

The Search

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INTRODUCTION Shirley had just joined UTE. The University of Tele-Existence. There were no conditions, other than the fee which let her use the facilities. Getting on to courses was another matter. It all depended on the professors, how many students they accepted, what they expected in a student, how much they charged and of course whether you really wanted to study with them. It was up to the learner to choose what was worth doing and the open policy of letting learners and teachers find their own levels had, everyone agreed, resulted in some brilliant innovations in teaching. There was a system she had heard about where groups of students who really wanted to study a particular topic or learn about the ideas of a particular person would hire someone to teach them, paying whatever they needed to...

She stood in the quad watching the patterns the telepresences made with the colours of their gowns. Each colour signified a field of interest so there would be clusters of people with the same colour all arguing with each other, and blinking on and off as they came and went...

...There was a reassuring link with tradition in the shapes of the four towering buildings on each side of the quad. Each one was dedicated to the founding factors on which the university was based: **teachers, learners, problems and knowledge.**

Pointing at the Building of Knowledge she flew up to its great rotunda and looked around at the giant 'mappa mundi' of knowledge about tele-existence and virtual reality. UTE was there in the centre with the world's biggest collection of virtual realities. Some benefactor had the wisdom to foresee the need to begin collecting from the beginning. The other parts of the

map showed the known territory of other collections of information and knowledge in different media that were allied or collections of information and knowledge in different media that were allied or related to the field of tele-existence and virtual reality. Most of them could be accessed through Internet but these days networking knowledge was like using the underground. You were always having to change networks and it was expensive. What was really fascinating was the terra incognita at the periphery of the map which was continuously updated as rumours came in of new developments in computergenerated virtual reality (CGVR)... To see the whole domain of a subject laid out on a 'live' map that was endlessly developing was exciting and all she had to do to find out more about something was to box it with her finger and like a Mandelbrot set it would show another knowledge map at another level of detail. You could search and explore until you found the knowledge you wanted and downloaded it for study. It was also possible to use the system to find an expert in a field, or someone who shared your interests... Soon she was talking to what she knew from the shape of his gown was a second year student who shared her interest in the effects of tele-existence on children. Before long the conversation switched to what was happening in the Place of Problems...

From here Shirley drifted to the Learners Locus... because students go to a university to meet students as well as study, even if everyone is a telepresence. Before she left the campus, Shirley wanted to visit the Towers of Teaching..

She moved back to the quad where there was a large crowd of telepresences watching a performance of virtual music. A full moon ivoryed the towers of

teaching. It was the balance, she mused as she lifted off her head mounted device (HMD) unit and savoured the heat of the midday sun. It was the special balance of the traditional and the new that made for a great university. That and keeping up appearances.

How feasible is this scenario? The technologies that make a UTE possible will be available by the end of this decade. Technologies like virtual reality and multimedia can give human beings fully immersive computer-generated, simulated communication encounters in real time.

WHY THE SEARCH? As information technology impacts on all sectors of society, it changes the way we live. As problems become global, for example, environmental issues, global solutions are needed. This in turn calls for internationalised knowledge. Just as national economies are jacked in to global, so national education systems and classrooms are facing major challenges.

Learning processes are lagging appallingly behind and are leaving both individuals and societies unprepared to meet the challenge posed by global issues. This failure of learning means that human preparedness remains underdeveloped on a global scale. Learning is in this sense far more than just another global problem: its failure represents, in a fundamental way, the issue of issues... (Botkin, Elmandjra and Malitza 1979, 9).

THE PROBLEM Worldwide, societies face the dilemma that their education systems are designed to meet past the needs of agricultural and industrial societies, not the coming information society. We live in a period of transition between an industrial and information society. But our educational systems based on a factory model are preparing people for the ideas and attitudes and values of a way of life that is fading away and for work in areas of shrinking labour requirements. Schools seem unable to respond to the new needs of the societies that support them.

It is no longer sufficient for people to become literate and numerate. The growth of the knowledge industry has brought a demand for new skills, and new literacies. Education systems are failing to provide the quantity and quality of workers which countries will require for sustained economic growth in the next century. They are also failing to address that part of the education of an individual that is needed to prepare them as citizens of an information society. What kind of system is needed to prepare people for life in an information society? It is the search for answers that prompted John Tiffin and I to write our book *In Search for the Virtual Class: Education for the Information Society*. It is not a search to replace the conventional classroom. It is a search for an alternative or complementary loci of learning in the future.

