Commonalities and Differences in Electronic Educational Environments

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Abstract: "Building University Electronic Educational Environments" was a working conference, held in conjunction with annual meetings of IFIP WG 3.2 on Computers in University Education and IFIP WG 3.6 on Distance Learning. Conference attendees from a wide variety of backgrounds and countries were invited to share experiences and ideas on Electronic Educational Environments. The similarities and differences in the underlying theories and philosophies held by the conference participants are discussed in this paper.

1. INTRODUCTION

"Building University Electronic Educational Environments" was a working conference, a forum for participants invited from 19 countries to exchange ideas on a common interest. In addition to the conference keynote addresses, paper presentations, and panel sessions, were the annual meetings of IFIP Working Group 3.2 on Computers in University Education and IFIP Working Group 3.6 on Distance Learning.

In conference sessions, the term "electronic educational environments" was applied to a wide range of technical, educational and organisational contexts. Within those contexts, many papers documented specific approaches to implementation and innovation. Some approaches were fairly similar, whereas others stood alone. As this was a working conference, discussion played a vital role in the exchange of ideas during the sessions and also during informal conference events. As the conference proceeded,

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both the similarities and the differences in the underlying theories and philosophies held by the conference participants became apparent.

The conference sessions were grouped into the themes:
- National Plans and Products
- Learning Paradigms
- Meeting Institutional Challenges
- Curriculum Development
- Defining and Building Technological Environments
- Scholarly Electronic Resources

The panel session topics were:
- Life-long Learning
- Better Learning Online
- Looking back, August 2005: How Obvious It Should Have Been.

By the close of the conference, a set of sub-themes had emerged. Depending on the perspective of the participant these included:
- What will be the role of universities of the future? Will they exist as actual places? If so, why? What is their purpose? Is the workplace a learning environment?
- What levels of curriculum are appropriate for university learning, professional development, sub-degree courses? Should education be academic or vocational?
- What is the role of teachers in universities? Do students teach themselves? Should teachers be coaches and facilitators rather than dispensers of knowledge? Should experts play a greater role in the learning process?
- How are student profiles changing? Is learning going to take place throughout working life and beyond?
- Making technology accessible. How can organisations be encouraged to adopt electronic technology?
- How do electronic educational environments influence on learning? Is learning actually increased?
- How can student-teacher and student-student interaction be increased in off-campus study?
- Which is a more effective application of electronic technology: the processes of learning or the learning content?
- Collaboration on a national and institutional level.

An exploration of these sub-themes and the accompanying debate and consensus follows.

2. WHAT WILL BE THE ROLE OF UNIVERSITIES OF THE FUTURE?

Central to the discussion was the impact of technology on the future operation of universities. The varied background of conference participants ensured a wide variety of perspectives.

2.1 Will they exist as actual places?

Alfred Bork[i] thinks not. He proposes an educational system based on interactive online learning. Cheap electronic learning devices will be available to students regardless of their physical location, so that learning can take place at home, at work, even in public places. He envisions a natural language voice conversation between student and learning material. Information about student progress will be stored and monitored so individual programs can be automatically tailored to student needs. Learning will be under student rather than teacher control.

Certainly many conference participants reported programs in which vast numbers of students never come near the university, and rely instead on electronic environments. The discussion touched on the issue of competition to universities emerging in the form of "wholesalers" who are rationalising education by offering online courses purchased from individuals and academics. Vendors such as Microsoft and Novell are offering accredited training courses that take advantage of electronic technology. Wibe[ii] takes this concept one step further when he discusses "informal education that may be organised by any individual or in any organisation". In other words, he raises the possibility of learning without any university at all, and gives the example of citizens managing their own learning supported by "virtual institutions" with resources such as in the "Virtual Teacher Centre" (http://vtc.ngfl.gov.uk).

2.2 If so, why?

However, many conference participants took a different perspective. They argued that universities had existed in physical locations for centuries for very good reasons, and that they were actually increasing in number and size. The physical resources of laboratories and libraries have to be located somewhere. Centralisation of administrative structures makes operational sense. Academic communities thrive on personal contact. The friction, competition, and collaboration, which are a consequence of the formal and informal face-to-face communication between academics and the students

they supervise, play a major part in the generation of thought and innovation. Personal contact therefore invigorates research and invigorates the intellectual life of a university.

