

48. The Learning Preferences of Current Generational Groups

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Abstract

Today's computer literate students think in ways that are incompatible with current educational goals and practices. If one of the aims of learning is to provide lifelong benefits for all, then a substantial rethink on the learning needs of students and the goals of education has become paramount. This emergent imperative presents an unfamiliar challenge for educational institutions to examine their past assumptions and to facilitate success in meeting the needs of current and future generations of learners. The type of change proposed in this paper requires a comprehensive rethink not only to devise innovative alternatives to accepted methods and practices, but also to develop theories and pedagogies more attuned to the preferences, values, and attitudes of the technology and information proficient generations. The eventual outcome will be a dramatic transformation in the essential nature and purpose of the online learning environment. It is not just bridging the transition from 'traditional' to 'digitised' learning that is fraught with difficulties. Any attempt to accommodate the skills and learning needs of the current generation computer 'literate' will compel education designers to think entirely "outside the box" and consider solutions previously thought impossible. Success in meeting the needs of learners will require radically new teaching methods and strategies. Such strategies may include for example: content interactive features that offer 'intelligent' meaningful responses; the ability to annotate and record ideas as required; user generated (manually) and automatically (dynamically generated hyperlinks to alternative materials relative to the current context; and automated display of customised content such as interactive assessments and constructive feedback tailored to students' immediate learning needs. For these innovations to be truly effective, libraries must also be viewed as an essential component of a complex network of information resources. Thus, it is argued that the nature of the learning environment must change dramatically, in particular in relation to the choice of flexible delivery techniques that are supported by distributed computing networks, advanced educational software, and universal access to quality learning resources regardless of location and time.

Introduction

There is some credence in the notion that the learning preferences of the current generation are at odds with accepted institutional views. Today's students are conditioned to thinking in ways that educational institutions have not fully come to terms with. Their expectations of education conflict with current teaching methods and practices in that they prefer an overt focus on the process of learning as opposed to being required to negotiate and memorise the complex maze of information and knowledge delivered by educational institutions and libraries. Moreover, students of recent generations prefer to participate in learning communities comprised of networked individuals and multiple, diverse groups of learners. They reject the laborious task of recording notes in a lecture theatre and are critical of the mass production 'television' broadcast approach to teaching inasmuch as they regard it as irrelevant and outmoded.

If resolving the issues outlined above seem difficult enough, then consider that the Internet may be cultivating a new type of user who is developing hitherto unexpected proficiencies in navigating electronic environments. Students of today are developing the ability to operate in complex digital environments and prefer not to work with printed page. They also display a remarkable adeptness in juggling text, popup-boxes, and hyperlinks simultaneously. Taken as a whole, these skills are strong indicators of a transition in culture and cognition. It is also possible we are witnessing the emergence of new cognitive capabilities. What at first may appear to be an inability to focus might in fact be a preference for working with multiple forms of electronic mediums. In practice, these preferences may compel educational designers to rethink their approach to learning design. We have known for some time that it is no longer adequate to simply convert printed materials to a digital format. Users do not respond to the computer screen the same way they do to the printed page. Hence considerable emphasis must be placed on screen layout, image position, animation, video, audio, colours, textures, font type, size and style. Moreover, page sequencing, navigation and hyperlink options are designed first to attract the user's attention and second as a prompt for locating and accessing information.

Given the current preponderance of related research literature, it is reasonable to conclude that the long-standing dominance of the industrial age mindset is rapidly giving way to the hitherto unimaginable influences of the information age. Our educational institutions must respond by restructuring their organisational goals to reflect the changes imposed by the emerging information age mindset. The accepted meanings attached to the terms “student,” “teacher,” “teaching”, and “learning” must now incorporate the notion of a distributed, flexible education, that is delivered in customisable combinations of in-class, distance education and online learning modes. The challenge for educators and educational institutions at all levels will be to accommodate the information-age mindset of current students and engage student in online classrooms that are comprised of ‘virtual’ networked communities of learners. Institutionalised education will need to expand their core focus from an internal, on-campus, localised experience to encompass the provision of an external, globally focussed lifelong experience.

A thorough understanding of the values, needs and attitudes of today’s learners must accompany any attempt to change the emphasis on how learning is delivered. What is required is a shift from faculty-centred lectures and tutorials to clustered learning environments facilitated by the lecturer or tutor and where possible, aided by the innovative application of computer, communication, and information technologies. This paper will explore three examples of learning models that may be more conducive to the preferences of current and future generations. The application of games-based theory to learning solutions for example, may provide new insights into educational design. Alternatively, replacing the role of “sage on the stage” with a “guide on the side” points to the return to the Socratic approach to learning (or as will be explained, the OxBridge tutorial model) where the lecturer/tutor poses questions and guides the learning process as opposed to an authoritative approach where success is measured by the student’s capacity to accept the information given, memorise it, and then reiterate it to reflect the lecturer’s expectations. Thirdly, the concept of digital libraries may provide valuable insights as to how the needs of individual learners may be better served through the provision of learning environments that permit independent learning that is underpinned by constructivist principles.

