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ABSTRACT

This document contains the following papers on theory from the SITE (Society for Information Technology & Teacher Education) 2001 Conference: (1) "IT with Integrity" (Savilla Banister); (2) "Applications of Knowledge Based Evaluation in Educational Technology" (Michael Connell); (3) "A Tutor's Advice Trains a Student's Self-Regulation Skill" (Michiko Kayashima); (4) "IT Practice from Theory: The Need for a New Paradigm" (Nigel Parton); and (5) "Communication Technologies: Post-Industrial Infrastructure" (Tatiana Solovieva). Most papers contain references. (AA)

THEORY

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Educational Technology is not an oxymoron, and yet there is a continuing struggle to find the blend between education and technology. Perhaps part of this struggle occurs because research over the past half a century continues to modify the conceptions of how teachers teach and how learners learn. At the same time, technology has changed and expanded in ways beyond expectation. The development of technology has altered society, creating new cultures and shifting individual perceptions of the world. Technology has influenced language by providing new words and phrases or new meanings to old words and phrases, for example, hardware, software, and multi-tasking. The message delineated from the articles presented in this section indicate that as education shifts with the advancing technologies, the theoretical constructs of teaching, learning, and evaluation must continue to guide this process.

There are twelve articles that are referred to in this introduction. These articles can roughly be placed in the categories of a) ethics, b) paradigm shifts, and c) lessons learned from the implementation of education and technology. All of the articles provide thoughtful considerations for educators as they continue to grapple with the integration of technology and education.

Banister's article, "IT with integrity" speaks to the fundamental issues regarding the ethical use of technology in education. Instructional technology provides an abundance of opportunities but certainly can be misused. Teachers have a greater understanding of the needs of their students and the promotion of appropriate classroom environments than does the corporate world, therefore, Banister believes that teachers must be at the forefront in ensuring that technology is implemented with integrity. For example, teachers should be involved in the design and choice of software rather than just using what is available thus depending on the persons who may profit from the use of software. Cassidy's article, "Historical perspectives on teachers, technology, and American public education" complements Banister's article by stressing that educators should develop a sophisticated sense of how to integrate technologies. Cassidy provides an historical perspective to relay the message that theories of curriculum and pedagogy have influenced the complex process of technology integration more successfully than social, political, and economic interests. Educators in the present can learn from the lessons of the past as they implement new communication technologies in the classroom.

The second group of articles concentrates on paradigm shifts that incorporate teaching, learning, and/or evaluation theories to provide new understandings of the integration of education and technology. The authors of each of the articles convey concepts related to the continuing effort to enhance communication and learning through the blending of education and technology.

Barner-Rasmussen's article, "Designing tasks for networked technologies using intentional acts" merges the taxonomies of interactivity and communicative events to provide a model for designing tasks related to online courses that foster interaction. The shift to the new taxonomy presents four intentional acts (informative acts, applicative acts, reflexive acts, and evaluative acts) that produce successful interactive communication. The implementation of the new taxonomy should also provide documentation and evaluation of why certain interactions succeed and others fail.

Holmes, Tangeny, FitzGibbon, Savage, and Mehan's article, "Communal Constructivism" introduces an expanded definition of Vygotsky's social constructivism that is dynamic and adaptive in trying to understand how to teach and learn effectively with technology. The authors have developed an approach in information technology that they call 'communal constructivism' that assists students to construct their own knowledge as well as knowledge for others. They use a river analogy to depict this type of learning. Parton's article, "IT practice from theory" also draws upon Vygotsky to present a paradigm shift beyond constructivism. Parton uses Vygotsky's Zone of Proximal Development to show how teaching and learning can be transformed through the social context of instructional technology. Kayashima's article, "A tutor's advice trains a student's self-regulation skill" presents for tutors a new paradigm of learning also based social constructivism as well as Soviet socio-cultural theories and situated cognition. Tutors do not give answers to questions posed by students but instead regulate how knowledge is to be attained by providing advice and modeling of their self-regulation skills. This provides the opportunity for students to develop their own self-regulation skills to gain knowledge.

Thampi and Mantha's article, "Creation of a new paradigm for the roll of educators through in service training that facilitates innovation and improves the process of imperfectly seeking emerging technology in tandem with the evolving market place" utilizes a case study approach to explain innovations needed for individuals to learn skills to keep pace with emerging new technologies. The authors apply the ABC analysis model in training to enhance the teaching-learning process of new technologies.

Connel's article, "Applications of knowledge based evaluation in educational technology" presents a paradigm drawn from formal evaluation theory that will improve research and evaluation in a field with an emerging knowledge base. Educational technology is just such an emerging discipline that can benefit from evaluation conducted based on the link between knowledge and justification systems. Lenaghan and Choate's article, "How do we know whether to plug in or plug out?" provides a paradigm shift for evaluation that departs from Connel's model by focusing on technology-based activities related to brain-based learning. Drawing upon the theoretical perspectives from brain operations research, Gardner's Multiple Intelligences, and three types of thinking (Bloom's Taxonomy, Scriven's Critical Thinking, and Ouch's Creative Thinking), Lenaghan and Choate offer a foundation for how to implement and assess teaching and learning with technology.

The next group of articles focuses on lessons learned in the use of technology that can be incorporated in education. Robinson's article, "Instructional technology: Practical application alignment with theory in student teaching field placement" describes a case study of a buddy system configuration between student teachers and cooperating teachers in order to appropriately integrate technology in the classroom. The findings indicated that time is the greatest obstacle in integrating technology. The lessons learned from this study were that in order to have a successful merging of technology theory with practice, student teachers need preservice training that enhances collaboration, self-directed learning, and coordination of equipment.

Solovieva's article, "Communication technologies: Post-industrial infrastructure. This model depicts the lessons learned so that humans can find their position in the complex world of technology and the interplay between society and technology. On the other hand, Neto's article, "Virtual worlds, real minds: An investigation about children, videogames and cognition" investigates the lessons that can be learned from investigating children's learning processes involved in skill acquisition in video games. This research project provides analyses that indicate how children learn in video games that can be incorporated into educational technology implementation in the classroom.

Ultimately, the articles presented in this introduction have provided a picture of how research and theory related to teaching and learning guide the integration of education and technology. Education will continue to provide answers for the expansion of technology and technology will likewise aid in the development of education. Eventually the struggle to find the blend between education and technology will lessen as the paradigm shift stabilizes.

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IT with Integrity

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In the past three decades, the use of computers in education has continued to grow and develop. With the introduction and expansion of the Internet, K-12 schools, as well as colleges and universities are tapping into the resources of the World Wide Web. "Technology" is the buzz word on the lips of educators across America and few seem to question its appropriateness. There are, however, signs that the manner in which technologies are impacting education is not always as positive as many claim (Olson, 2000; Stroh, 1999). It is time for teachers to critically examine the phenomenon of **instructional technology** with a commitment to honestly relating the shortcomings and dangers, as well as the benefits. Decisions based on such examination have the potential to focus the use of computers in education more productively (Bromley, 1998). Areas for consideration include an emphasis on teacher and learner needs, rather than computer system needs, an awareness of environmental consequences of our computer technology habits, and an acknowledgement of the economic factors that drive many of the choices being made today in the educational technology realm.

Analyzing these areas with a keen eye for disparities and inequities and then translating these discoveries into catalysts for action begins to foster an atmosphere of dedication to the process of education, rather than a commitment to increased technology, regardless of consequence. Such work is not easily accomplished and requires a willingness to sometimes question the authorities spreading more propaganda concerning the use of computers in the classroom, than productive advice. To embark upon such a task is pursuing instructional technology with integrity.

There is evidence to suggest that American educational institutions have rushed to include computer applications in their curriculum too quickly, with little evidence to demonstrate that these applications will provide more benefits than drawbacks. We have launched a huge national experiment that in years to come may prove to have been detrimental at many levels, including placing children at risk (Cordes & Miller, 2000). Teachers must take a stand and be vocal about what computers do well in their classrooms, and what they cannot do (Fabos & Young, 1999). Realistically evaluating these functions allows for a more balanced role of technology in the classroom.

Needs of Teachers and Students

Firstly, focusing on teacher and learner needs must be paramount, as technological "solutions" are made available to classrooms. Cuban (Cuban, 1986) examined the use of various technologies offered to classroom teachers since 1920. Historically, technologies such as the motion picture, radio, and television have been heralded by those outside the classroom as being "the answer" to improving the curriculum and transforming the schools. Once the technologies were placed in the schools and promised outcomes did not materialize, teachers were traditionally blamed for resisting the newest educational technology and attacked for not implementing the technology effectively. Cuban offers an alternative to this typical interpretation.

Teachers commit to working in an environment that is filled with complex expectations and multiple restrictions. Over the years, teachers have developed various strategies that effectively allow them to navigate through this environment and accomplish their work - teaching students. Teachers, for the most part, are astute and very capable people who will adjust and adapt outside intrusions to meet their needs and the needs of their students. In his argument, Cuban affirms a belief in the trustworthiness of the teaching profession. If instructional technologies are truly going to improve teaching and learning, then the best process for achieving this improvement will involve harnessing the expertise and the energies of those who are in the classrooms. Their knowledge and skills need to be respected and acknowledged.

Currently, most software is developed and produced with little or no input from classroom teachers. Why is it surprising that much of this software, once purchased, collects dust on classroom shelves? Perhaps if software developers more actively sought to involve teachers in product design and construction, and pursued innovative ways to recruit and compensate these experts, educational software would become a more integral component of classroom instruction.

Teachers can provide additional insights as to how computers in the classroom honestly help or hinder the work of teaching and learning. While dedicated "technophiles" bemoan the use of computer applications in the classroom that provide practice or review of skills introduced in the curriculum, dismissing them as "kill and drill", classroom teachers value some of these programs. Teachers know that students need practice and repetition over quite a long period of time to master certain skills or content, and using the computers to accomplish this, sometimes, mundane necessity is quite helpful. Rather than mocking educators as "out of touch" or "short-sighted", proponents of informational technologies in schools should cultivate an attitude of understanding and respect in this area.