Does the problem lie in the way education is administered, the methods of instruction and the content of curricula? These are the issues that advanced industrial societies focus on as they attempt to find a solution. In our book, our concern is with the extent to which the problem lies with the classroom as a communication system for learning. The classroom is a resilient system that has lasted for many hundreds of years. Any new alternative system has to be at least as successful as the conventional classroom. The use of technology in education can be justified on some critical grounds: it must provide as, or more effective, and cost efficient learning than conventional classrooms and expand educational opportunity for more people than was hitherto possible.

Around the world the demand grows for more education and training opportunities. Most societies now believe that their future advancement can no longer only depend on their land, climate and extractive fuels but rather upon the capability of their people, and this depends upon how they are educated. Education is fast becoming the key issue of our time.

Western educational tradition can be regarded as a two by four by six activity, to use a metaphor from the building trade. It is contained within

the two covers of a book; took place within the four walls of a classroom; and happened during six periods of the day. This deeply ingrained idea is changing. Education as a lifelong activity is becoming regarded as one of the characteristics of an information society. Advances in science and technology mean that increasingly industrial processes are knowledge-based and driven. Workers have to maintain their employability by constantly renewing their knowledge and skills particularly to satisfy the growing demand for knowledge workers with internationally competitive skills. The increase in the number of tertiary students in most countries is in part because more school leavers are going on to further education, but it is also due to the growing number of adults and particularly women returning to the educational system, seeing this as the key to economic advancement. More than the rise in unemployment, it is the rise in the unemployable that will be the critical issue facing governments in the next decade if education systems are unable to cater for the skills that will be required in a fast changing future workspace. Can this worldwide demand for more education be matched by an expansion of existing classroom-based educational systems?

WHAT IS NEEDED? What is needed is effective, cost-efficient instruction that can match the needs for skills related to technological change, delivered interactively, at the convenience of the learner. The learner, irrespective of their physical location should be able to interact with the teacher, with the content and with one another in synchronous and/or asynchronous mode. This is telelearning.

As telecommunications, computers and broadcasting merge to provide us with powerful information technology, new ways of learning and teaching will challenge the traditional classroom, not replacing it but providing alternative and complementary ways to extend educational and training opportunities for more people than is possible with conventional classrooms. These new technologies, made possible with advancements in digitisation

processes, create a communications environment allowing us to communicate using sound, text and pictures in sophisticated combinations and so replicating the multimedia environments of traditional face-to-face communication in a classroom. This is the virtual class where teachers, learners and curricula interact as telepresences from any location.

Dennis Gooler (1986) uses the metaphor of a national water utility and describes the concept of an educational utility thus: [The education utility consists of a massive and dynamic reservoir of information and educational programming from which individual teachers and learners can select the information and education resources they wish to work with, and when. The appropriate information can be transmitted via a state network in an economical manner to the school or site requesting the information] (Gooler 1986, 18).

In our book we prefer the metaphor of the electrical utility that has become a universal source of power where people can plug any device that worked with electricity. An educational utility such as a virtual class will allow people to attach information devices such as computer modems, telephones fax machines and security systems or give them information in any mode, from anywhere and at anytime. Coupled with the advancements in technology that are creating McLuhan's global village, there is a growing trend in this decade towards the sharing of materials, facilities, networking of institutions and internationalising of banking, education and training. As information superhighways crisscross borders, it becomes vitally important for countries wishing to function successfully in the global economy of the next millennium to learn to be drivers on the superhighways.

EDUCATION IS COMMUNICATION Shannon and Weaver in their seminal book *The Mathematical Theory of Communication* observed, 'it is clear that communication either affects conduct or is without any discernible and probable effect at all.' (1949, 5). Education is the

practice of a kind of communication. What are the fundamental communication functions that allow education to take place? How does the classroom facilitate such communication functions? How can the use of information technology such as virtual reality and multimedia improve the classroom?

It would be true to say that all of us, at some time, need some assistance to acquire complex sets of skills that are external to us. The term education is used to include training, life and citizenship skills, and learning without direct supervision, through mediated instruction as in the case of distance education or self teaching materials. However, the primary locus of education is seen to be the classroom. In seeking to improve the classroom by using technology it is necessary to establish a relationship between the ideas of information technology, communication and education. As industrial societies become information societies, conventional communication systems are becoming information systems. Where, for example, communication was based on paper transactions and face to face meetings in rooms there is now increasing use of information technology. From depending on transport systems to get people and paper to the place where business is done, society is beginning to use telecommunications to similarly to move information to where it is needed.