This paper will identify the specific research issues and questions that must be addressed in meeting the needs of divergent generational groups. From the brief analysis of the identifiable distinctions that will be made, the paper will conclude by outlining a number of research directions that may point the way to resolving the issues and complexities raised throughout the course of discussions.

Generational Groups and their Distinctive Characteristics

The available research literature suggests there is little consensus as to the precise span in years that indicate the actual birth years for past and current generational groups. The following birth year groupings provide a reasonable approximation as to the key generational groups that form the basis for exploring their distinctive technological, communication, cultural, entertainment, and human relational/psychological attributes.

Mature Aged	1925 to 1945
Baby Boomers	1945 to 1965 (birth years 1946 to 1964)
Generation X	1965 to 1980 (or 1960 to 1980; 1965 to 1985)
Generation Y (the Millennials or Net Generation)	1976 to 1995 (or 1977 to 1997; 1980 to 2000)

This focus of this paper will be on Generations X and Y, broadly exploring the commonalities and differences as expressed by researchers in terms of: technology use and skills; influences, needs, aspirations and preferences; values, perceptions and attitudes; current and future concerns; and gender differences relevant to each of the preceding factors. The issues and needs specific to the mature aged group are the subject of a separate research paper and will not be taken into account.

The increasing presence of more ubiquitous, flexible technologies has given rise to new complex interactions between the technology-based classroom activities of today’s youth and their out of school and post school experiences. Where young people are concerned, the new technologies constitute a natural part of the environment. As they grow into adulthood, they will naturally strive to extend the boundaries of an increasing availability of digital innovations and activities, which could for example, extend to a desire for self-directed learning. In the process, new innovations in information and communication technologies will continue to be adapted and refined to support the complex, learning activities of expanding numbers of diverse and widely distributed networks of online users (Candy, 2004, p 234). Designers of learning environments must distinguish

between the information-age mindset that is becoming more common amongst students who are growing up in a globally connected, digitally defined information culture, and the broader, more prevalent industrial age way of thinking.

In his examination of the current generational uses of information and communication technologies, Candy (2004, p 232) concludes that an unexpected yet fundamental reconceptualisation of the purpose of learning has emerged over recent years. The extent of this shift is such that it represents a marked transformation in the learning expectations of young people which is partly attributable to the fact that they are viewed as the most innovative exploiters of the new mediums, and partly because they will become the next generation of self-directed adult learners. The Millennials for example, have grown up in a world in which computers, cell phones, and cable television are a normal part of everyday life. They are inundated with information from a multitude of sources, and are capable of using a wide variety of media and devices to communicate, learn, and to be entertained. The most favoured of these sources are those that permit relatively instantaneous, concurrent, communication with multiple people, regardless of geographic boundaries. Millennials are also a genuinely interactive generation (Mask, 2002, pp 3 – 4). Virtual chat is used by the current generation to communicate directly with their peers and chat archives attest to the frequent and topical use of the Internet in late-night, peer-to-peer conversations that are conducted within the boundaries of their own cultural framework (Carmean and Haefner, 2002, p 5). Today's students not only constantly engage in interactive communications, they expect it. As a result, they are exposed to an unparalleled flow of customs and ideas that may in fact represent a significant step in the development of human cognitive processing. Kaimal (2003) identifies a number of distinctive factors and characteristics of the current generations that are worthy of further note:

- with 70 million members, Generation Y is almost as large a demographic group in the United States as the Baby Boomers (p 36)
- many researchers support the position that the Generation X and Generation Y groups came out of a different history and with a different set of coping skills and expectations than earlier generations (p 37)
- the current 18 – 24 year old group belong to the best educated generation in American history (p 38)
- Generation Y youth have been characterised as less cynical, more optimistic, more idealistic, more inclined to value tradition, and more similar to the Baby Boomers than the Generation X group (p 41)
- young people are less likely than their parents to read newspapers, believing there are quicker, more efficient ways to stay informed (p 42).
- rather than rely exclusively on traditional tools and teaching strategies, it is the innovative use of media and technology that may prove useful for assisting young people to learn (p 47).