Many advocates of computer-based education claim that students benefit from this method of instruction by experiencing a greater comprehension of the material being taught. The success of American classrooms has traditionally been measured by standardized tests, so linking technology to increased test scores is an attractive assertion. A multitude of research studies exists to demonstrate technology's positive effects on achievement (Fabry & Higgs, 1997). Many of these studies are quantitative in nature, operating with both a control group and an experimental group and comparing the educational results through the use of pre- and post-tests. Control groups received instruction through more "traditional" teaching methods (i.e. lecture, textbooks, worksheets), while the experimental groups participated in computer-based instruction. Meta-analyses, consolidating the results of hundreds of these studies, revealed that the average student in the experimental group performed about .3 standard deviations better than the average person in the control group.

Though the amount of research demonstrating technology's ability to increase student achievement seems compelling, a closer look reveals cause for skepticism. Most of these studies have been short-term and have focused on drill and practice applications. The issues of higher-order thinking skills and influences other than the technology specifically were not addressed. Dillon and Gabbard (1998) report that, after reviewing quantitative studies of hypermedia technology applications, the results were inconclusive. While the use of technology to teach various skills did not cause a decrease in student achievement, most achievement levels were similar to those in the control group (Dillon & Gabbard, 1998). To date, research does not conclusively demonstrate that introducing technology into the classroom environment will measurably impact student achievement and those who are championing the cause of instructional technologies must take care to not overstate the abilities of computer applications to impact this area.

Some longitudinal studies have been done which suggest that improved learning occurs when teachers and students have access to computers *whenever needed.* The Computers Helping Instruction and Learning Development (CHILD) research done in Florida from 1987 until 1992 revealed statistically significant changes in standardized test scores for all participating grades and schools. The Apple Classrooms of Tomorrow (ACOT) project, from 1985 until 1993, also demonstrated that technology significantly increases the potential for learning (Fabry & Higgs, 1997). However, though both of these studies spanned several years, they also contained elements that could account for the student achievement results, other than computer access. Monies spent to train teachers and provide additional guidance and support in the classrooms, as well as the interest and excitement generated by the addition of so much new equipment into the educational settings of these students, were influences not directly addressed in the research.

Other advocates point to the motivational characteristics of computers in schools. In a review of the Buddy System Project, teachers, students, and parents reported that the computers placed in the students' homes as a component of the project motivated the children to do homework. "The computers are fun and the children not only don't mind, but often enjoy doing homework." (Duffy & McMahon, 1992)

The excitement of being allowed to do something apart from the normal school routine, such as work on the computer, can be very motivational for students. The use of multimedia programs or presentations can increase attention and students report that they are more attentive to classroom presentations that incorporate these elements (Yaverbaum, Kulkarni, & Wood, 1997). Using a computer is heralded as a favorite activity of students (Cummins & Sayers, 1995) and teachers are eager to tap into their students' natural interest in technology (Quesada, 1996). The motivational qualities of multimedia make it the instructional material of choice in many classrooms (Roblyer, Dozier-Henry, & Burnette, 1996).

While the motivational characteristics of technology use are important to educators, we need to consider the appropriateness of the computer being used as a reward for students, a type of recreational or diversional unit. Is this the proper use of technology in educational settings? Also, will computer use still prompt excited reactions among students once the novelty of the technology begins to fade? Experts in the realm of instructional technologies need to openly admit that the motivational characteristics of computer use have been a curiosity since the 1960's. Early studies by the military in using computers to train personnel noted that automated instruction could elicit "sustained performance from students with little independent motivation for the particular task posed". (Noble, 1991, p. 124) It is clear that the computer can be a powerful medium for capturing the attention of students, but this characteristic alone can be as dangerous as it is beneficial. To truly promote the use of instructional technology in an honest way, we must be willing to caution teachers to not always equate student interest in the computer with an improvement in instruction.

Since schools are expected to increase the amount of information available to and understood by students, it is not surprising that technologies that promise to deliver a broader base of available information would be attractive to schools. Public school libraries have been renamed "media centers" and card catalogs have been replaced by databases. The fastest growing budget in the list of school technology expenditures is telecommunications, increasing thirty-three percent in the 1997/1998 school year to $266 million (Felix, 1999). Interest in assuring that students and teachers have access to the legion of informational resources available through internet connections is high among government, business, and community leaders. Thirty-five percent of our schools had some sort of Internet access in 1994, growing to ninety percent by 1998 (Becker, 1999).

Statistics continue to provide evidence of continued additions of hardware and software to U.S. classrooms, but "an account of technology in terms of circuits and processors alone is sorely lacking" (Garner & Gillingham, 1996). A closer look at the distribution of Internet resources in schools reveals grave disparities. American school districts in affluent areas with a high tax base also are equipped with high-speed modems and the newest computers. Most inner-city and rural districts are not so fortunate. Even with additional government grant monies and the recently added "E-rate" provisions, most poor and minority populations in the United States had no internet access in their classrooms in 1999 (Burns, 2000). In order to pursue informational technology with integrity we must admit the disparities that exist in our nation and around the world when the issues of access are considered.

Finally, it is hard to argue against giving students access to more information relevant to their interests or the curriculum they are expected to master. Educators committed to promoting the process of inquiry welcome resources for students to explore. However, unlimited access to everything available on the World Wide Web is another unrealistic vision for our schools. Providing access to multiple sources of information without screening inappropriate material or guiding students' evaluative processes to determine what information is useful or applicable to specific areas of study, is counterproductive. Very little empirical evidence exists linking Internet access to student learning and researchers are being asked to help fill the gap in this area. Again, accessing information alone, may not be a sufficient reason for investing in educational technology.

Besides the interest in increased achievement, motivation, and information accessibility, computers in the classroom are being promoted as tools of collaboration and communication with those beyond the walls of the school building. Students and teachers are being encouraged to exchange ideas, work on projects and develop relationships with those who are accessible through the technologies of email and the internet. Barab and Duffy (1998) discuss the benefits of developing these "communities of practice" and cite several examples of schools demonstrating this type of development.

Judi Harris (Harris, 1998) has devised a category structure based on the kinds of classroom activities which utilize telecollaboration. She outlines three broad areas of telecommunications activities which she entitles **interpersonal exchange**, and **information collection and analysis** and **problem solving**. Within these broad categories she groups eighteen types of activities used by teachers and students to incorporate internet resources into the classroom curriculum.

The National Geographic Kids Network is a telecommunications project that involves students in geographically dispersed classrooms working through real research processes in their communities and sharing their results over the network. Scientists review the data collected and organized by the teams of students, and participate in the conversations over the network by giving their interpretation of the data. This program is only one example of the type of communication and community of practice that can be nurtured through the use of technologies in the classroom.

However, teachers must also help students recognize the limitations of telecommunications. Much of what happens over the networks is a metaphor – we chat without speaking, smile without grinning, and hug without touching. While e-mail does have conversational qualities, it also possesses limitations, and those limitations are magnified when communicating with people from different cultural backgrounds. It is interesting to note that, even after months of online communications between the students of Joliet, Illinois and Tununak, Alaska, the Joliet students still held stereotypes about the Eskimo children, which were shaken loose only after viewing video tapes of the Yup'ik (Fabos & Young, 1999).

While computers offer a valuable way for students to share their ideas and thoughts with others, a few drawbacks should be considered. Communication is necessarily limited to those who are economically advantaged enough to possess the technologies required to make the exchange possible. Postal services and telephones are available to a greater percentage of potential collaborators, and some projects may be limited, if only those with internet access are included. Also, not everyone willing to collaborate may be capable of offering valuable feedback to the project at hand. Care must be taken to monitor projects to insure productive and meaningful work.

If those of us who are convinced of the value of using computers in the classroom can communicate with teachers in a respectful manner, freely admitting that the use of instructional technology has limitations, we might be able to begin to develop productive collaborative efforts. Efforts that help instructional technologies to become a more vital, rather than peripheral, part of the classroom work of teaching and learning. Focusing on the needs of teachers and students can help to accomplish this goal.

In order to be advocates of computers in the classroom from an ethical perspective, we need to admit that computers cannot meet all the needs of students. In fact, it is possible that channeling so much money into placing computer hardware and software and Internet connections into classrooms is harming students, by depriving them of resources that they need far more. Money invested in nutrition programs, health care, high-quality childcare, and early childhood education for low-income families could perhaps yield better results in the area of academic success than placing more computers in a classroom. Students also need more opportunities and resources provided through the updating of the traditional school library, and expansion of art, music and foreign language curricula.

> Teachers, for example, continue to call for smaller class sizes so they can give their most challenging and disadvantaged students the personal attention they deserve. They ask for more human resources of all kinds – more aides and volunteer mentors, more tutors in reading and other subjects, more social workers and counselors, to help meet children's emotional and remedial needs. (Cordes & Miller, 2000, p. 87)

Attempting to keep instructional technology in perspective will help us to support teachers and students more effectively.

Environmental Consequences

Considering the environmental consequences of the choices we make concerning educational technologies is also necessary. A constant upgrading of hardware leaves countless "outdated" machines filling up landfills across the country. Is it possible that the needs of the classroom can be met with computers that don't always have the fastest processor and maximum memory? Or can more pressure be placed on manufacturers to produce units that can be upgraded internally, eliminating the cost and waste of replacing hardware in 2 or 3 years? A sensitivity to the tax base that is supporting public education, also would demand that we evaluate the monies spent in this area.

It is impossible to purchase a new computer or piece of software without an updated, better, faster, more powerful, more versatile product not just about to be marketed. Our ability to continually produce these improved high-tech products may be overpowering our ability to discriminate what is truly needed in the classroom, and how the constant practice of upgrading can sabotage instruction, as well as the environment. I faced an example of this dilemma in my own teaching last year.

