The Future University in the Knowledge Society

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Abstract
As societies become part of the global economy with the rapid advances of information and communication technologies (ICT) the main challenge facing companies and organisations is the upskilling of employees to be productive in the emerging, competitive, global knowledge economy. ICTs define information infrastructures, calling for new thinking, new visions, understanding and ways of relating in an increasingly interdependent global community. The increasing importance of knowledge as competitive advantage for knowledge societies means a new paradigm of education, particularly at tertiary level and of the core function of education which is the creation, storage and processing of information into knowledge that can be applied to real life problems. This paper suggests a model for the future university that seeks to respond to the needs of the emerging global knowledge society.

Resumo
Com o rápido avanço das tecnologias de informação e comunicação e a sociedade como parte da economia global, o principal desafio para as companhias e organizações é preparar os empregados para serem produtivos numa economia emergente, competitiva de conhecimento global. ICTs define estruturas de informações, chamando por novo pensar, novas visões, entendimento e formas de ralacionar-se numa comunidade global altamente interdependente. O aumento da importância do conhecimento como vantagem competitiva para as sociedades do conhecimento significa um novo paradigma para a educação, particularmente no nível de terceiro grau, e para a função comum da educação de criação, armazenamento e processamento da informação para conhecimento que possa ser aplicado aos problemas da vida real. Este artigo sugere um modelo para o futuro da universidade que pretenda responder às ncessidades da emergente e global sociedade do conhecimento.

Resumen
A medida que las sociedades entran a ser parte de la economía global, con los rápidos avances de las tecnologías de la información y la comunicación (TIC), el principal reto que enfrentan las empresas y las organizaciones es la de actualizar las habilidades de sus empleados para que estos sean productivos en la economía emergente y competitiva del conocimiento global. Las TIC definen infraestructuras de información, llaman por nuevas formas de pensar y por nuevas visiones, formas de entender y de relacionarse en una comunidad global en progresiva interdependencia. La creciente importancia del conocimiento como ventaja competitiva de las sociedades del conocimiento significa un nuevo paradigma de educación y de las funciones claves de la educación, particularmente a nivel terciario, es decir, la creación, almacenamiento y procesamiento de información en conocimiento que puede ser aplicada a los problemas de la vida real. Este artículo sugiere un modelo para la universidad del futuro que busca responder a las necesidades de la emergente sociedad del conocimiento.

INTRODUCTION

The modern university of which we are all products, was born in the industrial society with the railway networks providing the infrastructure for the movement of people, goods and services. The critical technological infrastructure of a knowledge society, however, is its telecommunications networks, particularly the Internet and the World Wide Web (WWW). Therefore, to prepare people for life in the knowledge society, an educational system is needed that is based on telecommunications (Tiffin and Rajasingham, 1995).

The Internet, a global network enables a global interconnected and virtual world where no country is an island unto itself. Societies, particularly in Asia and the developing world, face critical challenges as the international economy evolves towards a global network centred on the value of knowledge, the capacity of people and organisations to use advances in ICT appropriately, effectively and efficiently, and the primacy of the English language.

Education as we know it from kindergarten to tertiary levels is designed for the society in which it operates. The interaction that takes place between teachers and learners about the application of knowledge to problems takes place in rooms in buildings and is based on transport technologies. However, advances in communications and information technology such as the Internet, virtual reality, multimedia and HyperReality are rapidly changing the way we learn, do business, bank, shop and play. Societies' future in an increasingly competitive, global digital economy will depend on how its people are educated. As building and transport technologies increase in costs, therefore, education for the future environment based on telecommunications networked environments will be the key to survival in the new millennium, offering educational opportunities to more people than is possible in conventional classrooms. This paper explores some possibilities.

Shifting Paradigms

In considering the concept of a university as a paradigm, Thomas Kuhn's 'The Nature of Scientific Revolutions' (Kuhn 1962) is relevant. He used paradigm to mean 'what the members of a scientific community, and they alone, share' (Kuhn 1977: 294) and explained that such 'communities are characterised by the relative fullness of communication within the group and by the relative unanimity of the group's judgement in professional matters. To a remarkable extent the members of a given community will have absorbed the same literature and drawn similar lessons from it' (Ibid: 296).