Most importantly, this group argued, students gain from being together in the same place at the same time. Leaning is helped by peer contact while group work is a sound preparation for working life. The co-curricular and social life provided within the university walls is an important part of personal development with lasting impact on most students' lives.

2.3 What form will they take?

Another group of conference participants felt that both viewpoints could be accommodated in universities both present and future–learning would take place both on and off campus depending on student requirements. Online learning could also take place both on and off campus.

Online catalogues and resources and digital libraries have significantly reduced reliance on physical libraries. Academic communities are flourishing because electronic communication provides global access to researchers and research in related fields, whereas previously research may have occurred in isolation. Group work and social contact can take place electronically while simultaneously fostering technical skills. The view of this group was that electronic environments have widened the available options and choices for teaching and learning but would operate in conjunction with more traditional university environments rather than as a replacement.

2.4 Is the workplace a learning environment?

Several participants reported programs that operate in the workplace. Instead of theoretical assignments or case studies, students work on projects in the actual workplace, supported by a set of electronic tools that allow them to prepare their work and communicate with their peers, teachers, and fellow workers. For example, an innovative project at the Open University of the Netherlands features Virtual Business Teams (VBTs)[iii] consisting of distance education students with limited computing backgrounds. They operate in teams "within a real-life project or within a section of a functional organisation" supported by a workbench of PC and web-based tools. "A typical VBT workbench provides tools to support collaborative work in a networked environment, tools for assessment and guidance, and tools for knowledge management." Support for peer and self-assessment is an integral process.

Programs like this project can take place in an employee's actual workplace, providing convenience and the learning benefits derived from a real-life application. The impact of electronic environments on workplace learning is related to other major issues raised at the conference:

- Should universities place more emphasis on vocational learning rather than the "pursuit of knowledge for knowledge's sake"?
- Is learning going to take place throughout working life and afterwards?

3. HOW ARE STUDENT PROFILES CHANGING?

A continuing theme in the conference related to IFIP TC3: Task Force on Life Long Learning which has been formed in response to a perceived shift in student profiles resulting from "the emergence of new technologies and their impact on society as a whole".

To meet the demands of a rapidly changing workplace, adults long since graduated are returning to university for re-training and professional development. Here again, Wibe's discussion of virtual institutions and community learning provided a link to Bork's vision of a learning environment in which cheap electronic learning devices will be available to students regardless of their global location, economic situation, or stage of life.

When viewed together with the options made available by electronic environments, the shift of student profiles from predominantly young undergraduates to older workers or retirees casts a fresh perspective on the traditional debate of vocational versus academic education.

4. WHAT LEVELS OF CURRICULUM ARE APPROPRIATE FOR UNIVERSITY LEARNING?

Several of the papers presented at the conference, including the University of Netherlands' VBT program and some information management programs, described professional development programs supported by electronic environments.

The IFIP/UNESCO Informatics Curriculum Framework 2000, tabled at the conference, took a different focus. This document acknowledges that often a degree of computer literacy is a vocational requirement, and lists different levels of computer literacy ranging from low-level application use. The Framework includes the European Computing Driving Licence that

contains very little traditional conceptual intellectual content and emphasises low-level skill development.[iv]

Although some participants disagreed, there seemed to be general acceptance of the idea that, in order to meet industry and student needs, university curricula should be expanded to incorporate a wider range of not necessarily academic courses. It was agreed that electronic environments not only create a need for a wider range of offerings, but also assist in their delivery.

5. WHAT IS THE ROLE OF TEACHERS IN UNIVERSITIES?

5.1 Should experts play a greater role in the learning process?

Some participants claimed that the rapidly changing world made it impossible for teachers to keep abreast of knowledge. Several papers referred to programs that dealt with this problem by using domain experts as a resource. In some cases, such as VBT, domain experts were resourced from their workplace. In other cases, documented later in this paper, they were represented in multimedia products in which students could participate in simulated interviews.

5.2 Do students teach themselves?

Some conference participants commented that off-campus learning and online resources were consistent with pedagogical approaches that promote student-centred rather than teacher-centred learning. For example, constructivist pedagogies could flourish in a wealth of online resources and feedback loops. Other conference participants felt that students would increasingly rely on their peers for information. Certainly, team projects assume both self and peer teaching. The discussion went one step further by producing examples of students actually teaching teachers, taking into consideration the approach that teaching is a proven learning technique.