In Frand's view (2000, p 14), the majority of today's first year undergraduates have never known life without a computer; are more accustomed to using a keyboard than writing with a pen; and experience little difficulty reading from a computer screen than from the printed page. Their priority is to be constantly connected to friends and family, at any time and from any place. In an attempt to understand the essential characteristics of recent generations, Frand (2000, pp 16 - 22) identified what he refers to as "ten attributes of an information-age mindset", each reflecting the values and behaviours of the current generation. The first four relate to broad observations of change, the three that follow describe how young people function, and the last three outline their subliminal needs that have been conditioned through exposure to the "cyberage". The ten attributes are paraphrased in the following order:

1. *Computers are not technology:* To the information age generation, technology is everything that surrounds computers and is made possible by computers. Computers by themselves are not technology; they are an integral part of life. Instead, computers that are connected to the Internet and the expanding world of cellular telecommunications are viewed as technologies.
2. *The Internet is better than TV:* The increasing use of the Internet and associated access to interactive media has resulted in a reduction in the number of hours spent watching television. Students are using the Web as their primary source of information and entertainment: what movie to see, what is on TV, where to shop and what to buy, as well as what is happening in the world. Today, young people are reading and writing (typing) more as they participate in chat rooms, e-mail exchanges, and bulletin boards.
3. *Reality is no longer real:* There is a general recognition of the fact that those things which appear real on the television and the Internet may not in fact be real as they appear. The concept of "real" can be interpreted in one of two ways: that the sender is who she/he claims to be, and equally vital is 'knowing' that the content is accurate. For young people, a virtual reality simulation (such as a flight simulator or a holographic tour of a city) can be interpreted to be as 'real' as the actual, physical experience.

4. *Doing is more important than knowing*: The industrial-age view of knowledge as a product - “a body of facts accumulated by mankind” that is relatively static over the long term, and must be ‘memorised’ and relied on for the duration of most careers has been replaced by the need to deal with complex, transitory, and often ambiguous information. Therefore, immediate results and actions are now more important than simply knowing facts or accumulating knowledge. This attribute coincides with Candy’s conclusion in relation to an emerging shift in perspective on the purpose of learning.
5. *Learning more closely resembles Nintendo than logic*: The key to winning computer games is constant, persistent trial-and-error to discover the hidden clues. The fastest way to win is through losing, since each loss is a learning experience. This approach contrasts sharply with the industrial-age mindset which relied on a logical, rule-based learning model in which trial-and-error experimentation was viewed as an expensive, time-consuming approach to problem solving.
6. *Multitasking is a way of life*: Most young people today do not concentrate on one activity at a time. Instead, they are accustomed to conducting multiple activities simultaneously such as watching television, listening to music, talking on the phone, doing homework, eating, and interacting with parents and peers. Spending quality, focused, and extended time investigating a problem is becoming a luxury reserved for fewer and fewer individuals.
7. *Typing is preferable to handwriting*: The countless hours previous generations put into practicing penmanship has now been replaced by practicing keyboard skills. Typed prose is viewed as easy to read; it can be checked for spelling errors, searched for key words, retrieved after filing, and easily manipulated for reuse. It is important to note that the preferred outcome is not related just to the act of typing, what is more important is the power behind the process of ‘typing’. Word-processing for example, holds the power to easily manipulate words in order to obtain an improved result. In many ways, it becomes an extension of our own memories, enabling the capacity to capture and retain material for use in more critical problem-solving and decision-making situations.
8. *Staying connected is essential*: For information age students, advanced telecommunication connectivity is a natural part of life. Beepers, cell phones, and PDAs are considered standard operating equipment. As larger numbers of people utilise the new devices, it follows that communication technologies will increase in popularity and become more valuable as a means of distributing information. Living in a fully connected world means that individuals can participate in real-time dialogues from anywhere, at any time, communicating using a wide variety of technologies (pagers, telephones, the Internet, chat rooms, and teleconferencing). The location of where an individual works or studies, whether it is in the classroom, the office, at home, in a library, or while travelling, will in time be determined by pedagogical, social, motivational, or biological factors, not by the synchronous constraints that were necessary in previous eras.
9. *Zero tolerance for delays*: Information age students expect 24x7 services in all aspects of their lives and are unwilling to tolerate delayed responses. Service is now an expectation, not an added bonus. This attitude accentuates the gulf between what institutions provide and what students actually demand. How well these services meet students’ expectations provides a good indication of the level of satisfaction. Good service is also viewed as a pre-requisite to retention and effective learning.
10. *Boundaries between consumer and creator are blurring*: The long held distinctions between author, owner, and consumer of electronic information are becoming unclear. In the past, dual-cassette recorders made the task of copying an audio or videotape easy and indirectly gave unofficial license to the practice. From their perspective, today’s generations ask why copying a CD, a software application program, or any type of digital material should be viewed differently from previous replication practices. The accepted rule now is that if there is something the individual likes, then it is acceptable to copy and reuse it for personal needs.