If communication is the process of moving information from one source to another, the process of education can be described in terms of moving information from a source that has the information (for example, a teacher) to someone who is yet to learn how to use the information (the learner). Of course, both a person's genetic endowment and their environment contribute to the way they develop. However, is a violent, unsociable, unemployable person the consequence of a genetic predisposition, or a lack of parental guidance, or what they see on television, or a failure of classroom teachers? Whatever the prime factor, a positive way that we have to prepare people for their part in society is by creating an effective educational communication system for those that need it.

One advocate of the environmentalist approach in education whose work has provoked interest in recent years is Lev Vygotsky, and his concept of a Zone of Proximal Development (ZPD) provides a basis for looking at education as communication. Simply stated, according to Vygotsky the ZPD is the difference between what a person can do by themselves and what they could do with help from people more experienced than themselves (Vygotsky 1978). The ZPD implies that any educational system involves people who have roles as teachers and as learners and a communication process between them that allows the teachers to help the learners to solve problems that they would not be able to solve by themselves. In addition, 'problem solving under guidance... or in collaboration with' means practice and feedback, and a two-way interactive communication process between teachers and learners that is dynamic. What Vygotsky did not have in mind in the pre-computer era he lived in, is the possibility that the helping hand for the learner need not be human. Nor could he have realised that developments in telecommunications as well as computers would mean that the teacher, human or otherwise, could be anywhere and only present with the learner in a virtual sense.

THE FOUR CRITICAL FACTORS OF EDUCATION In his ZPD, Vygotsky specifies three factors in the educational process: someone in the role of the learner; someone in the role of the teacher, and, something that constitutes a problem which the learner is trying to solve with the help of the teacher. By implication there is a fourth factor: the knowledge needed to solve the problem (Tiffin and Rajasingham, 1995). It is the interaction of these four factors – learner, teacher, knowledge and problem in a particular context – that constitutes the fundamental communication process that is education. How can the new information technologies intermesh the four critical factors of education? Can they create an effective, complementary and or alternative to the classroom?

THE INFORMATION SOCIETY The development of society can be divided into three phases: the agriculture society where our great grandparents and grandparents worked on the land and studied in village schools close to their homes. In the industrial society people began to travel away from their homes to work in factories and get an education. Conventional educational systems were based on transport systems where one had to travel to school by foot, rickshaw, bus, train and if one wanted to get international education, then one had to fly there.

We now live in the transition period between industrial and the new era, the information society that arrives as the electronic information superhighways enter silently into our homes. Telecommunications networks carrying telephone and television analog signals have become largely available around the world. However, it is the digitally based communications that are the basis of the information age, allowing vast amounts of information to be created, collected and distributed almost instantaneously over vast distances, over an integrated terminal. For example, Integrated Services Digital Network Services (ISDN) allow the fast transmission of voice, text and pictorial information over one composite terminal giving the user value-added services such as teleactivities. Access to ISDN and the superhighways of information means that one could telebank, telework, telelearn, teleshop and so on without leaving one's home. Distance from any place is no longer a limiting factor. There are many countries today where increasingly people are using telecommunications to do their transactions without having to face massive traffic jams.

As demand for these value-added services grows, countries are rapidly allowing the new computer-based, packet-switched frame relay networks to transmit domestically and internationally. The prime example of course is Internet with about 30 million subscribers in 1994, and increasing. Another significant information carrier is Direct Broadcast Satellite that can be more economical than cable for transmission over vast distances

and difficult terrain. Satellite communication is increasingly becoming the preferred transmission medium in India and amongst the isolated communities, particularly Aborigines in Australia. It is possible, however, that the communication utility for the information society could be a mixture of both satellite for international information access and terrestrial cable for domestic retrieval.

What will the global communications network mean for cultural integrity and development? According to Buckminster Fuller, the American social commentator, in the information age we would need to think globally and act locally. To do this people would need education to learn how to use the technologies as tools to create their own culturally appropriate messages and courseware, rather than importing them.

An information society implies a society based on an infrastructure of information technology where the main form of employment is as information workers. Ironically, however, our own grand-and great grandchildren in the information society, like their forebears in the agricultural society, could be working, playing and learning close to home. Work, entertainment and learning will be delivered to homes through telecommunication networks, eliminating the need for travel. In this scenario, human society would have come the full circle in how they conduct their daily activities.