Being an elementary music teacher at an inner-city school, I have limited financial resources available for equipment purchases. When the computer monitor on one of my classroom machines went out, the corporation technology staff suggested I go "slumming" and look over the equipment that had been discarded by other teachers. I was told that most of this hardware still worked, it had just been replaced by newer equipment and schools didn't have space for all of it. I was directed to the "basement" of one of the corporation's larger elementary schools, a building that was originally designed as a junior high school. I entered what was fondly labeled "the dungeon, a huge open area underneath the building, complete with a dirt floor. As I wandered through the piles of outcast pieces which included stacks of chairs, tables, chalkboards and even a piano, I spotted a mountain of computer equipment in one portion of the area. I began to crawl over the piles of computer monitors, printers, and CPU's, hoping to find something that I could use. Taking advantage of a nearby electrical outlet, I began testing the units and found many to be in working condition. I was really enjoying "the hunt" until I lost my footing in the mass of technology and was nearly caught in the avalanche that ensued. Realizing that being alone down in this huge mound of equipment was probably not safe for me, I left quickly, without finding the monitor I desperately needed.

On the drive back to school, I began to reflect on what I had seen…stacks of computer equipment, some in disrepair and some not, waiting to be eventually transported to the land fill. If this was a sample of what is happening in our schools, as well as our homes and offices, as we continue to purchase new machines year after year, will we soon be living on top of such mountains? Is upgrading our system to provide more power and memory really worth the expense of creating such waste?

If we are able to continually manufacture these more powerful machines, can't we figure out a way to use existing units and just replace processors and memory cards to improve their performance, without constantly acquiring completely new units? In schools especially, where tax dollars are supporting the operating budget, wouldn't it be more ethical to try to make computer units last as long as possible, considering the needs of the classroom? Isn't it possible that the applications teachers and students find most useful don't always need the fastest processor speeds available or the maximum memory (Bromley, 1998)?

It's very possible that we undermine teachers' abilities to experience optimal success in using computers in the classroom by constantly upgrading. Teachers have tremendous demands placed on their time and energy, and working with a certain operating system or application may require years of use before a comfort level is reached and real curriculum integration achieved. Changing the hardware and purchasing upgraded versions of software every year or two may serve only to keep teachers feeling uncomfortable and ill-prepared to use these resources. As advocates for instructional technology, we need to concede that the newest "tech-toy" on the market is not always going to be of great advantage in the classroom.

Education or Ecomomics?

Finally, considering the classroom environment over the corporate world is crucial if instructional technology is to be implemented with integrity. A strong interest in preparing students for the work force of the future drives one segment of the educational technology proponents. Business owners want students to learn the skills necessary to function in their job markets. They believe that placing computers in the classrooms will encourage the development of these skills (Jamison, 1992).

This concern with training students to meet the economic needs of the business community reflects the social efficiency model developed by Kliebard (Kliebard, 1995) in his writings on the American curriculum. For nearly one hundred years a segment of the American populace has advocated that the public schools train students to efficiently join the working world with practical skills. Vocational education programs are now being reconstructed into "tech prep" programs in high schools across the United States in order to satisfy this demand. "Computer literacy" is a term that is tossed about in this dialogue, though a clear definition of what is meant by the phrase is difficult to articulate.

Students who are adept at manipulating digital information through the use of a computer are a valuable commodity in the job market. Corporations are eager to contribute computer hardware to school systems when they believe that they will receive a substantial return on their investment. Those in the business of producing and marketing computer hardware and software have a vested interest in the use of technologies in the schools, profiting most from the growing budgets for computer equipment in education.

Though training students to use computers to prepare them for the adult working world is a strongly supported rationale in the American culture, educators must evaluate their goals in the classroom and the overall context of their curriculum in order to decide what needs to be taught. Jonathan Kozol (Kozol, 2000) discusses the dangers inherent in a mindset that views young people as our future workforce. Spending time and money in the schools to produce students who possess computer skills alone is unrealistic and dangerous.

Especially at the elementary school level, it is difficult to argue that students really need to be able to effectively use the office applications of the workplace today. Technology is changing at such a rapid pace that it is ludicrous to believe that constructing a PowerPoint presentation in the third grade is somehow going to prepare students for the working world of tomorrow. Yet teachers, parents, and school board members are being lured by the business world to see such activities as exciting and highly desirable. Just the image of a child sitting at a computer seems to provide adults with the false sense that something wonderfully educational is happening, and those in the business of selling technologies are taking full advantage of this phenomenon.

Hardware, software, networking, and telecommunication companies have gotten directly involved in financing and/or taking leadership roles in groups like the Consortium for School networking, TECH CORPS, and the CEO Forum on Education and Technology. The press frequently quotes such organizations without mentioning their close links to companies with a financial interest in high-tech schools (Cordes & Miller, 2000). Before taking the advice of these groups on how to transform education through the use of powerful technologies, we need to acknowledge that their opinions are heavily based on their hopes for increasing corporate profits.

Even government commissions are susceptible to the propaganda espoused by corporate America. For example, the Web-based Education Commission, established by Congress, has conducted hearings at the headquarters of Sun Microsystems in Silicon valley. At the hearing, the commission heard testimony from Sun's vice-president, Kim Jones who testified, "There may be only a handful of, say, third-grade math courses that are the best in the world. A robust network that links schools and students to those courses ensures that any third-grader anywhere can benefit from the best course, no matter where it originates. This is why Congress must invest not only in such a network, but also in the best educational content." (Jones, 2000) Is Congress also considering the dismal track record of the last 30 years of computers in education?

The business of distance learning is booming across the country, not because all universities have embraced the great educational benefits of such programs, but because distance learning offers revenue potential previously untapped. Again, this is a national experiment that has yet to demonstrate effectiveness in producing well-educated citizenry. Are educators being duped into believing that their "business partners" are truly interested in the development of well-educated minds, or do we see the "dollar signs" in the eyes of those who view schools as customers who will keep paying for the products they develop?

Conclusion

Teachers who want to use information technology with integrity must come to grips with these issues and push to create learning environments with technology that genuinely meet the needs of their students, while protecting the environment and frugally making use of the tax dollars being spent in the classroom. Those in the business world must be influenced to tailor their products and services to better match school needs and goals. We must be honest about what computers in classrooms can do and what they can't. We must demonstrate courage in openly acknowledging the disparities that exist between what we envision and what currently is happening. If we can discuss the weaknesses and dangers of computer use in schools, as well as the benefits, then we are on a better path. When these practices become the norm, instructional technology will function with integrity.

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Designing Tasks for Networked Technologies using Intentional Acts

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Abstract: Teachers all over are finding that designing tasks for networked technologies requires more than setting up a web-server with class schedules, a few links to related materials, e-mail, discussion areas and so on. All too often on-line-materials are not read, on-line-discussions die out and teacher-mailboxes remain empty.
What is happening, when no mails to the teacher arrive? When a conference dies? When a carefully prepared volume of on-line-papers is not applied to the student-task at hand?
We need a better way to model/understand/connect the various elements of the on-line learning experience to understand these failures in more detail.
The theoretical framework described in this paper greatly expand the analytic understanding of student-student and student-teacher interaction in the educational context to allow for a better founded planning of these when designing online courses or course-support.
From this outset a number of specific teaching situations using networked technologies are analyzed in order to show the depth and breath of the frameworks capabilities.

Introduction

Teachers all over are finding that integrating networked technologies into the educational setting requires more than setting up a web-server with class schedules, a few links to related materials, e-mail and discussion areas - All too often on-line-materials aren't read, on-line-discussions die out and teacher-mailboxes remain empty. What is happening, when no mails to the teacher arrive, when a conference dies, when a carefully prepared volume of on-line-papers aren't applied to the student-task at hand? We need a better way to model/understand/connect the various elements of the on-line learning experience to understand these failures in more detail.
This article explores a pragmatic linguistic approach to understanding how communicative failures can lead to such breakdowns and how to avoid such failures in the design of electronically mediated communications in the teaching situation. By combining Bordewijk and van Kaam's theory of modes of interactivity (Bordewijk & van Kaam, 1986) with an adaptation of Ole Togeby's theory of communicative events (Togeby 1993), the constitutive rules governing the success of communicative events can be used to formulate the success-criteria, which must be met in order to turn an intention to interact into an interaction. Incidentally this leads to a much more general model of interactivity, since communicative events can be affected by anyone with access (students, teachers, third parties), thus opening up the field to a plethora of socio-institutional relationships other than the 'traditional' teacher-as-center-student-as-periphery-relationship.

Assumptions

Three assumptions or claims underlie the proposed framework:

1. All interactions starts with an <u>act</u>, which, importantly, is the only thing, the one intending to interact has any control over (Sperber & Wilson, 1986)
2. Due to the opacity of computer-mediated communications most if not all acts through networked media can be considered intentional and purposeful communicative events
3. Technology assisted/delivered courses can be viewed as being comprised of series of sequences of communicative events, which only retrospectively can be seen as a series of interactions.

The interesting bit, from a linguistic viewpoint, is what happens 'in-between' he abovementioned events: What makes a communicative event successful in affecting interaction? How does one facilitate the turning of communicative events into the intended gainful **interactions**? To answer the question we need a usable taxonomy for communicative events as well as a taxonomy of interactivity in order to combine them into a theory of affecting interaction.

A Taxonomy of Interactivity

When dealing with communicative events, that are mediated through some electronic delivery channel or other, differentiating the interactions, that takes place by looking for different traffic patterns seems logical. Bordewijk & van Kaam (Bordewijk & van Kaam, 1986) arrive at such a taxonomy by posing two questions to Interactive Mass Media:

1. Who is the producer/owner of the content? The Center or the Consumer?
2. Who controls the delivery and use of the content? The Center or the Consumer?