Kuhn's concept of paradigms has been widely applied in other fields. Heinich (1970) talks of educational paradigms: 'The possibility of the emergence of … a new instructional paradigm raises the whole question of paradigms and how they change (Heinich 1970: 25). The dominance of such a mindset can only be understood by comparing it to the scientific rationalism in which the developed world and its universities are immersed today. Michel Foucault calls such zeitgeist an episteme by which he means an all-encompassing body of unconscious knowledge peculiar to a particular time and place. Kuhn's idea that 'when paradigms change, the world itself changes with them' (1962: 110) reflects Foucault's view of an episteme as a worldview that is so comprehensive it is not possible for people in one episteme to comprehend the way people in another episteme think (Foucault 1970).

The rapid advances of information and communications technologies call for new thinking, new vision, new understanding and new ways of relating in an increasingly interdependent global community. demands re-thinking of the core function of a university: the creation, storage and processing of information into knowledge that can be applied to problems. The increasing importance of knowledge as competitive advantage for modern organisations and businesses is changing the paradigm of education and in particular the university as the critical driver of sustainable economic growth and the development of democratic knowledge societies.

Like all human organisations and businesses, as the university changes with a new episteme so too does the knowledge it teaches and researches. Not only has knowledge been broken up into a multiplicity of subjects, but is seen differently from university to university, country-to-country and language-to-language. Whereas medieval universities in Europe had a common language in Latin, modern universities use the written language of the nation that supports them. But even here, in the same university with the same common language, we find the same subject addressed from different perspectives in different paradigms of different subjects. Those who have studied in more than one language will resonate with the Saphir Whorf hypothesis, that the way we think depends on the language we think in (Whorf 1956).

The prevailing postmodern times sees virtue in multiple knowledges on the same theme (Lyotard 1984). The growing fragmentation and lack of consensus as to what constitutes knowledge creates a context for chaos. If a language means all things to all people it is meaningless. If knowledge is whatever an individual thinks it is, then there is no paradigm and no way people can communicate and cooperate in its application. If knowledge is a paradigm that varies according to the subject studied, then its wider application in society will be as confusing as letting people skilled in different versions of football play in the same game. If knowledge is a paradigm that varies according to the country or culture, then global issues can only be addressed from the perspective of that country or culture (Tiffin and Rajasingham 2003).

There is a close relationship between universities, knowledge and civilisation. We associate knowledge with universities. Universities are communication systems where teachers help students to apply knowledge to problems. Societies' future in an increasingly global digital economy will depend on how its people are educated, particularly at tertiary level. Knowledge-driven growth demands expanded and inclusive education systems geared to expand opportunities for value-added higher level skills for increasing numbers of people seeking lifelong learning that emphasise creativity and flexibility to respond to the changing demands of global knowledge-based economies.

Michael Marquardt (1996) argues that to succeed in today's fast changing, globally competitive business environment an organisation must have the capacity to continually learn from its experience, and to translate that knowledge into improved performance, and an organisation must become a 'learning organisation'.

The impact of globalisation on today's university system suggests that the future university will be based on telecommunications rather than on transport technology. As a system through which society learns to understand and make meaning of complex globalisation processes, the challenge for the future university will be to design global education on the Internet that addresses the needs of different cultures in curricula, and approaches to learning. A paradigm shift is in the making for what we teach (and learn) and how we teach and learn. In the words of Marshal McLuhan (1967): 'The Medium is the Message'. And herein lies the challenge.

Tiffin and Rajasingham (1995; 2003) argue that education is communications. Both are information intensive and technology-based, culturally contextualised activities. The 1900s saw the use of correspondence based on postal services and radio in education. The 1960s, saw educational television and the 1980s, the advent of the personal computer in education. The 1990s saw the use of narrowband Internet and virtual reality in education. In this decade of the new millennium we see the rapid advances in computer power that bring new sophisticated clusters of technology such as nanotechnology and HyperReality on broadband Internet for education. What will it mean for education when learners and teachers can access Pentium4 computers and high-powered 3D FX videocards and 2Meg Bandwidth from wherever they are?