As broadband ISDN, fibreoptics and satellites that are the new superhighways and infobahns become available, instead of transporting physical material across space using roads, information superhighways transport information across not only geographic, but cognitive and symbolic space in time/space compression. It is possible that multimedia and computer generated virtual reality technologies in the next decade could transform education and help create the virtual class. But roads will not disappear. Classrooms will not disappear. There will be, an alternative, complementary loci of learning, a virtual class.

VIRTUAL REALITY The virtual class is made possible by virtual reality technology. Virtual in this context means reality in effect, not in fact. Already we are aware of virtual universities, virtual schools and virtual classes on the global communications network, the Internet. This network allows people separated by distance to meet by writing to each other. Today, the technology for basic virtual classes exists. Technologies such as videoconferencing and multimedia allow a virtual class where we can see and hear one another. Research shows, however, that we are slowly able to move our whole bodies into a virtual class. For example, it is possible to attend a virtual class by putting on a helmet; by putting on data gloves our hands in a virtual class can write on a virtual whiteboard. Research currently being done in Japan, Europe and the United States suggests that one day we will be able to step inside a virtual learning environment as full bodied telepresences that can hear, see, talk with and even touch and smell other telepresences in classrooms and communities that are virtual simulacra of the subject being studied. We could study the human heart inside a heart, study Hamlet inside Elsinore Castle, the history of India during Shah Jehan's time inside the Taj Mahal, and so on. This kind of scenario is no longer science fiction. Professor John Tiffin of the Department of Communications at Victoria University of Wellington is currently working with Dr Nobuyoshi Terashima, the President of the Advanced Telecommunication Research Laboratories in Kyoto Japan to design a virtual seminar where students in New Zealand could meet with students in Japan as telepresences where they can see each other in three dimensions, talk to one another and even touch one another and the virtual objects that they share. Such a facility is scheduled to be commercially developed by the year 2000. What are the forerunners of the virtual class?

THE CONVENTIONAL CLASSROOM

The conventional classroom as the locus of learning has been around for many hundreds of years. It has been most successful in meeting the needs of the societies they served and provided

an effective, multimedia and interactive environment for education processes. However, as economies become information based and global, new kinds of education and training systems become necessary to produce people with internationally competitive skills for a fast changing future.

To survive, the classroom depends on rapidly depleting, finite extractive fuels used for buildings and travel. Also the bureaucratic structure of traditional educational systems that are usually bastions of conservatism makes it difficult for them to incorporate changes rapidly. Today, keeping up to date with developments means that curricula need updating regularly. Students are now paying clients, and increasing numbers of students are working adults. Unlike education, commerce, being more global, tends to incorporate information technology as a matter of strategy. But education needs to become more responsive to market needs because students looking to upgrading their knowledge and skills today are intolerant of education and training systems lagging behind industry.

DISTANCE EDUCATION: TRADITIONAL

Since very early times, there were people who could not attend schools because they lived in remote areas, could not afford the travel, had a disability, or would not do so by choice. For these people distance education was the only alternative. Distance from educational opportunities can be measured not only in kilometres but also in terms of social or economic inequalities. It may be just as difficult for someone living in an urban area to attend classes on a campus as it is for someone living in a remote rural location. Distance education relies on communication technology to bridge the gap between teacher and learner, and historically this was correspondence and postal based. It has a long history and most countries have had successful distance education programmes since the nineteenth century.

Byorn Holmberg described distance education as a didactic conversation and Michael Moore cited interaction between students as

instrumental to learning. Interaction and collaboration in the learning continuum are given impetus by network technology that allows synchronous and asynchronous interaction. Print, radio, television, telephones and computers have been used in distance education around the world since the late eighteenth century. Their success was limited, however, because they were mono or stand alone technologies allowing limited synchronous interaction between teachers and learners that is critical in the learning process.

DISTANCE EDUCATION: NEW A United Nations Report published in 1989 identified distance education as the fastest growing sector in the knowledge-based world economy. As communications technologies move towards digitisation and convergence a new kind of distance education called telelearning is becoming available. Today this includes teleconferencing, audiographic and videoconferencing. What are the implications for distance education as it seeks to operate in the new interactive electronic workspace?