A comparison of Frand’s synopsis of the information age mindset with Oblinger and Oblinger’s (2005) extensive study on the characteristics and preferences of what she refers to as the ‘net generation’ reveals several significant consistencies. Individuals raised entirely with the computer manage information differently to that of previous generations. As the need to apply linear thought processes have become less common, they have developed ‘hypertext minds’ along with the ability to piece together information from multiple sources. Although derived from the American context, other discernable differences that may exemplify the learning preferences of the current generations in Australia are evident in a capacity to (Oblinger and Oblinger, 2005, pp 14 - 15):

- *Be digitally literate*: The net generation have grown up with ICT and are able to use a variety of devices and navigate the Internet with little reliance on the instruction manual. They have never experienced a learning activity without the use of a computer. Technology is not an option or an add-on; it is an essential part of their lives. They do not think in terms of specific technologies; the focus is

on a technology or application that will enable or assist them to achieve what they consider to be necessary. Thus a cell phone is viewed as technology if it provides a new feature not previously available, whereas a phone with standard features is not (p 19). Technology must adapt to their needs, not something that requires them to change. It is not separate from the activity it enables - it is a tool and represents a means to an end.

- *Read visual images:* They are more comfortable with image rich environments, are visually literate, and adept as intuitive visual communicators (p 14). They also have short attention spans, little time for reading large amounts of text and shun written assignments (p 16).
- *Use visual-spatial skills extensively:* This capacity is due in part to their expertise with the computer games from which they have learned to integrate the virtual with the real. Every part of life is presented in a multi-media format - no medium is viewed as one-dimensional (p 56).
- *Apply inductive discovery methods:* Net generation students are experiential, exploratory learners - they prefer to learn by doing and learn better through discovery than by being given instructions. Knowledge is less about memorisation and is orientated towards understanding (p 175). They also favour inductive discovery by making observations, formulating hypotheses, and figuring out the rules. They prefer to construct their own learning, assemble information, tools and frameworks from various sources (p 21). They also want to be challenged to reach their own conclusions and derive their own results (p 55). On the minus side, they have little time for reflection and lecture theatres are not regarded as their optimal learning setting.
- *Use attentional deployment strategies:* They are able to shift their attention from one task to another and may choose not to pay attention to things that do not interest them. In addition, they are capable of carrying out multiple tasks simultaneously. However, they prefer structure over ambiguity and like to know what it will take to achieve a given goal (p 16). The skills of parallel processing, graphics awareness, and random access are undervalued in today's educational institutions (p 23).
- *Expect fast response times:* They rely on immediacy by responding quickly and expecting rapid responses in return. Interactivity is an important aspect of learning. That is, they crave the type of interactivity that provides an immediate response to their requests (p 23)
- *Be constantly connected:* They are highly proficient in the use of networked media and are always 'on' (p 15)
- *Be highly social:* The net generation are prolific communicators with an obvious openness to diversity, inclusiveness and sharing. They learn through social interaction and display a preference for working in teams and engaging in peer-to-peer interactivity. They also place higher credibility in their peers than with their teachers. In addition, they display a propensity to move seamlessly between real and virtual interactions as demonstrated for example in the use instant messaging even though the recipient may only be located a few feet away (p 20).

Candy (2004, p 234) notes that a great deal of attention, both anecdotal and scholarly, has been given to the impact of ICT on the transference effects of young people's leisure time activities to their school-based pursuits. Most serious researchers tend to be more circumspect about the differential effects of digital technologies preferring instead to rely on variables such as class, gender and cultural background. They point to the fact that the number of highly adept young people with access to the best and most sophisticated technology is not perhaps as great as we have been led to believe. Nevertheless, it is possible to catch glimpses of the self-directed learner of the future. As Young (2002, p 4 cited in Candy, 2004, pp 212 - 13) astutely observes:

As we shift from a culture of need to know to want to learn, on-line brings new options for learners. But here we speak of the technology, as we understand it and ourselves today. All the limitations of technology are being worked on. Think of the coming generations of young people who have grown up with technology, and see it as second nature. We have to see computers not as something people escape into, but as a way to reach people. It's about seeing the possible in what seems impossible. That's what will make on-line learning work.

While 'technically' it could be argued that students may be ready to engage in the digital world, it is important to question how we can be sure they are adequately prepared for learning in an electronic environment. Using the Internet as a mode for delivering teaching does not necessarily translate into quality learning outcomes. As Taylor (2002, p 11) reminds us, there are many complex factors to consider:

In efforts to determine an appropriate approach to online teaching and learning, there is a need to acknowledge the importance of the complex interplay of different epistemologies, modes of thinking and associated types of subject matter in different academic disciplines, different

educational objectives for a course of study, and not least the extant levels of expertise of the student target audience.