In 1948, Lasswell articulated one of the abiding dictums in communications which is still used as a basic checklist of the critical components of any communication system: "who communicates what, to whom, in what channel, with what effect" (p.37). For a class as a communication system this could be expressed as teachers communicate with learners about knowledge and guidance as to how to use the knowledge, so that learners can apply it to problems. In a conventional class which is 4000 years old, the channels (or transmission technology) are sound and light, paper/ blackboard/ whiteboard. The conventional classroom is an old communication system for teaching and learning and is a sophisticated, multimediated system, which is still beyond the anything telecommunications is yet capable of. However, we suggest the advances of ICT will make this possible in a global virtual university.

Worldwide the demand for education is increasing in tandem with rapid advances in communications and information technologies. Just as roads, railways brought teachers and learners together to learn how to apply knowledge to problems in the industrial society, the Internet, multimedia, virtual reality and HyperReality are likely to provide the communications technologies for education in the emerging information and knowledge society. It is suggested that future education will be global and commercial, and will be on broadband, using artificial intelligence (AI) and virtual reality (VR) environments.

The Polemic
Education as we know it prepared for life in a nation state. Worldwide, conventional education systems, which long and well served the needs of the industrial society, are increasingly unable to respond to the fast changing needs of the knowledge society. They are transport and buildings based and dependent on fast depleting fossil fuels, are costly, bureaucratic, and slow to adapt to change.

As we are in the process of becoming a global society operating in a global economy, and as the worldwide demand for lifelong learning opportunities grow, we need education that prepares us for life in a global society. We therefore need global education, not instead of, but as well as, national education to, in Buckminister Fuller's words, ' think global and act local'. With the emergence of new kinds of knowledges, it is appropriate to act global and think local in culturally appropriate ways.

The Challenge
In order to be internationally competitive and survive, societies are facing the dilemma of responding to the demands for new skills for the global knowledge society through education systems geared for the past needs of national industrial societies.

What is needed is effective, lifelong, cost-efficient, culturally appropriate instruction that can match the needs for global skills related to technological change, delivered interactively, at the convenience of the learner. The learner, no matter where their physical location should be able to interact with the teacher, with content and with one another in synchronous and asynchronous modes, using text, words and still and moving images, and in future, smell taste and touch. A global virtual university on the Internet could meet this need.

What is a Global Virtual University?

There is one way in which a global virtual university is different from any of its predecessors and that is in the technology of the communication system by which teaching and research is done. All previous university paradigms have been based upon the face-to-face communication supported by some form of reading and writing technology encompassed in some kind of rule. In this, universities like other educational institutions modelled themselves on the world for which they were preparing their students. Ever since there have been schools and universities, their students have gone forth to employ the skills they have learned in rooms whether they be offices, shops or businesses. The virtual university will prepare people for an entirely different world. It is a world that we can hardly as yet comprehend. To respond to multiperspectives in a globalised world, the virtual university will need to be global, commercial, multilingual and multicultural on the Internet. The HyperClass is a step towards this.

What is a HyperClass?

Today's schools, colleges and universities could not exist without the roads that make it possible for students and teachers to come together to make use of the buildings which house libraries and classrooms and support systems. Virtual schools and virtual universities are rapidly appearing on the Internet. What distinguishes them is that they use computers and telecommunications instead of buildings and transport to bring teachers, students, knowledge and problems together in a virtual class. What comes after the Internet? This is the HyperClass where students are equipped with global skills to solve global problems, and at the same time act local in consonance with their own cultures and social networks (Rajasingham, 2003).

New clusters of technologies like nanotechnology, artificial intelligence (AI) and HyperReality (HR) are becoming available and could provide revolutionary infrastructures for the global virtual university for the knowledge society where education through our five senses, will be available to anyone, anywhere at anytime in culturally appropriate ways.

What is HyperReality?

The man who first conceptualised HyperReality, Nobiyoshi Terashima (Tiffin and Terashima eds. 2001: 4-24) states that it is a technological platform that intermeshes virtual reality (VR) with physical reality (PR) and artificial intelligence (AI) with human intelligence (HI) in a way that appears seamless and allows interaction. Still in experimental stage, a research project between New Zealand and Japan are developing the communication system that addresses the implications for education of real students, teachers and objects freely interacting with virtual students and objects and with artificial intelligence in a class.