Which, when placed in a matrix, yields the four basic modes of interactivity:

	Content owned (produced) by Center	*Content owned (produced) by Consumer*
Center controls choice of content and time	Transmission	Registration
Consumer controls choice of content and time	Consultation	Conversation

Both the explanatory power and weakness of this taxonomy lies in the fact that the power-relationship is built into the understanding from the outset. In today's networked interactive media, and particularly in the educational setting, problems arise with understanding who is fulfilling the role of Center and who the role of Consumer. Modern teaching methods casting the teacher as anything but a information-controlling center
In addition, the model makes no determination as to why and when a consumer might choose to view a transmission, supply information, consult the center and so on, and when he or she might choose to ignore the 'difference' made.
That is all somewhat well and good for Interactive Television, but not so good for Interactive networked media. Here success (meaning the event is received as intended and has the intended consequences) is not granted the initiator in the same 'easy' fashion as an information controlling and -disseminating center.
Interaction is what happens when personally initiated events has the intended consequences, not the acts in themselves; Bordewijk and van Kaam model is descriptive, simultaneous or (more often) after-the-fact, and what we need is a heuristic for creating tasks that are more likely to succeed in the electronic classroom.
However, the four interactivity-modes identified still reflect different basic modes of availing information for perception and inference, and are, for the educational setting, quite all-encompassing, so it should be possible to analyze them to deductively reformulate the model in terms of sender(initiator)-intentional acts instead of in terms of content- and temporal control.

- Transmission
  To transmit something means the uninteruptable transfer of signs - The purpose of transmitting must then be to **inform** about some point about the state of affairs by means of availing the information in its entirety to the receiver before allowing any transmission-interrupting interactions to take place.
- Consultation
  To consult is basically to ask a question, again about the state of affairs, to some authoritative source. The purpose of consulting can then be said to be the whish to **apply** the sought for information to some problem or deliberation.
- Registration
  Registration is an inverse consultation, where the information sought doesn't concern the state of affairs (since the consumer isn't an authoritative source) but instead concerns the consumers personal attributes .e.g. views, opinions, knowledge, skills in order to **evaluate** the questioned attributes on some scale or other.
- Conversation
  Conversation is the free exchange of ideas, information, knowledge etc. between equals (consumers). Since we have already covered the intentions of informing, applying and evaluating, what remains in the domain of conversation, and that is not covered by the first three intentions, is the individual purpose of achieving a better understanding of ones own views, knowledge, feelings, etc by means of **reflecting** on what is known, thought, meant etc., against a peer intellect.

Thus, the four basic modes of Interaction can be shown to subsume four basic purposes/intentionalities with acting to attempt to initiate an interaction, by means of creating a communicative event for perception and inference by the receiver. The:

1. Informative
2. Applicative
3. Evaluative
4. Reflexive

Communicative events.

A Taxonomy of Communicative Events

Communicative events are what the actants produce to 'create a difference' in the environment of their intended receivers (Sperber & Wilson, 1986), thus, a text event is ... *not an object which can be recognized in physical or mental space, but a historical event in time.* (Togeby, 1993, p. 819). In Togeby's taxonomy of these events five outside contributing factors of the text-event are linked to their related functions by a constitutive rule for each function (Togeby, p. 819-845) in the following manner:

Function	Constitutive Rule	Factor
Expression	(must be) Sincere	(of) Sender (views and oppinions)
Use	(must be) Correct & Comprehensible	(in the chosen) Sign System
Contact	(must be) Regular & Fair	(through the) Channel
Information	(must be) Relevant	(to the) Receiver
Proposition	(must be) True	(about the) State of Affairs

I'll briefly explain the terms used to denote the factors and, where relevant touch upon their related functions and constitutive rules:

- Sender
  The **initiator** of the text-event. The initiator creates the difference in the intended receivers' environment for some purpose or other. It is the fulfillment of this purpose that is the intent with creating the difference, not the transferal of the informational content of the communication. For this intent to succeed, the **senders expression** must be regarded as **sincere**.
- Sign System
  The semantic and structural content of the text-event. This is the **code-level** of the taxonomy. For any message to succeed the use of the sign system must **be correct and comprehensible**. Meanings exist at the code level – Togeby's taxonomy is definitely not purely inferential, but 'the meaning' can only be unequivocally/unambiguously determined by looking at all the other factors present in the specific historic communicative-event.
- Channel
  The **social-institutional and technical arrangement**, the **channel**, that enables and constrains the contact to be made. That contact must be **regular** denotes that the relationship between sender and receiver must be well defined and be within societal-institutional norms. That contact must be **fair** denotes that no undue/unfair social-institutional demands or requirements may be placed on any of the communication partners through the arrangement. Note that regularity and fairness must be fulfilled both for the technical and the socio-institutional arrangements.
- Receiver
  Whom or what the text-event is intended for. Human decoding of text-events is not perceived as happening at a code-level only, but also at an inferential (often abductive) level at which the receiver infers the intention of the sender and selects the domain of optimal **relevance** (Sperber & Wilson, 1986).
- State of Affairs
  The **knowledge-domain** treated in the text-event. Determining the **truthfulness** of the proposition is a process involving not only knowledge within the domain, but also knowledge of that particular domains epistemology and (scientific) methods.

Merging the two Taxonomies

We now have both a taxonomy of text-events and a taxonomy of the accompanying purposes of initiating them. Integrating the two different optics can then derive the success-criteria; the constitutive rules in Togeby's taxonomy with the four base intentionalities derived from Bordewijk & van Kaam:

- Informatives
  Since the purpose is to inform a 'receiver' the foremost demand must be that of **relevance**, to that receiver, and secondly truthfulness/consistency in respect to the state of affairs.
- Applicatives
  With the intent of gaining a usable answer, the foremost concern when affecting applicatives must be to supply a correctly posed question to make a more success likely. Thus focus of attention becomes that of **correctly and understandably** using the sign system.
- Reflexives
  Here, the purpose is 'achieving a better understanding of ones own views, knowledge, feelings, etc by means of reflecting on what is known, thought, meant etc., against a peer intellect'. Thus, one must have the feeling of being in the presence of peers and for that feeling to present itself; the initiator must primarily ensure that the communicative event created is a **sincere** expression of his or her views etc.
- Evaluatives
  Much the same way as Reflexive-interactions, a certain level of trust is required for an Evaluative text-event to turn into an Evaluative interaction. However, here trust is established through a formal system since the trust is directed towards the institutions/initiators formal right to evaluate the receiver. Thus focus is foremost on the social-institutional arrangement, the Channel, so, for an evaluative communicative event to succeed it must be **regular and fair**.

A new matrix can now be proposed. Whereas Bordewijk and Van Kaam concentrates ownership and temporal control, we now instead ask **only the initiator**, why he or she attempts to affect the interaction. Is it to avail or to get something? And is that something declarative conceptual knowledge or is it the views, attitudes, understandings, etc. of a certain individual or entity?

A matrix of potential purposeful acts intended to affect interaction (foremost success-criteria parenthesized):

	Purpose is to avail	**Purpose is to get**
Declarative conceptual knowledge	Informative (Relevance)	Applicative (Correct use & understandability)
Views, attitudes, understandings, etc.	Reflexive (Sincerity)	Evaluative (Regularity & Fairness)

We now no longer have the problem of determining a center or periphery. The four types of acts can be undertaken by all actants present in the situation, and every act can be interpreted or misinterpreted freely by the receiving actants.

Designing Tasks using Intentional Acts

Coming all the way back to task-design we can now begin designing tasks by designing the communicative events intended to affect the undertaking of the task. With the proposed taxonomy of four different intentions with affecting a communicative event, we can uniquely fit each communicative event to the whole and thus create a learning experience that at least will fail in a document-able manner or will succeed and we will know why. The rest of the article therefore discuss a number of common task-elements in relation to the new taxonomy.

How to make Informative acts succeed

Where the other three concepts of the proposed taxonomy somewhat subsumes their own purposes an Informative act does not. We must always ask: **in relation to what**, the informative act should be relevant.

Informative acts are always the answer to (interaction with) some previous communicative act or setting the stage for something that comes after.
Examples of Informative acts, that sets the stage:

- If the Informative act is a lecture, it implicitly fulfils the need of the students to prepare for the upcoming exam, i.e. the informative act must be relevant in relation to preparing for the upcoming Evaluative act.
- If the Informative act sets the stage for some exercise of task, it must be relevant in relation to the implicit Applicative act of asking, "How do I do the exercise?"
- If the Informative act is followed by discussion, it must be relevant in relation to the upcoming Reflexive act of relating the knowledge presented to ones previous views, opinions, feelings etc.

Examples of informative acts, which are answers to previous acts:

- Interactions with Applicative acts
  - ⇒ The student signs up for an exercise by clicking a button on a web-page, thus interacting with a previous applicative act initiated by a teacher.
  - ⇒ The teacher answers a question using e-mail regarding a previous lecture, some administrative procedure, previous task etc., thus interacting with a previous applicative act initiated by a student.
  - ⇒ A student does the same thing as the teacher in the previous example, thus interacting with a previous applicative act initiated by another student
- Interactions with Evaluative acts
  - ⇒ A student fills out an online examination questionnaire, thus interacting with an Evaluative act initiated by the teacher
  - ⇒ A teacher answers a question regarding his teaching style or choice of content, thus interacting with an Evaluative act initiated by a student
- Interactions with Reflexive acts
  Most of the time, interactions with Reflexive acts will take the form of new reflexive acts, but sometimes it becomes necessary to 'short-circuit' or stop the discussion and put forth an Informative act to achieve that end.
  - ⇒ The teacher informs a student, that there is not enough time left to continue a discussion started by the student, thus interacting with a previous Reflexive act
  - ⇒ A student informs another student or the teacher, that he or she cannot participate any further because of other duties, thus interacting with someone's previous Reflexive act.