Taylor is not alone on these views. Oliver, Omari and Herrington (1998, p 121) for example, emphasis the need for online content that arouses and holds learners' attention:

With any form of information or knowledge, providing students with access to meaningful content, does not guarantee learning, a factor frequently overlooked by developers of WWW based learning materials. What is also important to learning is the level of learner engagement

Strategies for Designing New Learning Environments

The pressure is now increasing to prepare graduates with the skills and strategies required for living and working in an information society. That is, curricula must be aligned to the needs of the digital age. As touched on a number of times, the new technologies are changing not only what students learn, but also how they learn. Curricula should focus less on "knowing facts" and more on "strategies for learning that which is not known". Learning to know how to learn is assuming greater significance than the skill of memorising facts. To be truly successful, learners must be given the freedom and the resources that will encourage them to be active and independent learners. In this model, the teacher serves as a facilitator or consultant, not as a provider of information. Moreover, the creative use of digital technologies is enabling learners to explore the inner workings of the systems that make up our world in ways that until now, were not feasible. Rather than dividing the curriculum into bounded disciplines and subject areas, the focus of learning should be on identifying and exploring the rich connections that thread throughout different domains of knowledge utilising key concepts, themes, and issues. In this way, concepts that at one time were not introduced until university level could be accessed and made available to learners of all age groups (Resnick, 2002, p 36).

Learning should not be assumed to take place within set age groups and confined to timetabled schedules. The new digital technologies permit access to learning from all locations and throughout all stages of life. The traditional classroom as we know it needs to be fundamentally reorganised. Students should not be grouped according to age, but instead all age groups could be encouraged to work together on projects thus empowering them to learn from one another and to teach each other. Learners could also be given opportunities to work on projects over extended periods of time, enabling them to explore ideas in ways that are more meaningful and relevant to their personal experiences and needs. Furthermore, access to education should be not confined to schools, TAFEs and universities. Learning opportunities reside not just in these institutions, but also in homes, community centres, art galleries, museums, and workplaces. As the full potential of the new technologies are gradually realised by greater numbers of individuals and institutions, new learning opportunities will surface, enabling virtual networked communities of learners or "knowledge building communities" to form in which individuals located anywhere in the world collaborate and learn from one another.

What is required is a new delivery model designed to demonstrate how personal needs can be taken into account within a framework of universal relevance and benefit to current generational groups. Leadbeater (2004, p 6) suggests it may be useful to think about learning from another perspective. He points out that today's youth are far more avid and aware than previous generations. They have developed an entrenched sub-culture that is bound to have an effect on how they perceive learning and education. Many secondary school age youth now possess mobile phones which provides instant access to twenty-four hours, seven days a week telephone support that offer different price plans, equipment and service packages. They have also become accustomed to a world in which they can search for, download and share digital music on the Internet. Their inventiveness and desire for innovative thinking is evidenced in the way they have developed uses for new technologies that were not anticipated by the original designers. A simple but notable example is the pervasive use of SMS messaging by young people, which has not only taken telecommunications companies and mobile phone manufacturers by surprise, but has also led to the invention of a shorthand language for quickly conveying large amounts of information. This has led to the use of the term 'thumb people' that refers primarily to SMS messages and more generally to those using the new technologies (Candy, 2004, p 233).

Perhaps the direction that needs to be considered is less about choice between institutions, and more about choice in what students learn, and how they prefer to learn. There are many educational institutions that are advocating a 'learning to learn' agenda that encourages students to be more involved in making decisions about the way they learn. Such shifts in thinking naturally introduce the notion of personalised learning which is about

enabling pupils to achieve the best that they can through working in a way that best matches their individual needs. Ultimately, what is needed is for educational researchers to develop new learning technologies attuned to the needs of current and future generations of learners. No longer is it enough to offer information online. Over the coming decades, new methods for the design and delivery of challenging, highly interactive learning environments are crucial to the success of learning. Already today's youth show signs of a readiness to be much more creative with computers than many educators have imagined to date. What is now needed are the hardware and software that will enable the new generations to become fully immersed in seeking out and creating new knowledge.

Exploring the Merits of Existing Design Models

As in all instances where new ideas are being explored, care should be taken to avoid "reinventing the wheel". Whilst it is tempting to devise solutions that are highly innovative, particularly given the diversity of factors and issues posed by the new generations, often good solutions are already within our grasp. Three models hold such potential for application and adaptation to the needs of current generational groups.

Digital Libraries

One emerging innovation that makes the innovative construction of knowledge possible is the digital library. Dreher, Krottmaier and Maurer (2004, pp 1 - 7) present their visions and expectations of what a modern digital library might deliver over the coming years by outlining the extended functions that could be incorporated into existing services that will enhance and support the needs of learners. They argue that the basic functions and services provided by most libraries today do not match the design promises and implementation functionalities offered over the past decade or so. In their view, the current functionality of libraries must be extended to include tools and services that provide learner access to content regardless of the storage location. Several resources may be held in different locations throughout the world and automatically assembled and distributed in accordance with the learning needs of individuals and groups. To this end, Dreher et al (2004) advocate a number of "extended functions" ranging from: *active annotations* and *active documents* that automatically or manually generate links from additional notes and comments made by learners or groups to other suitable resources, users, or groups to provide additional information, comments, or answers as required; expand the support structures for teaching and learning by delivering more than just content – to assist the learner to structure, reflect, analyse and synthesise new knowledge using sophisticated 'Knowledge Management' systems and implementing *learner support systems* that emphasise learning in the broadest sense of the term; implement *intelligent search mechanisms, agents, interfaces and portals* designed to accommodate the diverse mental models or cognitive maps that learners draw on in their search for understanding and the eventual construction of knowledge.