The world's first HyperClass was held in December 2000 when a three-way link was successfully made in HyperReality between Waseda University in Japan, Victoria University of Wellington in New Zealand and the Queensland Open Learning Network in Australia using digital image avatars. An avatar in New Zealand handed a virtual CD-ROM from Japan to an avatar in Australia, who then handed it back to the avatar in Japan, who fitted it into a virtual computer. The experiment was successfully repeated two days later. The interaction took place inside a computer-generated virtual class, where the virtual mixed with the real in the form of the three avatars, one participant in each country in attendance and the task was to pass a virtual object originally located on a table, from one participant to the next. The task was successfully completed as the virtual object travelled at the click of the mouse from Japan to Australia, then to New Zealand and back to Japan again.

Simple as this sounds this experiment is the accumulation of many years of collaborative research, and its implications are profound for the future of education in the information/knowledge society.

A research project has been in progress since 1997 to apply HyperReality (HR) to education in a HyperClass (HC) (Tiffin and Rajasingham, 2001: 110-125). Nobuyoshi Terashima led the research team at Japan's Advanced Telecommunications Research Laboratories (ATR). It makes possible a future where the people and the objects around you may be real or may be virtual and may have human intelligence or artificial intelligence.

From our neo-Vygotskian perspective of education as a communication system that allows teachers to help learners to apply knowledge to problems, can now be done by the Internet. The communication process where teachers and students interact to apply knowledge to problems by telecommunications and computers is called a virtual class and seeks to replicate the fully meshed, multimediated communications systems of a conventional classroom, at different locations. A HyperClass is the interactive conjunction of a real class made of atoms with a virtual class made of bits of information. As e-business, e-shopping e-

banking, and e-learning as virtual classes and virtual universities now proliferate the Internet, it is suggested that the future education will be competitive and big business.

The Virtual Class/HyperClass Nexus

Tiffin and Rajasingham (2001) describe the design and development of the HyperClass, as technology that would allow students in their own physical localities, to climb through the computer-generated "window" and freely intermingle in real-life space as full-bodied three-dimensional beings, from different locations in culturally appropriate ways. In this environment, teachers can be virtual and students real and vice versa, and both teachers and students could be virtual.

The virtual class/HyperClass paradigm at its most basic can be thought of as the critical communications systems for instruction in an information/knowledge society and as having a function analogous to the conventional classroom in an industrial society. The virtual class and virtual university are dependent on information technology, based on virtual reality, multimedia, nanotechnology, artificial intelligence, and HyperReality providing access to a breadth of intellectual and cultural resources far greater than ever before. The dichotomy of what is physically real and what is virtually real is what Nicholas Negroponte refers to as the world of atoms and bits. We must learn to live in this dualism because it is the defining infrastructure of the knowledge society, which is rapidly emerging.

The clusters of technologies are bringing a revolution in our infrastructures whereby we use telecommunications rather than transport to telebank, teleshop, telework and therefore telelearn. Will virtual reality technology linked to telecommunications make possible the global virtual university, the default educational system of the knowledge society where education through our five senses, will be available to anyone, anywhere at anytime in culturally appropriate ways? A HyperClass is a class that is conducted in an environment where physical reality and virtual reality comingle in a way that becomes increasingly seamless. It is a combination of a conventional class and a virtual class. Teachers, students, knowledge and problems can come together in a class via local transport and they can also come together via the Internet.

The Need for the HyperClass

National education systems have come into existence over the last hundred years in response to the needs of commerce and industry in industrial societies. Today, on the Internet, commerce follows education. It is schools and universities that have pioneered the use of the Internet. It is the young that lead the way. In trying to understand cyberspace, students surf the web before their teachers.

Recently, a group of New Zealand students joined a group of Japanese students for a seminar in the Master of Communications. The medium was videoconferencing. Both students and academics saw their counterparts in the other country as two-dimensional images on a video monitor. The seminar proceeded in a conventional manner. Papers were presented by academics from both countries and there were questions from students. Pictures were carefully composed by video cameras and framed on the monitors in the manner of a television programme.