How to make Applicative acts succeed

I probably interpret Togeby's factor, 'the sign system', in a somewhat wider sense than anticipated by Togeby himself. My reasoning is that often the biggest problem with asking questions is not that there aren't things one isn't clear about, but that phrasing the question itself is too demanding of one's present capabilities.
The Applicative act, requiring correct and comprehensible use of the sign system, can in the educational context be analyzed to require of the 'sign-system-use', that the question posed must:

- correctly and understandably use the terms/concepts specific to the subject being taught
- correctly and understandably pose the question within the subject being taught's area of inquiry.
- correctly use the subject-being-taught's epistemology in the determination/description of the 'problem'

It seems obvious, that in order to pose 'good' questions the asker must have a good grasp of the sign systems concerning the 'state of affairs' that the course presents.
So, to ask questions 'correctly', one must have at least partially appropriated the specific concepts and concept-relationships of the domain - the correct and understandable use of the sign system in the specific domain.
In most teaching situations, Applicative acts are most often enacted by students asking questions of a practical nature to their teacher, but as this analysis shows, often are stumped because many questions cannot be phrased correctly at the time, where their answer has any usefulness. Understanding this brings focus to the demand on the teacher or 'availing institution or technology' of supporting the 'correct and comprehensible' asking of questions.

How to make Reflexive acts succeed

This mode of interactivity is often more difficult to achieve than the others due to the fact that affecting it puts the initiator a risk of being labeled or judged by peers and tutors. The competitiveness of many school environments naturally inhibits any personal display of preference or depth of knowledge.
The level of risk can often be coupled to the way a course is evaluated. In the Nordic countries we have a tradition for using oral examinations of a discursive nature, making the teachers opinion of ones 'standing' an important factor. In this situation, it can prove impossible to achieve a true state of Reflexive interactions – the students will rather attempt to say, what they think the teacher wants to hear.
For the Reflexive act to succeed it must be interpreted as sincere, but it is exactly the sincerity of the expression that gets to be questioned, when the institutional and/or social context, that the Reflexive acting out is taking place within, is not sincerely addressed in the initial Reflexive act!
Reflexive acts can then be encouraged along two dimensions:

- Controlling the audience
  - ⇒ Providing students with private and/or anonymous forums for having such discussions
  - ⇒ Dividing classes into smaller units, that can have private discussions (as in the point above), that maybe later is brought into plenum as a 'group-
- Controlling (or understanding) the potential consequences
  - ⇒ Addressing the problem directly to get discussions started
  - ⇒ Asking teams to discuss rather than individuals, thus 'smearing' responsibility across multiple persons
  - ⇒ Require participation as a part of the course-completion-demands

Not addressing these issues leads to insincere, and therefore failed Reflexive acts. Resolving the social and institutional barriers is a real challenge to educators today, since their resolution may entail concrete changes to the formal and cultural side of conducting a course, the way it is evaluated and the way it is taught.

How to make Evaluative acts succeed

In the examination-situation, ensuring that the Interaction takes place is most often not a problem, however, there are many situations, that are not exams, where Evaluative acts are in order. Self-evaluations are more and more becoming de rigeur, and can often prove useful for modifying a course to the level and whishes of the students taking the course.
For the educational setting we can explicate the general requirements of regularity and fairness:

- Constituting regularity
  - ⇒ Make obvious, that the answer is needed for a relevant task, e.g. giving a grade or modifying an upcoming lecture.
  - ⇒ Assert, that the initiator has the necessary social standing and -relationship to be able to ask the question
- Constituting fairness
  - ⇒ Ascertain, that the answers sought are (or has had the chance to get) 'inside' the person or persons queried
  - ⇒ Ascertain, that the answers sought can be fully communicated through the used technical arrangement (technical side of the channel)
    In technologically mediated situations, this can prove a real problem. E.g. where a model or prototype is required many a times it is much easier to build that in the real world.

Making sure, that regularity and fairness is communicated properly in the evaluative act can often be a good authors tool in determining whether one really knows, what it is one whishes to know about; what the purpose of requesting the input is.

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Historical Perspectives on Teachers, Technology, and American Public Education

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Abstract: New technology is one of the most frequently named components in, or rationales for, school reform. Many of the hopes expressed today for educational technology sound reasonable and desirable, but history suggests that integrating technology into classroom practice is a very complex process, profoundly affected by trends in educational policy, curriculum theory, and pedagogy. This paper points out some of the common themes that run through the history of educational technology, with particular attention given to overlaps with trends in educational policy and theories about curriculum, teaching, and learning.

Introduction

It has been a characteristically American response to new media to see them as reasons for changing schools, and to hope that their introduction into classrooms will revitalize education in one way or another. Hopes for the educational potential of new technologies abounded throughout the twentieth century, and continue to dominate policy talk. Film was so vast in "its possibilities for the instruction . . . of humanity that did it not already exist we should, if we possessed enough imagination, pray for its invention" (Forman, 1935, p. 1); once fully understood, films would, "no doubt, be considered as necessary a part of school equipment as are textbooks, maps, charts, and blackboards" (Ellis & Thornborough, 1923, p. vi). Radio was predicted to raise the human mind "to an entirely new level of precision and efficiency" (Darrow, 1932, p. ix). Television was hailed as "the power tool
"the greatest vital force in modern education" (Long, 1952, p. 417). Computer-assisted instruction would "march relentlessly into our instructional lives" (Goodlad, 1968, p. 7). Each of these media was embraced by many education reformers of its day, and argued to be compatible with then-current ideas about pedagogy, curriculum, and the purposes and priorities of schooling. And yet, despite some very high hopes about the potential uses of these media in schools, they rarely saw extensive use in typical classrooms.

A common response to this troubling history is to claim that today's computers will be differently received by schools, because they occupy a different role in social life than did those earlier technologies. There is some truth in that claim; however, one of the common themes running through the history of twentieth century educational technologies is that some difference in the new technology is *always* named as the reason why the new one will succeed where the older one failed. Mere difference is not enough to ensure different outcomes.

The differences in these various attempts to bring new communication technologies into the school environment are in the details—for example, in the particular social problem people hoped to solve by using a new technology in schools—not in the basic, underlying assumptions—for example, that social problems can be addressed by using technology in schools. We need to be more consciously aware of the assumptions being made today about technology and education, so that we can think harder about their validity and usefulness. A good place to start—and, it sometimes seems, a rare one—is in the past, where we are not quite so emotionally invested in what people were thinking and doing, and are therefore more likely to be able to establish some critical distance. From there, with any luck, we can apply our newly honed skills in critical distance to the present, along with some different ideas against which we can compare our own. What's more, we come back to the present with a better understanding of where our ideas came from, what circumstances brought them into being in the first place, and how they have changed over time.

The story of educational technology must be more thoroughly and deliberately intertwined with other aspects of school reform if the repeated attempts to transform schools with technology are to be more adequately understood. That is, what happens to new media in schools is—and has always been—mediated by theories of curriculum and pedagogy, prevailing beliefs about the purposes of schooling, and the relationship between technology and the work of teachers. For example, educational film and radio were closely tied to the child-centered progressive movements of the time. These media were advocated for their appeal to multiple senses, for their capacity to arouse students' interest, and to connect children to the world outside the classroom—all hallmarks of child-centered progressivism. At the same time, some of the social efficiency reformers of the time also advocated the use of these media, believing that children would learn more quickly and efficiently through film and radio than through conventional instruction.

Similarly, instructional television was tightly bound up in educational policy of postwar America. After World War II, American public schools suffered from intense overcrowding and a severe teacher shortage. Instructional television was developed, in large part, with the aim of spreading out the teaching force by providing mass instruction by master television teachers. The idea was that television-taught classes could be much bigger than conventional classes, and would only require a teacher's aide for supervision. Furthermore, television lessons could make up for the inadequacies of underqualified teachers.

Other aspects of postwar educational policy were related to the development of teaching machines and computer-assisted instruction. As the Cold War intensified, Americans became increasingly concerned that their public schools were inferior to the schools of the Soviet Union. In particular, there was great anxiety that American instruction in math, science, and foreign languages was inadequate. There had been a great deal of military research during World War II on the use of various audio-visual devices for training, which brought together audio-visual educators and psychologists. In the 1950s, behaviorism, and the teaching machines that went with it, were popularized, where the material to be learned was broken down into its smallest components and "dispensed" to the learner. Also popularized in this period was the "systems approach" to education, another inheritance from military research and practice, which involved conceiving of the learner as part of a human-machine system, where each was to be adapted to the other to streamline training. Computer-assisted instruction was developed in the context of these efforts to make learning efficient and failsafe.

Some of the more recent modifications to computer-assisted instruction are a product of further psychological research and the development of information-processing models of human cognition. For example, computer simulations arose largely out of an interest in modeling the workings of the human mind and, in turn, using those models to shape human learning. Much of the current "constructivist" focus of educational technology arose out of these developments.

Hopes to improve American public education though the use of new technology need to be informed by the historical context in which those hopes are embedded. In the process, we can develop a more sophisticated sense of how to integrate new technologies into schools, and a better understanding of the factors that can work so powerfully against such integration.

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Applications of Knowledge Based Evaluation in Educational Technology.

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Abstract: In an emerging system, one of the primary functions of the founders should be to explore acceptable justification systems. Consider, for example, intuition, logic, or causality. In doing this, it is helpful to recognize that each choice of systems—even if only made on a temporary basis—will have significant impacts on which true items may be proven and which false items may be disproved. When this is done a case is easily made that a meaningful evaluation is possible with only a shared justification system present. Items of truth and belief, although of extreme interest to the parties of most evaluations, are shown to be irrelevant to the advancement of knowledge that may come about as a result of the evaluation itself.