5.3 Should teachers be coaches and facilitators rather than dispensers of knowledge?

In a scenario where students are working online, possibly in the workplace, in a self-directed mode, relying on online resources, their fellow students and domain experts, what, if any, is the role of the teacher? Most papers that referred to this scenario seemed to include teachers in the role of coaches and facilitators.

However many conference participants felt that teachers were needed to design the courses in the first place, and that student-teacher dialogue is one of the most important elements in learning. In order to achieve this effect in an electronic environment, several presenters identified two major challenges:

- Avoiding traditional techniques that do not translate to electronic environments, and discovering teaching practices that do effectively incorporate appropriate media to maximise learning.
- Incorporating student-teacher dialogue into electronic environments.

6. HOW DO ELECTRONIC EDUCATIONAL ENVIRONMENTS IMPACT ON LEARNING?

6.1 Is learning actually increased?

Simulations and visualisations are respected forms of electronic educational content. They are among the innovative applications being developed using Java applets embedded in hypermedia at Brown University[v] under the guidance of Andries van Dam. In the course of his keynote address, he demonstrated some wonderful examples and then asserted that no quantitative evidence had been produced to support the theory that software visualisation or simulation increases learning.

At the Virginia Polytechnic Institute and State University[vi], web Java-based modules incorporate state of the art simulation and visualisation techniques, including CAVE virtual reality technology[vii]. The modules were created by a multidisciplinary team and build an entire course. Ronald Kriz described a set of modules in a materials simulation course that included atomistic behaviour, and then added that students reported that they didn't often enter the "CAVE".

In fact, neither quantitative nor qualitative evidence of electronic educational environments actually improving learning was widespread at the conference, despite many applications based on sound pedagogical theory.

However, several papers documented the greater efficiencies, increased access, and flexibility resulting from the use of electronic environments, with increased learning as a probable side effect. On several occasions, reference was made to both the constraints and the advantages of electronic media in educational applications. References were also made to the difficulties confronting experienced teachers when adapting their courses to these constraints and advantages.

6.2 How can interaction between student, teacher and content be increased in off-campus study?

There was general agreement that one of the major constraints of off-campus learning is the missing leaning benefit derived from classroom dialogue. Electronic media can, however, provide forms of interaction beyond the classroom.

Catherine Fulford of the University of Hawaii discussed her research compiling a taxonomy of interactions in a two-way television environment. Working with three classifications of interaction: student-teacher, student-student, and student-content, she identified student behaviour that could be encouraged to promote interaction in that environment.

Software tools to promote communication and collaboration are in widespread use.

Chris Hughes of the University of New South Wales described software and discussion forums that simulate classroom discussion. Students are provided with a structure within which they can ask questions and compile teacher responses in order to complete study requirements.

At the Gippsland campus of Monash University, students and teachers, both on and off-campus, are supported by WebFace[viii], a tool that can operate in any standard browser. WebFace integrates web course content and team repositories with virtual classrooms in the form of subject and team newsgroups. It also automates assignment (not just questionnaire) submission and processing. Entire assignments, submitted using the web and e-mail, can be graded by a sequence of markers before being returned to students together with textual feedback. Marks, submission details, and grading statistics are recorded and available to both students and teachers. Marking of computer programming assignments can be automated, so that grades and feedback can be returned to students in less than half a minute.

6.3 How can the features of electronic environments be used to maximum effect in learning?

Despite differences in content and development methodologies, several of the electronic learning products presented at the conference shared common features.

6.3.1 Pedagogical foundations

Pedagogical theories were recognised as an important element in the successful development of electronic educational applications. Several of the electronic educational applications discussed at the conference are based on pedagogical theories, some complex, some established, some recent.

CATWEB, a Course Authoring Tool for Web-based Educational Environments[ix] created at the Universidade de Vigo "structures the pedagogical contents in learning blocks", making it easier to tailor courses to teacher and student needs. CATWEB instructors need to be able only to follow a succession of screens in a web browser in order to develop and maintain learning blocks. Students can use support tools including note-taking, communication, bookmarks, and question papers.

A flexible hypermedia system for interactive learning of foreign language text comprehension[x] has resulted from collaboration between content experts and educational media experts at the Universidad Complutense de Madrid. The learning environment has a sound pedagogical basis. It contains a tutorial to help students navigate the course, a sound tool to accompany the text, guided and unguided routes of activities, a contextual grammar, and dictionary. "Educators can produce and modify the marked-up documents, and programmers use these marked-up documents as input to the hypermedia system that recreates the learning environment."