At one point there was a break of 15 minutes and the videoconferencing link was left open so that the students in the two countries could communicate socially. Suddenly the communication changed. It seemed as though the video monitor had become a dormitory window through which students were leaning and chatting with frank curiosity about each other: "Hi, what's your name? What subjects are you taking? How about a date?"

There seemed to be a raw desire for a technology that would allow students to climb through that window and freely intermingle as full-bodied three-dimensional beings. This is the basic goal of the HyperClass concept as described at the beginning of this paper.

The current use of telecommunications in education - for emailing, bulletin boards, conferencing, generating web pages, surfing and videoconferencing - are steps along the road towards a virtual class which would ultimately be in distributed virtual reality on broadband fibreoptic networks and with developments in HyperReality, we suggest that the virtual class will become a HyperClass.

Dynamics of a HyperClass

HyperSchools, HyperColleges and HyperUniversities can exist in real and virtual dimensions at the same time. In so doing they will provide an intersection between the local and global dimension in education.

The universities can be in different countries, and can link classes in different universities in different countries in a HyperUniversity. A student could go to a conventional class in a conventional university or stay at home and use a PC and the Internet to link to a virtual class in a virtual university. A HyperClass allows a student to do both. A HyperClass exists where the virtual and real dimensions intersect. This is a coaction field where students and teachers in a conventional classroom can synchronously interact with students and teachers in other universities that may be in other countries.

A coaction field conceptualised by Terashima (2001:9-12) is where students and teachers in a conventional classroom can synchronously interact for the purpose of learning with students and teachers in other universities, possibly in other countries. The HyperClass is where real and virtual dimensions of students and teachers intersect providing a common field to reconcile the learning that is local with learning that is global in order to understand the subject from multiple perspectives of other cultures than one's own (Tiffin and Rajasingham, 2001; 2003).

Participants in a HyperClass come together because of their interests in a specific subject and it is suggested therefore that the development of HyperUniversities can be dedicated to specific disciplines, in contrast to national universities that emphasise location. Instead, the emergence of virtual universities in specific fields such as communications, nanotechnology, Chinese literature and so on could emerge, fitting with Terashima's (2001) definition of HyperWorlds as a technical environment where coaction between reality and virtual reality is based on a shared domain of knowledge.

In the HyperClass, the relationship between knowledge and problem domains suggests another important contrast to conventional classroom processes. In a conventional classroom the application of knowledge to problems is expressed symbolically, through alphanumeric notation and two-dimensional still pictures. If the subject matter in a HyperClass requires no more than similar visualisation then all that is required besides the means for real and virtual students and teachers to interact is some kind of virtual display unit - a whiteboard/blackboard. Regardless of whether it is in a real classroom or a virtual class, a whiteboard which acts as a short term memory of an instructional event is one of the most basic and powerful instructional devices at a teacher's disposal and must be available in a HyperClass.

However, Tiffin and Rajasingham (2001) suggest that when problems have a real life referent in the participants' social reality, then classrooms with whiteboards may not be the best place for learning. For example, learning how to drive a car from a whiteboard or a book, or where medical students who can write an essay on a disease but cannot recognise it when a patient has it, proves the inadequacy of alphanumeric and diagrammatic instruction alone. The challenge is to transfer learning from the classrooms to real life situations. It is a problem that is seldom addressed because of the way what is learned in a classroom is tested in a classroom and solutions to problems are examined in the way they were learned, that is alphanumerically, rather than testing the application of knowledge to real life situations in whatever form they take, in multimediated simulated environments.

The HyperClass introduces a new dimension in education with the juxtaposition of knowledge with problems that have a referent in physical reality. But it is not easy to take someone on a field trip to a volcano or to ensure they are there when the volcano erupts in a safe way that demonstrates what volcanoes do, and so on. HyperReality that allows for object modelling can take a class to an active volcano, or the bedside of a patient in crisis while at the same time it can window key knowledge that students should have while they study the problem.