Introduction

I use the term Knowledge Based Evaluation to refer to a conceptual framework that arises when one uses an epistemic perspective to examine the dynamics of performing an evaluation within an emerging, or ill-structured, domain. A full description of this framework is beyond the scope of this paper, but may be found in a future volume of the Journal for Technology and Teacher Education[1].

As was suggested in the abstract, one of the primary functions of the founders in an emerging discipline should be to explore and legitimize various acceptable justification systems for use within the emerging discipline. This does more then just legitimize a research paradigm, at a foundational level it serves to frame the broader parameters of what knowledge may and may not be found within the discipline and how such knowledge claims are to be contextualized.

Application

Within an epistemic tradition knowledge has often been expressed by the rather formal relationship K=JTB. In this expression K refers to Knowledge, J to justification system, T for truth, and B for beliefs. These are all to be thought of in the perfect idealized form. In actual applications we are not dealing with abstracted perfection, however, but rather with a localized and specific area of inquiry. I will use the lower case *k=jtb* to refer to this contextualized set of features.

Thus in an actual evaluation, from the perfect set of all knowledge, K, a subset, *k*, would be selected to for the basis for creating areas of evaluation. Although not previously noted, *k* is also contextualized by the institutional constraints of the target audience, as influenced by the evaluators. This points to the need for an extensive period of development between all parties to the evaluation to develop a mutually meaningful *k*. Thus, expectancy management is not only important for the nature of the deliverables, but also to set up the epistemic foundation and philosophical arena within which the evaluation will function.

Once a shared understanding of what is to be measured is determined, this item of measurement is the *k*-knowledge item, which may then be explored and measured by examinations of the systems of justification accepted – *j*, the truths shared by the parties to the evaluation - *t*, and the beliefs expressed - *b*. Each *k* needs to be justified by the holder or knower of that *k*, using a *j*-system of justification appropriate for the system at hand. This *j* is comprised of the acceptable methods of defense for the domain from which the *k* was drawn. This *j* should be the subject of significant debate, particularly in the case of emerging systems, or ill-defined realms of inquiry such as technology and teacher education.

Within education, for example, two paradigms—each with their respective *j's*—might be classified as qualitative and quantitative research methodologies. Should these be blended in evaluation, great care must be taken to ensure the developing *j's* reflect the *k* under consideration. This often creates situations within which selected items of knowledge are intuitively obvious, yet must be classified as an unknowable *k* within *j*—the acceptable system of proof. A poignant example currently exists in education in the struggle with paradigms concerning which *j's* will be accepted and institutionalized. Such struggles are characteristic of an emerging discipline, but distract from the nature of what specifically the systems should be able to measure. It would make more sense to first decide the true nature of *k* and the select an appropriate *j* for the task at hand for each study.

In an emerging discipline, such as educational technology, there may not be a well-established and institutionalized method of justification for *k* claims. In mathematics, on the other hand, there are well-established systems of proof that are acceptable within that discipline. This has an impact on the nature of the knowledge claims that can be made. Clearly justification systems, once accepted and privileged within any system, determine not only what a good defense should look like, but also what a knowable item is and under what circumstances knowledge advancement may be claimed.

Apart from the advancement of knowledge within a field, this has a direct implication on the evaluation in progress. If an element (i.e., an individual, system, institution, or whatever can make appropriate use of the accepted *j*) is under evaluation, then that fact itself can be an item for evaluation. When that is done, the following are examples of the type of inquiry that this conceptualization might generate:

- How well does the *j* used by the element correspond to the *j* accepted by the system performing the evaluation?
- How well is the *j* used by the element implemented by that element?
- From the potential *j* available, was the element able to select one appropriate to the problem under investigation?
- From the potential *j* available, was the element able to select one that was acceptable to the field?

It should be noted that whether the *k* is true or false, knowledge could still advance within the system. The state of knowledge advancement is only determined by the selection of an appropriate *j*. The selection of *k*, that is the form of knowledge to be evaluated, is critical to guide subsequent evaluations. Its own universal truthfulness, however, is not itself subject to universal verification. All that is required is that it is acceptable as a *k*—a knowable item within the field or audience conducting the evaluation.

Although there is not room to develop this argument here, it is sometimes the case that at one level, even the localized *t* becomes unimportant to the evaluation. Thus, a *k* can be held to be universally true or false for all of the potential knowers who are members of the discipline conducting the evaluation. Indeed, the system of justification can be independent of the truthfulness of the *k*. An item may or may not be *t*—true at the individual or institutional level, but this decision is independent of the evaluation. Similarly, b—beliefs held by the institution or individual only impact the evaluation to the extent to which they are instantiated in the *j*—justification system in use by the individual or institution. Thus, when conducting an evaluation using this knowledge-based approach, we can express the "space" within which we are concerned by filling in the necessary assumptions and limitations.

An emerging field or discipline, such as teacher education and technology, defines itself by creating the linkages between *k* and *j*. It is through this mechanism that we define the forms of knowledge that will be known and knowable within the emerging field. It is also through this mechanism that we may discover what legitimate items of inquiry might look like.

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Communal Constructivism:
Students constructing learning *for* as well as *with* others.

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Abstract

We believe there is a need for an expanded definition of social constructivism that takes into account the synergy between the more recent advances in information technology - which are increasing our potential for communication and the ability to store a variety of data types - and advances in virtual learning environments. In particular we are still at an early stage in trying to construct knowledge as to how to teach and learn effectively with ICTs. What we argue for is a communal constructivism where students and teachers are not simply engaged in developing their own information but actively involved in creating knowledge that will benefit other students. In this model students will not simply pass through a course like water through a sieve but instead leave their own imprint in the development of the course, their school or university, and ideally the discipline.

Introduction

The most interesting effects of the advent of Information and Communication Technologies (ICTs) in teaching is they force the teacher to undertake a radical re-assessment of the way in which they teach. The use of ICTs raises a whole series of questions ranging from the appropriateness of the 'chalk and talk' paradigm, through the role of assessment, to the need to cater for different learning styles. This paper describes how the authors, who are themselves both teachers and learners, are re-assessing the way in which they teach and learn in light of the enormous flexibility being offered by ICTs.

The context for the discussion is a 2-year, part-time Masters program in the area of ICTs and Learning – Master of Science in Information Technology in Education - in which a wide variety of techniques, many old but some new, are being used in an attempt to enrich the learning experience and have begun to fundamentally change the way in which we envision education. The theme, or educational philosophy, underlying our approach is one we call '**communal constructivism**', by which we mean an approach to learning in which students not only construct their own knowledge (constructivism) as a result of interacting with their environment (social constructivism), but are also actively engaged in the process of constructing knowledge **for** their learning community.

We argue that the modern education process is too like a sanitized pipe system through which large numbers of students are pushed through to emerge from the far end 'educated' but without leaving any discernable trace on the system they have passed through. The 'communal constructivist' philosophy is more akin to a river that shapes its own environment as it flows forward. We draw upon a diverse range of educational inputs ranging from the constructivist theories of Vygotsky to those of Cognitive Apprenticeship, through techniques used in one-teacher rural Irish primary schools to the Japanese *han* system. Of particular interest is the way in which ICTs can be creatively used to bring new life into these diverse ideas and how it can combine and synthesize many previously separate initiatives.

A search for an appropriate model of education

Our current classroom model is largely a product of the industrial revolution whereby groups of students of the same age come to a single physical location to be instructed in the same subject matter at the same pace. By comparison, earlier models of learning were much more tailored to individual learners and stressed high-level interaction between the tutor and student. Indeed modelling the process of learning was considered as important as imparting facts and information. A stress on skills of speaking and rhetoric has been largely lost as delivery was increasingly restricted to the teacher. Assessment plays a defining role that results in students being conditioned to learn only what is of direct relevance to examinations and often only then in a superficial manner. Although it varies somewhat from country to country, for the most part the education system acts as a shrinking pipeline with students being channelled into greater and greater specialisations at earlier and earlier ages[1]. The emphasis is on an individual learning by oneself, for oneself, and even where learning is within a wide group or social context, the goal of learning is still for ones own benefit.

[1] In Ireland for example many undergraduate degrees are specialised, or professional in nature. Entry to university is highly competitive and judged on the results of a single set of nation-wide exams and students are encouraged, and in some cases are required, to pick between language and science courses as early as fourteen.

Not only are the processes of learning narrow, but the products are also boxed in. School subjects are increasingly standardised and defined. Science subjects, for example, have been delineated and divided while the field is increasingly connecting and evolving. Developments are moving so rapidly that whole areas of knowledge are increasingly obsolete. What is needed is a reflection of the growth and expansion of the knowledge of the discipline within the subject being taught in the classroom.

Pouts-Lajus and Riche-Magnier (2000) argue that new educational technologies give us an opportunity to rethink educational relationships as we reflected on what was presently being offered to students as an educational experience as well as best practice, both from our own tradition and internationally we began to evolve a new theory of an approach based on building a community of learners with a focus on the community itself rather than on the individual learner.

Our ideas on 'communal constructivism' derive from a wide variety of sources. Theories of social constructivism, combined with advances in ICTs are introducing new ways of learning. Social Constructivism is defined as a process by which students make meaning, and the central role their community, through culture and language, plays in this process. Learning is seen as a social and collaborative activity that is facilitated rather than directly taught by the teacher. Building on constructivist theories, where students are involved in building their own knowledge, social constructivism adds an interactive dimension. This approach is influenced by the work of Vygotsky who believed that children learn from within themselves and as well as from influences in their social or cultural environment. Although Vygotsky focused on the role of speech and not on the role of new technologies, the fact that communication is increasingly supported by computers, e.g. e-mail, discussion boards, chat rooms, MOOs, MUDS and Virtual Worlds, has lead to his work influencing theories of learning in the information age.

We also have been influenced by the concept of cognitive apprenticeship and the work done in designing supporting computer environments to test theory (Lajoie & Greer, 1995). Essentially teachers offer students cognitive apprenticeships by working with students and modelling key aspects of learning until the students are able to work unassisted. The teacher is responsible for passing on knowledge of the process rather than simply focusing on content. Earlier models of apprenticeship learning underlie the theory.