The process of convergence requires new alliances and new kinds of collaboration among the players. Worldwide, technologists in the computer, telecommunications and television industries are locked in collaborative competition trying to overcome inherent barriers that are endemic to their cultures. Similarly, as educational utopias pitch against technological ideals, new paradigmatic relationships based on alliances and collaboration pose unprecedented challenges. Collaboration among all players is critical however if interactive technologies are to be used successfully in teaching, creating, interpreting and integrating knowledge for problem solving. The fundamental problems in creating networks that can serve academic, training and commercial purposes are not technical. They are organisational and financial and need close negotiation between educationists, networks and technology providers. A union of forces is necessary for the creation of a modern, cost effective distance

education system for a nation enroute to the next decade. The key role in building an electronic infrastructure and its governance would belong to government because it involves policy and national development strategy issues.

Research in distance education suggests that it is learner-controlled. Teachers remain just as critical to the education process, but their roles change to that of facilitators and navigators to help students find information and most importantly, sift and structure information for their needs. Successful education is a collaborative process. Students need to interact with teacher, with content and also with one another. While the traditional use of technologies in distance education such as print and post, radio, television and computers gave learners limited control over their learning, new information technology such as teleconferencing, audiographic conferencing and videoconferencing allow synchronous and asynchronous learning. Irrespective of location the learner can interact at any time with the teacher, the instruction and with other learners using the written word, the spoken word and still and moving pictures. In the late 1990s, advancements in information technologies such as virtual reality and multimedia allow fully immersive, interactive, realtime communications through audio, textual video and even touch and smell. This kind of development could create a communications environment where all the functions of a conventional classroom can take place (Tiffin and Rajasingham, 1995).

THE VIRTUAL CLASS TODAY Information technology is already widely used in education and training. Computer-assisted instruction, computer-managed instruction and the use of computer simulations for training goes back to the sixties. Audioconferencing has been used since the seventies and instructional television has been tried around the world since the fifties. It is, however, the coming together of computer and telecommunications technologies that could lead to the virtual class as the primary or complementary loci of learning in society.

How is it possible to have the effect of a class without the reality of a classroom? A classroom is a communication system that makes it possible for a group of people to come together to talk about something they want to learn, and to look at pictures and diagrams and text that help them understand. The question is, can information technology provide an alternative communications system for learning that is at least as effective?

The idea of a virtual class is that everybody can talk and be heard and be identified and everybody can see the same words, diagrams and pictures, at the same time. This calls for the use of telecommunications and computers. At its simplest, it can be done using two conventional telephone lines at each site, one to link telephones and one to link computers. One line is for sound, and one is for pictures that can be generated on the video display unit (VDU) of a computer. To link more than two sites, a teleconferencing bridging system is also needed. Teleconferencing bridges can be linked to other teleconferencing bridges and theoretically there is no limit to the number of places that can be linked, or where these places are. This is one technology that makes a form of virtual class possible today and there are pilot projects taking place in many countries that show that it can be made to work at least as effectively as a conventional class. Such projects make it possible to think about what a virtual class could be like in the future, as telecommunications systems improve. In time it will be possible to use the public switched telecommunications system to transmit high quality digital sound and high definition video images. Audiographic conferencing systems are being upgraded to include videoconferencing. Not only is it possible for everybody in a virtual class to talk to one another, they can also see one another. We can expect, through the nineties, a rapid development of teleconferencing technology and attempts by the teaching world to adapt it for educational purposes.

THE VIRTUAL CLASS TOMORROW

The telephone can provide televirtual voices. Teleconferencing can provide the effect of a

meeting without people actually meeting and is already being adapted for instruction and called a virtual class. However, a new technology is emerging in the nineties called virtual reality. Involving the use of a datasuit, helmet and gloves that are connected by sensors to a computer, it seeks to create the effect of actually being inside a simulated reality. We are beginning to conceptualise it as a new medium and come to some appreciation of its possibilities. Applications of virtual reality are being developed in such fields as architecture, medicine and arcade games. However, its origins were in institutions, in the development of flight simulators for training. It is time to see how it could be applied to education and the development of virtual classes in the fullest sense as wraparound environments for learning where students as telepresences can see hear, touch and perhaps one day even smell and taste. What will be possible with virtual reality fifty years from now? What form could a virtual class take? What potential capabilities could it have? Will the UTE with its virtual classes likely to be an improvement on a conventional classroom as a communication system for learning in the coming information society? Finally, will the UTE be similar to the place where our children and their children can access a mappa mundi of knowledge just by the flicker of an eyelid, or the fractal turn of the head, or a mere whisper?

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