Greater recognition of individual learner's idiosyncratic needs, past experiences, and search strategies will noticeably assist to enhance their cognitive development; the provision of *graphically represented search results* using visual devices such as images, graphs, and symbolic maps that represent the search output in more meaningful ways. For example, a found document set could be displayed as a graphical 'map' and then rearranged to indicate which documents are similar according to preferred selection criteria. *Conceptual searching* is another option where the process of searching provides "an interaction between the search concept and the search target, mediated by the searcher's intellect, with criteria and results being represented visually in addition to the usual methods". Although a variety of words can be applied to form a concept, the act of searching for information using concepts as opposed to entering descriptive keywords requires a complete rethink on search strategies. For example, 'white lists' that refer to the names and address of other server systems could be integrated within the scope of all user searches so that the operation includes materials from all relevant sources. Finally, 'adaptive user interfaces' are needed that are sensitive to user context through a combination of 'learning' from user responses and user configuration. A useful advantage of an adaptive user interface is in the provision of session control where the termination point in the last session becomes the starting point for the next session.

As an indication of what may be in store for learners consider the work of the Columbia Centre for New Media, Teaching and Learning (CCNMTL) at Columbia University in New York. The CCNMTL is working closely with the university library to create electronic multimedia study environments (MSEs) on topics ranging from history to literature to sociology. Access to texts is enabled in digital form through MSEs and the Web. At present, searchable text for over 10,000 books is available online. Eventually, faculty and students will be given access to fully digitised encyclopaedia entries, dictionaries and other reference sources such as text, video, and audio collections. These developments permit a 'search inside the book' approach to research and information

gathering. For students of the future, search engines and hyperlinks will replace indexes and bibliographies while a 'search inside the book' technology will replace concordances. These transmutations from print-based to digital-based methods are clearly one step removed from delivering 'just-in-time', 'on-the-fly', and incremental learning environments.

An OxBridge Tutorial Model

The OxBridge tutorial system offers a unique learning experience in which students are responsible for managing their own time to ensure the necessary work is completed. They meet at least once a week with their college tutor, either on a one-to-one basis or with one or two other students, to discuss an essay or solutions to set problems that have been researched in advance of the session. The purpose of the tutorial is to review answers and theories and to appraise any new points to arise out of the discussion.

The success of the OxBridge tutorial system relies on the active exchange of ideas between the student, the tutor and other students present. Students must be prepared to give and defend their own opinions whilst conceding to the views of others and accepting constructive criticism and advice. Through this method of teaching, students develop an ability to think independently, which not only benefits them academically, but also provides an opportunity to develop a range of contextually transferable critical thinking and analysis skills. In the words of Fox (2003, p 8):

The Oxford Tutorial brings one or two pupils into contact with a single teacher in their subject. It is not just a source of information, of which there are so many sources, on and off line. It aims to teach pupils something else: to think.

In today's terms, the original configuration of the Oxbridge model was in effect a database plus tutors. The database is the conventional but excellent, well-stocked library. The student reads, then writes and takes the results to the tutor. They then discuss and analyse it. In training critical thinkers, the type of interaction described here must take place because it is not just the known that is being taught - a technique to teach a medical student for example, but the real education is to teach students how to think and solve problems etc. The relationships that are formed somewhere down the line are also critical. That is, the meeting of minds between the tutor or lecturer and the learner is critical. As Clark (2003, p 10) observes, there is a marked preference by students for those tutors who do not set a specific agenda for discussion, and permit spur-of-the-moment ideas to be pursued to their logical conclusion. Other students prefer that the tutorial becomes a testing-ground for ideas, an opportunity to identify problems and to raise further questions. Others prefer a conscious debate over a single issue, or a cluster of issues. From the students' perspective, the consensus is that the more the discussions become animated then so much the better. The advantage of the OxBridge tutorial model is that discussions are not just open but are also open-ended, and there is unrestricted opportunity for students to choose the direction or focus for themselves. In essence, this is a model that can and should take place on the web.

Games-based Learning

Pivec and Dziabenko (2004, pp 15 - 24) conclude that for the purposes of learning, the new forms of interactive content developed for electronic games hold considerable promise. They emphasise that already the game-based learning model has been successfully adapted to formal education, in particular, in military, medicine, and training applications. Their views are premised on the notion that whenever students are engaged in learning environments modelled on proven game theory principles, they learn to understand and combine different points of view in a wide variety of unexpected ways: understanding individual/organisational interests versus the interests of teams and societies; discerning their own point of view whilst remaining aware of the perspectives and opinions of others; applying not just isolated factors but also integrate multiple aspects to resolving problems; and knowing how to turn confrontation into cooperation. There are many aspects of educational computer game design that can benefit the learning process. For example, learners can:

- be encouraged to combine knowledge from different subject/discipline areas
- choose from a number of given solutions or make decisions at critical points
- test how the outcome of the game changes based on their own decisions and actions, and
- contact other team members to discuss and negotiate subsequent steps, thus improving social skills.