> *Before schools appeared, apprenticeship was the most common means of learning and was used to transmit the knowledge required for expert practice in fields from painting and sculpting to medicine and law. Even today, many complex and important skills, such as those required for language use and social interaction, are learned informally through apprenticeship-like methods - that is, methods not involving didactic teaching, but observation, coaching, and successive approximation (Collins, Brown & Newman, 1989; p. 453).*

The great educator Cardinal Newman argued in his classic *The Idea of a University* that people learned more from been in contact with each other than from formal classes. "If I had to choose between a so-called University which dispensed with residence and tutorial supervision and gave its degrees to any person who passed an examination in a wide range of subjects, and a University which merely brought a number of young men together for three or four years… I have no hesitation in giving the preference to the later…" (Newman, 1852; p. 35). This is very much the same thinking that underpinned the classic British Boarding School model for many years. In both these cases, however, the collective aspect of learning is in the area of socialization, or in Newman's case becoming a 'gentleman', rather than on traditional subject-based learning that was still done in a conventional classroom.

An in-depth study by one of the authors, Holmes (1998), of a rural Japanese community in the Hiroshima area identified many practices which have given us ideas as to how our view of teaching and learning can be expanded in a Western context. In Japan, for example, Grade 6 students primary school collect the younger ones walk with them to school each morning and home each afternoon. This is obviously a valuable exercise in socialisation but of even more interest is the use of *han* groups within school. A *han* is made up of 3 or 4 students within a class and it is the responsibility of the *han* to make sure that all members are able to progress through the materials. This is radically different from Western education where the individual is paramount.

The *han* system in Japan – from an interview with a Japanese teacher.
It looks like in the UK that students should not disturb other students; but in Japan, in such a class, it is encouraged. One plus one is usually more than two. Partly because of this, students turn to each other for help before turning to the teacher. Since the class moves at the same pace they will help each other to move forward. Students rarely compete with each other in class.

Students working individually– from an interview with a British teacher.
We do not deliver skills from the front, but instead, we are allowing people to develop skills at their own rate.

(W)e are very much encouraged to look at differentiation and we are asked to provide extensions of tasks for those people who are able to move more quickly.

Group-work is also of course prevalent in Western education and much has been written on the advantages of group-work and project-based learning (Papert, 1993; .Rotherenberg, 1999) A related concept is that of peer tutoring which has been shown to have benefits for the tutee. We are particularly interested in the benefits for the tutor in such arrangements.

Closer to home small rural Primary schools, of which there are still very many in Ireland, where two or three teachers take the full range of ages from 5 to 12 years old, offer very interesting models of education. Enormous creativity is required in timetabling subjects and extensive use must be made of both group project work and peer-tutoring. Economies of scale argue that such schools are not viable units but the power of ICTs to extend the horizons of such schools is seriously challenging that assumption.

At the other end of the educational spectrum, the concept of a learner making a contribution to the field within which they are learning is at the core of what it means to do Ph.D. level research. Ph.D. students attempt to expand knowledge of a discipline and are encouraged to publish their results so that their own work is recorded and helps develop the field of knowledge. At this level in the formal education system delivery, and reception, of information is replaced by the process of building new knowledge and making it available to others. This we argue is one of the best learning experiences but applies only to a select few. We shall explore how it can be delivered at other levels in education.

Courses in the formal educational system are predominantly static in that a teacher covers the same material year after year. At the same time new technologies are impacting with subject disciplines and teaching pedagogy to evolve present fields, such as biology into new areas such as biotechnology. The syllabi of many courses could be constantly rewritten and still be almost always out of date.

External pressures are also calling for change in the education system as employers are more and more looking for people with good teamwork and communication skills. There is a real challenge for an education system to ensure its graduates have relevant and applicable knowledge and skills. Partly in a response to such issues, large-scale organisations such as the OECD are stressing skills of knowledge management and creation rather than simply memorization of content materials.

Communal Constructivism

Many of the previous proposed solutions to challenges faced by educators today involve more time and more money. Teachers are increasingly pressured to provide more of their own time to training and updating their skills while governments are obliged to keep increasing educational budgets. What has not been considered is a way to build on the knowledge, skills and energy of those at the heart of schooling – the students.

We believe there is a need for an expanded definition of social constructivism that takes into account the synergy between the more recent advances in information technology - which are increasing our potential for communication and the ability to store a variety of data types - and some of the educational ideas outlined above. In particular we are still at an early stage in trying to construct knowledge as to how to teach, and learn, effectively with ICTs. What we argue for is a communal constructivism where students and teachers are not simply engaged in developing their own information but actively involved in creating knowledge that will benefit other students and teachers. In this model students will not simply pass through a course like water through a pipe but instead, river-like, leave their own imprint in the development of the course, their school or university, and ideally the discipline. This will result in a gain for the institutions or course, but more importantly the students themselves will benefit.

We argue that a diverse range of techniques can, and should, be used to enrich this type of learning environment within which the focus is on learning *with* and *for* others. Peer tutoring and project-based learning are obvious techniques but we also advocate the ideas of cognitive apprenticeship, the publishing of information, flexibility in the time table, a radical look at the way in which assessment is done, and so forth.

Our pipe and river analogy derives from the observation that presently much of the student learning that happens in one year of a course is lost for the next. The pipe can not be enriched by water travelling through it, indeed over time the pipe may need repairs, whereas water flowing through a river will leave rich mineral deposits and slowly influence the course of the river. Obviously the students have learnt material during their studies, and the teacher would have learnt from the students, but there is little or no year-to-year transfer of knowledge between students. If the student learning processes and their work could be captured then courses might instead build on knowledge rather than simply repeat it.

To create an environment where students leave their imprint on the course, and the field, as an integral part of their learning not only benefits their own learning, the learning of their colleagues in their classes and those that will come after, them but more importantly creates a vast number of graduates who will be well aware of the importance of teaching and education and thus communal constructivism also provides a teaching apprenticeship for all those who come through the school system. The profession would benefit from a rich pool of people who understand the concerns and support new initiatives.

Putting Ideas Into Practice aided by ICTs

We are now seeking to explore ways in which these ideas of communal constructivism could be developed by applying them in a classroom setting. The course in question is a new two-year, part-time Master's programme in the area of Information Technology in Education. The students, or learners, on this course are predominantly teachers themselves who are involved are some level in using ICTs in the classroom. The course has an intake of 25 and the first year is made up of a taught component with the second year being devoted to a research dissertation. The first in-take was in October 1999 and at the time of writing we have now both the taught year and the dissertation year up and running.

The Communal Constructivist approach requires that the course be dynamic and adaptive. As the field itself (ICTs and Learning) is so dynamic it is necessary that both the course content, and more importantly the method of delivery, be capable of adapting to new information and new techniques as they emerge from within the course itself and from the discipline at large.

The potential of information and communication technologies (ICTs) in the area of learning are well known. Aspects which are particularly relevant to our subsequent discussion include the potential to allow students to become publishers, and not just consumers, of information through the use ICTs, for example, word processing, web and multimedia authoring tools. The use of Email, list servers, discussion boards, virtual chat rooms, MOOs and so forth greatly enhance communication capabilities and cut across divisions of space and time. Digital audio, video, web cameras, on-line logs can capture and disseminate classroom experiences for research and reflection. Databases, referencing packages, statistical and text analysis packages allow the storing, structuring, and analysis of information. On-line tracking, monitoring software, adaptive learning environments, for example, aid in the structuring and analysis of ones own learning.

Our approach also requires that from the very outset students see themselves as producers and not just consumers of information. Students are given instruction in various technologies for presentation to their peers, ranging from PowerPoint tools to produce slides to sophisticated Web design. All coursework and projects have presentation built in as a fundamental part of the exercise. The students must present their work to their peers and also place it on the Web for use by students in subsequent years and for inspection by the wider community. Students are actively encouraged to submit their work to national and international conferences, not just at the end of the degree but during their study and not simply as an addition but as an integral part of their studies. All proposals for research topics must include a section on how the work could make an impact on their field and an outline of plans for publication and dissemination of the research. Students are encouraged to write research papers with the academics and to jointly present their work at conferences, specific individuals are not encouraged but rather the entire class is prepared. This is not just a passive participation but an active collaboration in both the preparation and the presentation. It is probably best summarised by our experience at the students first outing at a national conference where one first year student, who was asked to videotape a presentation being given by some students from the second year, felt compelled to come forward and give the audience the benefit of his views on the topic. Students are also required to write their dissertation proposal in the form of a grant application and to actively pursue (with some success) real research contracts.

Within the course a wide variety of techniques are used to instil in students the idea that they are involved in a process of constructing knowledge and that that construction is a communal affair. Of particular interest are the following.

1. Extensive use is made of **group work** and **project-based learning.** Assignments are done in groups of 3-4 for first term and then in groups of 2 for the second term. The final term assignment is an intensive individual project by which time the students are much more confident with the technology and the subject matter.
2. The initial specification of the course had built in assessment by examination. A realisation that the learning taking place in an exam is purely focused on the individual lead us to adopt a portfolio approach **assessment process** that would both benefit the individual, their peers and learners that followed them[2].
3. Student work has developed into a **portfolio** allowing for reflection on their year-long learning process and also allowing for future students to see the progress of knowledge acquisition.
4. The **lecture format** used varies somewhat between modules but typically involves making reading material available on the web a week in advance with a modest amount of "lecturing" in any class. Students engage in project work and discussion during lecture time.
5. Extensive use is made of **peer tutoring** and **mentoring**. There is considerable diversity in the backgrounds of the students on the course so peer tutoring arises naturally within the class. More formally each student on the 1st year negotiates with a student on the 2nd year of the program to act as their mentor.
6. 2nd year students are encouraged to engage in an **apprenticeship** lecturer role by being given the opportunity to: deliver part of a lecture; lead a discussion group; develop course content; adapt and expand on a lecturer's notes; act as a technical assistant; act as a general helper (there is always a need for someone to answer questions in the hands on session); develop related tasks for students to undertake in the hands-on sessions and add relevant links into the lectures.