A similar technical approach has been taken at the Universidad Nacional de Education a Distancia, Madrid. In an effort to support distance learners, a framework for building web-based scenarios has been proposed[xi]. The scenarios employ different learning strategies for a single knowledge domain. Examples of scenarios are drill-and-practice, case study, self-evaluation, and content delivery. The tool allows domain experts to build a scenario using "pedagogical building blocks" such as "introduce an activity", "give a definition", "offer a hint". In this way different learning styles can be accommodated.

6.3.2 Multidisciplinary development

Reports of successful development of these applications described multidisciplinary teams, containing at the very least, the teacher together with a specialist in educational applications that use technology. Teams also include graphic artists, technical and domain experts, and professional managers.

6.3.3 Multidisciplinary support and resources

Other papers documented strategies to provide teachers with resources, such as help centres, to assist in the development of their courses. For example, courses at the University of Twente in the Netherlands are being re-engineered to incorporate ICT to "support, enrich and improve current education, and to provide more flexibility in course delivery".[xii] This goal is achieved by providing support to instructors. A well-equipped multidisciplinary team, composed of technical, educational and administrative experts, and support staff, assists instructors to incorporate technology into their courses and to adjust their learning and teaching approaches accordingly. A decision-support tool is employed to "identify which ideas and approaches are most likely to be acceptable and interesting to the particular course of the instructor and his or her way of teaching". In addition, an Educational Centre stimulates the use of ICT in learning with staff development and innovation projects.

6.4 Which is a more effective application of electronic technology — the processes of learning or the learning content?

In spite of the similarity in approach of many of these applications, the discussion of the strategies used to maximise the benefits of electronic environments on learning revealed a fundamental difference in philosophy. Many of the educational applications could be clearly separated into two categories: focus on content, and focus on the processes of learning.

Tom Van Weert and Bauke van der Wal of Utrecht argue that the value of electronic educational environments is in the processes rather than content. "The real strength of information technology lies not in automating existing work processes, but in empowering people in changing work processes."[xiii] They feel that on-going and adaptive learning now takes place in the workplace as well as in educational institutions, and suggest that electronic educational environments consist of three main processes:

- learning by the student in a knowledge network
- quality control in the form of student accountability, peer and expert assessment
- coaching by the teacher and educational institution.

In other words, student-centred learning can occur in groups or teams, supported by an integrated set of tools which aid distance communication, information retrieval, document production, organisation, and sharing. These tools should facilitate peer, professional and teacher assessment and coaching. In a rapidly changing world, content is secondary in this approach, and the value of the electronic environment is in adding process to the content in the form of interactivity and feedback loops.

Packages that combine interactive content and support tools can support this approach. Several in-house products that integrate support tools, courseware, and authoring tools in a single environment were presented. CATWEB is one example. Usually the web, supported by CD-ROM, is the major form of delivery for these products.

Some participants provided personal evaluations of commercial integrated environment tools including WebCT, LearningSpace, and TopClass. Most of these products contain modules for course creation and editing facilities, questionnaires, and groupware but the emphasis rarely appeared to be pedagogical.

6.5 An example of the trends in electronic educational applications

MUNICS (Munich Net-based learning in Computer Science)[xiv] is an example of a product that combines many of the attributes of learning environments discussed at the conference. It is an integrated environment that aims to support students and teachers working on case studies in the domain of computer science. It aims to equip computer science students better for professional life. The product has a sound and complex pedagogical basis in the cognitive apprenticeship field of situated learning. Multimedia is employed because it is "particularly qualified to realise active, situated, self-directed and co-operative learning". The problem is presented in a way that, in order to obtain a solution, the user must ask a sequence of questions of appropriate domain experts who are simulated in a multimedia module. MUNICS also contains tools to provide instructional support to assist team development of a solution, including groupware and expert modelling tools

It can therefore be used on or off-campus, both on and off-line, has a vocational focus, uses domain experts, has a sound pedagogical basis, was developed by a multidisciplinary team, and provides student-content

dialogue in the form of a simulated dialogue with the domain experts. It also integrates content with tools that support student-teacher, student-student dialogue. Teachers using the product take a facilitating and coaching role.

7. HOW CAN ORGANISATIONS BE ENCOURAGED TO ADOPT ELECTRONIC TECHNOLOGY?

Apart from the application of technology to best advantage for learning, the role of technology in the wider organisation and on a national level was a key issue. There was general agreement that adoption of technology by the mechanisms surrounding the core educational functions is essential in order for technology to be used to best advantage in education. General use of technology feeds into educational content and processes, and fosters a flexible and responsive approach to the adoption of new technology in courses. There was also general agreement that technology assisted the efficient functioning of educational institutions.