In citing the work of other researchers, Pivec and Dziabenko (2004, p 18) highlight the increasing demand for greater interactivity to be built into learning materials. In their view, there is a clear need to support and facilitate the learning process by offering a variety of different knowledge presentations and to create opportunities to

apply that knowledge within the virtual world. To achieve this goal, they advocate the need for complex levels of interactivity that stimulates user engagement, and to apply “different interactivity concepts such as object, linear, construct or hyperlinked interactivity, non-immersive contextual interactivity, and immersive virtual interactivity”. In order to create a successful game-based learning solution, the authors offer the following steps that can be applied to devising the essential elements of effective online learning and engagement strategies:

- determine the preferred pedagogical approach/s
- situate the task in a model world
- elaborate the details
- incorporate the underlying pedagogical support
- map the learning activities to the interface actions
- map the learning concepts to the interface objects

By applying the concepts and strategies as outlined above to collaborative learning activities, researchers of the FH JOANNEUM Graz involved in the EU project UniGame have designed a new games-based learning environment. The key aspects of the game include the capacity to search for information, select appropriate and necessary information, develop discussion strategies, resolve the “conflicts” arising out presented arguments, and engage in decision-making processes and negotiations. The ultimate aim of the game is to reach consensus on deriving suitable solutions to problems as they arise. The design strategies proposed by Pivec and Dziabenko (2004) clearly support the diversity of needs and preferences of current generational groups.

Identifying the Key Research Issues

A comprehensive research plan for realising the potential advantages of seamlessly blending the known modes of learning with information and communications technologies (ICT) to construct dynamically flexible delivery models should be high on the list of priorities for any institution dedicated to educational excellence. To this end, the essential focus of all ICT related research is to identify and explore the educational benefits of applying advanced learning techniques, learning methodologies and pedagogical innovations to the complex task of delivering learning environments tailored to the specific needs of all generational groups.

It is anticipated the insights to be gained will be considerable. Nonetheless, without a thorough examination of the relationships between technology, communication, media, human interactions, and cognitive development, the full extent of the power of individualised learning cannot be fully realised. By way of illustration, the significance of a broader design focus is made clearer by the fact that given the increasing connectivity of people around the world and the expanding globalisation of media and communications, then predicting future perceptions and studying future orientations must move beyond national boundaries as evidenced by the way the influences on current generations have already transcended that of their local environment. To summarise, the specific issues to be examined should include:

- facilitating individual learning methodologies and styles (incorporating principles of multiple intelligences theory) using automated learner profiling techniques
- development and evaluation of the potential of new kinds of learning experiences through research on learning styles and multiple intelligences to model intelligent learning agent software
- identifying generational distinctions in technology use, preferences and attitudes
- determine the unique characteristics of knowledge domains and their inherent relationships
- an informed analysis of future skills and knowledge demands
- understanding the social and cultural aspects of learning
- the motivational factors that influence learners (as applied to the generational differences that influence learner preferences)
- an investigation of new pedagogic paradigms and teaching roles required for advanced learning environments
- evaluation of the effectiveness of electronically delivered learning solutions, and
- how to build on established practices in the use of ICT-supported learning.

The research should not only aim to address the research issues listed above, but also direct attention to the provision of practical solutions to one or more of the following research questions:

- how to enable automated support for the dynamic profiling of individual learners, taking into account their existing and developing skills, knowledge, culture, needs, assumptions, and expectations in the context of learning?
- how to construct dynamic guidance and intelligent response mechanisms that enable individual learners to achieve their learning goals?
- how to provide for the design, creation and interaction of teaching content that matches the individual's learning context?
- how to identify, contextualise and make available the knowledge and skills relevant to lifelong learning with a strong emphasis on tacit knowledge and 'soft' knowledge skills?
- how to provide automated support for the identification and promotion of networked 'communities of learning' within a given population of individual learners?
- how to provide systems and services to support learning on demand in a way that is well integrated into personal and work environments and also affords flexible mobility?

Ultimately, the scope of the research should demonstrate a clear pedagogical and technological capacity to interweave all aspects of learning within a loosely structured electronic teaching environment where the focus from the outset, is on the learning needs of students. However, improving the quality and effectiveness of learning is not the only factor to consider. Future learning environments, regardless of the delivery mode, should be inherently flexible to facilitate support for the multiple and diverse needs of current and past generations. These needs, as described earlier apply to: technology use and skills; influences, needs and aspirations; values, perceptions and attitudes; and current and future concerns. Attention must be given to identifying and allowing for variations in learner behaviour, values, inter-personal communication, and learning styles relative to all modes of learning. In essence, the flexible delivery of learning solutions will require the evolving development and provision of qualitatively diverse forms of support.