Basically, with HyperReality technology, objects are created in 3-D using an array of videocameras, creating a database/library of problem case studies that could include dangerous conditions. Learners could for example, drive a virtual car through a virtual reality of a specific intersection in which they could be faced with a vast array of different situations. Learners seeking solutions to their problems with the help of their teachers and peers from diverse cultural perspectives can manipulate the 3-D modelled objects.

A significant strength of HyperReality as contrasted with virtual reality today in for example, ActiveWorlds, is that the communication process is prescribed using the shapes and designs that have already been created by someone else as computer generated virtual reality. HyperReality on the other hand allows a syncretion of cultures. The content of the communication process can be designed, altered, and objects modelled by the participants can then be used to catalyse collaborative learning from multicultural perspectives.

In today's education and training, students are faced with practical problems and their human perspective of time and space limits their comprehension of the problem domain. For example, motorists may sense the size and speed of their vehicle in relation to that of other road users but they cannot see the way they use the road from the perspective of the other drivers. Whereas today's researchers conduct experiments

to test the relationship between a theory and problem domain it addresses, and the process is analysed, described and reported in text using words, numbers and diagrams. The ability to collect objects and case studies as virtual realities from multiple perspectives suggests a new methodology for research.

The creation of virtual reality simulacra of problems has many advantages over simple alphanumeric descriptions, especially because it means that everyone is looking at the same thing, but from their different perspectives. The description of the HyperClass in this paper reflects the inadequacy of alphanumeric representation in limited bandwidth and that absence of visual and sensorial cues affect clear communications. It is like reading King Lear rather than being at the performance in the Globe Theatre.

The HC is, like a conventional class, essentially synchronous in nature and, like a conventional class, can readily embed asynchronous episodes during the class as well as before and after it. However, to prepare people for life in the information and knowledge society where networking is a valuable skill, the HyperClass will need to facilitate communication at all levels, in synchronous or asynchronous mode and between virtual and real components.

To participate in a HyperClass, students and teachers will need avatars. Moving through such Internet VRML sites as WorldChat or Black Sun suggests that we have a lot to learn about communication protocols between virtual people if we are to move this kind of communication beyond the level of street graffiti.

Perhaps the most profound aspect of the teacher/learner axis in a HyperClass is that the avatars of teachers and students may not necessarily represent human intelligence. As this is being word-processed, a little cartoon character, a wizard looking like a paper clip keeps popping up on the screen to say it sees someone is trying to write something and could it help. Someone has tried to programme a just-in-time (JITAIT) artificially intelligent teacher that follows Vygostky's zone of proximal development (ZPD) model of learning. It detects that someone has a problem and comes along to try and help them apply the knowledge they need to deal with it. The fact that the device pops up when there is no problem and offers the wrong help and never turns up with useful knowledge when there is a problem does not mean that one day such wizards won't be more 'humanly' intuitive and smart. The idea is already there for just in time (JIT) teaching agents, especially when the instructional tasks are clear and there are strong patterns of student needs and frequently asked questions (FAQs).

Marvin Minsky (1986) first proposed the idea of small programmes called agents with a degree of autonomy, an appearance of intelligence and the ability to work collaboratively. Interlinking agents are now being devised for office systems to look after such tasks as schedule management, email management, meeting arrangement and workflow management (Asakura et al. 1999). A HyperClass needs to reflect the modus operandi of the society it prepares people for. It makes sense to have agents who will set up a HyperClass and ensure that everyone and everything is present.

As a pedagogical system, in a HyperClass a teacher and a learner can be virtual or real. A virtual teacher can have human intelligence (HI) or artificial intelligence (AI). Teachers and learners can communicate synchronously, using speaking avatars, or asynchronously, using written words or visuals. Knowledge and problems can be embodied in the teacher and the learner or they can be represented alphanumerically or in simulacra. Problems can be real, however knowledge is always abstract. The interaction of teachers and students over the application of knowledge to problems takes place at the level of the individual, the dyad, the group, the class, and the university.

Finally, whether any of the trends I describe in this paper, or some combination of them all, or something new emerges, we will have a virtual dimension in education to match the emergence of a virtual dimension in society's private and professional activities. Not to attempt to look into the future will find us unprepared.

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