However some participants felt that organisations and individuals are resistant to change and that structures and strategies are required to encourage the adoption of technology by the wider institution. Van Weert and van der Wal feel that "Realisation of an electronic educational environment is as much about managing organisational change as it is about solving technology-related problems. It is of no use to introduce information technology without changing the organisation of education." However, they also feel that the existing content-based, teacher-centred, hierarchical structures can be resistant to change. "People's acceptance of the technology is an issue."

Methods used within individual institutions to promote and manage technological change were discussed. They could target instructors, the information infrastructure, or the organisation as a whole. In most cases, emphasis is placed on encouraging adoption of electronic technologies. Often, top-down strategies are implemented with the aim of stimulating bottom-up initiatives and adoption of new technologies within the context of pedagogical, organisational, and scholarship issues.

In Denmark, Aalborg University's[xv] IT-Innovation project exemplifies this approach. IT-I "serves to initiate the integration of information and communication technology into the existing university structure" and is currently affiliated with 60 projects across different faculties and disciplines. The aim is for the university to "use ICT in order to build up new practices—to develop new pedagogical models, and develop new ways of collaboration in order to enhance mutual understanding and knowledge".

This project applies a model for technological and organisational change that acknowledges the university's need to learn and be open to change while at the same time builds on its existing strengths and experiences.

The organisational model for IT-I is based on:

- Christensen's[xvi] matrix for planning for known or unknown technology in conditions of agreement or disagreement about goals
- Dixon's[xvii] model for organisational learning based on Kolb's[xviii] model for experiential learning

It is summarised

- in a matrix which shows how specific tools and methods can follow the processes in experiential learning.
- in a diagram that "shows the relationship between the experiments and the (IT-I) Project group".

In order to reach the project's strategic goals, five areas of work were identified. Within those areas, five themes were investigated. Applying the goals of IT-I to the five themes, nine activities were set into process. These activities include dissemination of information, establishment of collaborative inter-disciplinary and IT contact networks, organisation of workshops, seminars and, most importantly, support of decentralised IT projects.

This organisational learning model therefore incorporates the "bottom-up" experiences and visions of its staff with "top-down" initiatives and co-ordination.

7.1 How can technology be made accessible?

Making technology generally accessible was a preferred method of encouraging organisations to adopt technology.

In New South Wales, Australia, the Department of Education and Training, which has responsibility for over 2,200 widely-spread government K-12 schools and higher education colleges, is "integrating technology into professional development programs which support changes in teaching and learning"[xix]. The programs aim to deliver high quality, location-independent, just-in-time courses, and materials that model new teaching and learning methods and integrate technology. Strategic planning is in place to "ensure a smooth transition to an effective electronic environment for the whole organisation".

Staff and students at the University of Kent at Canterbury have been encouraged to generate and use a large information system of co-ordinated web pages[xx]. Apart from assisting internal communication, this site assists the university in projecting a wider presence. A database stores staff, student, and course information together with research publications.

Context-aware "active" templates assist general users to create and maintain pages in the "house style". Tools to track user activity were developed and confirm extensive and interesting patterns of use of the web site.

Just as Kent incorporated evaluation structures into the project, Wellesley College has formulated a structure to initiate research projects[xxi]. A technology assessment project created "a framework in which we could develop specific research projects examining the relationship between technology and learning. Our goal was not to evaluate or enumerate the uses of technology for learning ... nor to set policy but rather to explore and understand the shape(s) of learning on a technology-rich campus." Eight main themes emerged from focus groups whose membership was drawn from different faculties. In a similar process, four main themes emerged from student focus groups drawn from a wide range of students. From the conjunction of the two sets of themes, two research projects have been initiated.

7.2 How can electronic educational environments be supported on a national level?

On a national level, centralised decision-making and collaboration between institutions appear to be preferred strategies for efficient utilisation of resources. "Bottom-up" participation is being encouraged with infrastructure development, funding for innovative projects, and professional development programs and support. Greater student choice is a major objective. Improved teaching and learning is a possible, but not always definite outcome.

The higher education information systems infrastructure[xxii] in the UK is being centrally organised to provide a national network and distributed electronic resources. Research, evaluation, and reporting are an integral part of the project.

