoming collaborators in both these virtual classrooms. It is hoped that this collaborative action research project will continue to make a constructive contribution to the transformation of Higher Education in South Africa, and to education at Technikon Natal, where the mission is "to become the best educational technological institution in Africa".

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We gratefully acknowledge the National Research Foundation of South Africa for conference sponsorship.

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