Summary Conclusions and Future Research Directions

The design of delivery systems and interfaces that meet the needs of different generational groups whilst supporting genuine individualised learning inevitably raises a number of complex issues around the use of flexible, adaptive human computer interfaces (HCI) that not only interact with and respond directly to the needs of learners, but is also intuitively and cost effectively aligned with the diverse needs and preferences of lecturers, students groups, and institutions alike. Recent innovations aimed at providing ubiquitous access to learning through the use of portable devices such as such as laptops and personal digital assistants (PDAs) for example, will inevitably engender issues of synchronous and asynchronous interaction; the effective storage and reuse of resources; and the usual problems of interface design that affect the learners' performance efficiency. Alongside these issues are the broader questions of preferred standards and specifications that permit automatic transference and interoperability of solutions across all delivery platforms and devices regardless of the end user's intended purpose and preferred method of access. Moreover, there is a cogent need to attend to the development of design standards and procedures for ensuring the inherent learning structures supporting advanced delivery systems align with proven best practice in ICT assisted learning.

A major challenge to be addressed in the immediate future will be to design and deliver innovative solutions aimed at representing complex knowledge structures and devising effective design methodologies for learning that use emerging technologies to support the development of the high order cognitive skills of analysis, problem-solving, conceptual thinking, and metacognition (which are dependent on tacit, experiential knowledge), all of which will be valued highly by individuals, organisations, and society in general. With these goals in mind, the ideal learning solutions should assist learners to derive answers to high level 'meta-questions' such as: How do I know what I need to learn? How do I get there? How am I progressing? Are my goals still relevant? What are the best learning models for me? What is the effect of social change, cultural differences, and market needs on my personal learning goals?

Advanced technology supported delivery techniques and strategies offer the promise of delivering learning environments designed to manage and facilitate detailed exploration of the complex relationships that link networked repositories of knowledge and information to globally distributed learning environments. There is an increasing awareness of the fact that the computer is much more than an analytical device; it is also a gateway to a vast network of digitised data and information. The emerging recognition of the power of computer technology is just beginning to be explored in ways that until now were thought impossible to achieve. It is feasible, using the right technology, to interlink separate nodes of information in highly imaginative and creative ways whilst catering for the learning preferences of each generational group. However, proficiency in the application of

advanced cognitive competencies to the acquisition and creation of knowledge extends well beyond the transmission of prescribed knowledge and prerequisite skills. This in turn raises the many latent and complex problems of how to structure and model knowledge and how to predetermine the relationships that connect all knowledge structures to form new teaching content taking into account contextual meaning and the innate cultural contexts of diverse audiences. Resolving such issues requires an unreserved commitment to: identifying the key properties and relationships that serve to model targeted knowledge domains; 'intelligent' methods for managing and transferring tacit knowledge; and the strategic management of the teaching resources (and associated knowledge) to be delivered within the learning environment to permit its use and reuse in the dynamic creation and contextualisation of content. The capacity to extend the learning experience beyond accepted epistemological distinctions as delineated by established disciplines and specialist subject areas is now a technical reality. By designing learning environments that assist to connect and reconnect insights gained in the process to multiple contexts, it is possible to enhance the learner's capacity to generate new understandings and knowledge whilst taking into account the learning preferences and attitudes of the generational groups identified beforehand.

The social element of collaborative learning also poses significant challenges to ICT supported systems, in particular environments in which the relationship between collaboration and learning is crucial. As many educators would be aware, there are many occasions where learning is also a collaborative activity, involving interchange between individuals within a community and across communities, or between individuals and other communities. Some communities may confine their focus to the knowledge and skills of a specific area of interest, or others may more broadly span several disciplines united by a common purpose (for example, working as a multi-disciplinary networked partnership). Alternatively, they may be structured as a single organisation or span many organisations. Therefore, delivery systems designed for generational learning will also need to address the issues of:

- social interaction in a virtual world
- identification of communities of purpose established within broader networks of learners
- defining learner roles and accommodating individual and group preferences and behaviours
- the creation and transfer of knowledge within virtual learning communities, and
- the ownership of knowledge created by individual learners and groups participating within each community.

Finally, taking into account all that has been raised so far, a crucial area of research that is the major focus of this paper relates to students' technology preferences and their emerging cognitive skills. An understanding of how all generational groups cope in complex information environments could trigger a major rethink on HCI and layout design. It is clear from the divergence of interests, attitudes and preferences displayed by distinct generational groups that greater flexibility in delivery options and learning opportunities are essential. The capacity for emerging technologies such as learning objects to deliver teaching materials matched to individual learning style preferences underscores the significance and feasibility of undertaking further research in this emergent area of need.

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