The Swiss Virtual Campus[xxiii] is a centrally organised project aiming to promote collaboration between the nine universities and other institutes of higher education in Switzerland. Government funding will be allocated to projects that develop high quality materials accessible to students at other institutions as well as the home institution. Learner-centric pedagogical approaches will be encouraged to support different modes of study, including distance education and open learning. A common suite of tools to assist in the development of the materials is being created and assembled. Libraries will use standardised web-based catalogues. Electronic journals and web materials will supplement inter-library loans.

In the entire Central and Eastern European region, libraries are collaborating to provide information management professional development

for the librarians charged with the task of using electronic technology to co-ordinate access to a rich collection of distributed resources[xxiv]. In this case the collaboration is international as well as inter-institutional. Students are paired with international experts in a combination of on-campus study, distance education, and internships.

Project DEDICATE [xxv]is another international program. It is a networked professional development initiative for information literacy. The project utilises collaboration between "library staff, students, faculties, and researchers at five science and technology universities in Estonia, Hungary, Latvia, Lithuania, and Poland".

8. HOW SHOULD ELECTRONIC RESOURCES BE MANAGED?

The last two examples in the previous section demonstrate widespread changes in information management resulting from advances in technology, in particular, the Internet. Representatives of information management attending the conference did not appear to question movement from print to electronic resources, from local manual catalogues to globally accessible electronic catalogues. Digital libraries, electronic catalogues and documents provide access to high quality resources distributed around the world. Students and researchers are no longer constrained by the limitations of their local libraries.

However, this move has added significant complexity to information literacy and management. The cost of establishment and maintenance of electronic systems and digital libraries can offset the savings derived from the elimination of manual processes and physical delivery of printed resources. Information managers reported their strategies to deal with the significant complexity. These strategies included centralisation of administration and resources, collaboration on a national and international level, and professional development programs all discussed in the previous section. Vinod Chachra discussed "creative financial arrangements to fund the development and access to digital libraries"[xxvi].

8.1 Is there still a place for printed text?

In the scenarios presented at the conference, media such as the Internet, CD-ROMs, television and video are being used to deliver educational content. Are these media replacing printed materials? Although some participants felt this was the case, and others discussed problems with

student resistance to text, most courses discussed at the conference still relied on printed text and, in fact, several participants were well-known authors of textbooks. Multimedia forms of content presented at the conference generally aimed to enrich learning, in particular learning outside the classroom, but did not supplant the academic depth of printed text.

8.2 How are electronic resources being integrated with text?

Some of the educational applications presented text on the screen and added some interactivity, whereas others relied on graphical visual presentation and contained minimal text.

Bruce Shriver, in the first keynote address, provided advice gleaned from his experiences authoring a multimedia textbook. In this case, the volume of information that can reside on a CD-ROM accommodates enriching support material. Hypertext links are exploited to provide non-sequential navigation to text, diagrams, and other resources. But the product is still primarily a textbook.

Matt Loeb pointed out that traditional printed publications are considered reliable, credible, and authentic sources of technical information whereas electronic publication and information dissemination media are less secure and manageable. He explained that professional societies have long depended on printed publications for reputability and on their subscription lists as a primary source of members. Ease of access to electronic resources challenges this product-oriented view of membership, as well as concepts of source reliability[xxvii].

9. THE ROLE OF THE UNIVERSITY REVISITED

In the second keynote address of the conference, Star Trek director Alexander Singer used video clips of his work to convincingly illustrate "how the media both reflect and shape the public perception of the nature and practice of science". A captivated audience was aligned in whole-hearted appreciation of his case. Singer's address could be seen to highlight the commonalities and differences in the approaches of the participants at the conference. This conference worked on the assumption that electronic technology has enabled a multiplicity of media to be incorporated into educational environments and, as such, is an agent of extensive change to higher education. Whether it is to content or process, that change both reflects and shapes the society in which the educational environments reside.

Pivotal to this discussion of change was an examination of the role of the university. Some participants felt that universities are an anachronism, whereas others felt that their role in society would continue to grow and flourish. However, all were aligned in the opinion that higher education would continue in some form or other.

Regardless of differences in philosophy and approach, the participants worked together to share experiences and discover ways to best use electronic environments in higher education.

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[iv] Mulder, F. and van Weert, T.

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[vii] CAVE is a trademark name of the Electronic Visualization Laboratory of the University of Illinois

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