[2] The specification for the end of year capstone project is "Do something interesting that showed you learned something".

Conclusion

There are a number of down stream effect of the flow of students through the course. Although it has taken time and effort to set up a system the benefits are already apparent, numerous, and include the building of a dynamic and well-researched body of course material. This material will be continually updated and thus new directions for the course will evolve. Already there is a to expand the course into new areas such as distance learning and we hope to be able to offer the course for the blind. The active participation of students in the course has created an internship for university teaching as well as strengthening their own understanding of the 3rd level learning environment thus increasing their metacognitive and reflective skills. Having student work available also drives up the level of the course as other students can more easily understand what is expected of them and thus build on a high standard rather than reinvent the wheel.

The fact that we had a student population of adult learners who had already demonstrated responsibility in their learning and professional lives was of benefit to us. We were interested in how this model might be rolled out for learners of other ages. One of the most interesting effects observed in the first year of the course was, therefore, the extent to which students on the course began to replicate the learning environment they themselves were part of in the classes that they in turn were teaching. The most dramatic example was where one of the authors, herself a primary teacher, employed both peer-tutoring and Web-based publication with her class of 10-year olds. The class were taught how to use a simple story-authoring package and gained experience in its use. They then were given the task of going into the classes of 9-year-olds in the school and teaching not just the students how to use the package but also the teachers of the other classes. The whole process was documented on a Web page that the students took great delight in showing their parents. The teacher in question would have described herself as barely IT literate at the outset of the course and what is interesting is to see how she felt empowered to apply her own experiences from the Masters course to her very different classroom situation. Other examples include the accompanying papers in this proceedings by Dearbhaill McKibben and Sharon McDonald on their experiences in the course and as well a paper by Eileen Brennan on how she is conducting research into public policy in ICTs.

Dewey (1916) argued at the turn of the century that learning is a building process, we believe that education as a whole should also be considered as a in the same light. It is early days yet but we feel that we have much to learn, or rather much to construct, in this communal approach to constructivism. Luckily we are not alone in this rather daunting endeavour but have the human resources to regularly expand and update the course as we are presently supported and aided by over 25 master's students and will soon be aided by 25 more and so on and so on... With their aid we will enrich the course and our own ideas with resources. Not just the identification of more useful information but we are investigating developing software that supports interactive student input to the course. Ubiquitous computing we believe will ease applying communal constructivism ideas to classrooms. When students all have lightweight, wireless laptops that are connected to the Internet they are able to download lectures, visit resource, and post material to the lecturer while engaging in group work or listening to lectures. As our own students reflect on and record their experiences in the course we will also research on our own learning in order to build back into the course. This will aid future students and record the evolution of the modules, future teachers understand the work to date and indeed the discipline itself.

We are also meeting a need to identify and train 3rd level instructors as the course provides an apprenticeship and internship for lecturing at university. As each of our own students returns to influence teaching practices in their own schools communal constructivism is impacting the community and thus supporting lifelong learning.

The biggest benefit of communal constructivism, however, is to the learners themselves. At present their role in the education system is akin to a charity case. They receive benefits from the state and/or their parents for years and have very little input into what they learn, as well as when, where and how they learn it. This has created passivity not only in the learners but within the whole system. A sense of community has been lost. Communal constructivism is about empowering the learner to allow them to reclaim a role in their own education. The advantage to the learner is in taking part in deep meaningful and allowing them to have a role in society throughout their formative years and not just after graduation. Giving students responsibility will train them to be responsible.

Communal Constructivism stresses that learners should be listened to and to be important to others. We believe that they should be useful and have some say in their own lives. They must be included and their work should be valued by others. Their learning tasks should be useful and recognized as such. They have a right to be needed.

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A Tutor's Advice Trains a Student's Self-regulation Skill

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Abstract: We propose that a tutor's appropriate advice trains a student's self-regulation skill. Through analysis of the tutoring interaction between academic departments, we discovered that a tutor's advice transformed a student's questionings. Our hypothesis by the analysis is that this transformation indicates an appropriation by the student of the tutor's self-regulation skill. We propose a training model of a student's self-regulation skill, which is based on the appropriation by the student of the tutor's self-regulation skill.

1. Introduction

Currently, a new paradigm of learning incorporating three distinct theories is emerging - social constructivism, Soviet socio-cultural theories, and situated cognition. This new paradigm brings these social issues to the foreground as a central phenomenon for study (Koschmann 1996 p.11). Under this new paradigm, the emphasis in research on collaborative learning has shifted from the study of the conditions under which group members learn more effectively, to the collaborative interactions themselves. Chi and VanLehn have shown that specific kinds of interactions may engender specific kinds of outcomes (Chi and VanLehn, 1991). The outcomes of these studies led collaborative learning research to show that the interaction must be structured in order to promote effective discourse (Cohen 1994). Some researchers have developed the structured interaction model in order to force the group members to mediate each other's learning. For example, in Reciprocal Teaching (Palincsar & Brown, 1984), the interaction is structured to promote a specific discourse pattern: questioning, summarizing, clarifying, and predicting. Reciprocal Teaching has been found to improve the ability of understanding prose. The ASK to THINK – TEL WHY (King 1999) model of peer tutoring also relies on structuring the interaction which consists of a question and answer component. In the Reciprocal Teaching and ASK to THINK – TEL WHY, the discourse pattern promotes interactive cognitive activity as well as metacognitive process such as monitoring and regulating the cognitive activity.

On the other hand, effective discourse has a common factor. It involves metacognitive processes such as mutual regulation and reflection (Brown 1987). This indicates that effective discourse plays the role of controlling a group member's thinking or causing him to reflect upon his thinking. In other words, effective discourse temporarily supersedes a student's self-regulation skill. From this, we can see the possibility that structured interactions composed of specific utterances can fulfill the metacognitive processes of interlocutor-regulation skills and self-regulation skills.

The purpose of this study is to explore an appropriate advice, which train a student's self-regulation skill. In this paper, we propose that a tutor's advice trains students' self-regulation skills. We will first focus on the discourse pattern: a question-answer methodology using structured interactions, and we describe how the use of appropriate questions trains a student's self-regulation skill. Next, we will describe how a tutor's advice trains a student's self-regulation skill. Finally, we will describe a training model for self-regulation skills.

2. Training the student to use of appropriate questioning

In both the Reciprocal Teaching method and the ASK to THINK – TEL WHY model of peer tutoring, students were trained to use appropriate questions. This is indicative of a students' self-regulation skill training.

In the Reciprocal Teaching method, students as well as teachers take on the role of guiding other members in a group through the processes required to understand texts. In the initial phase, the teacher modeled effective monitoring strategies and feedback. In the intermediate phase, students became much more capable of playing their role as dialogue leader, and by the final phase they provided sophisticated paraphrases of the text and asked sophisticated questions (Brown 1987). One reason for this effect is that the teacher introduced students to their role as a dialogue leader through explicit instruction about appropriate strategic directives (Wertsch 1998).

In the ASK to THINK – TEL WHY model of peer tutoring, the student who is in the tutor role also constructs a more accurate student model through the student's feedback. And the tutor could select the appropriate question on the basis of the student model. If the student's answer to the tutor's question is incomplete, the tutor asks another question. This methodology of training using appropriate questions causes the student who is in the tutor role to construct a model of another student's knowledge and to control another student's acquisition, integration and organization of knowledge through asking appropriate questions. From these analyses, we can conclude the following.

- Through explicit instruction in appropriate questioning technique as described in Reciprocal Teaching and the ASK to THINK – TEL WHY model, the student could be trained to see an interlocutors' thinking as an object of his cognition.
- These methods imply that the teacher advices or appropriate questions give students a demonstration of the proper self-regulation skill.
- The students who are in the tutor role or group leader role could be trained to control the interlocutors' thinking with the basis of appropriate questions.

It should be emphasized that these processes indicate that the students who are in the tutor role took the meta-level role for the interlocutor's cognition. In other words, the student's ability to use appropriate questioning indicates the [interlocutor]-regulation skill.

3. A Tutors' advice transforms student's questions

Now we are ready to consider our main problem. We regard both Reciprocal Teaching and the ASK to THINK – TEL WHY model of peer tutoring as an indirect training of self-regulation skills. In this section we will analyze research of student's spontaneous questionings and a tutor's advice. We will consider that a tutor's appropriate advice can directly train a student's self-regulation skills.

We analyzed the interaction between advisers and students during tutoring sessions among different academic departments. And we observed that the students' questionings prior to receiving a tutor's advice were different from questionings after receiving advice.

In the initial phase of the tutoring, all students asked similar questions such as "What is a modem?" However, tutor's advice transformed some of the students' questions into a confirmation-question or another what-question. The former students were asking for justification of their own assumptions that were based on an explanation encountered in their reading. The latter students were asking for information to integrate their understanding of what they read. For example:

Confirmation-questions:

"I suppose that all information is represented as one or zero. If so, is hiragana or katakana represented as

What-questions:

"Let us know more information about it, for example, the merits or the demerits and so on."

3.1 A classification of user's questions

In order to account for this transformation of students' questionings, we categorized the various questionings. As there were many factors encountered in students' questions, it was very difficult to determine their classification. Moore (1995) classified students' follow-up questions according to previously given explanations and communicative goals. As student's questions are spontaneous and random, we decided to follow her classification. Our adaptation of this classification is shown in the following table.

QUESTION	PREVIOUSLY GIVEN ADVICE	COMMUNICATIVE GOAL
What?	None	Acquisition
Is it true?	Make uncertain things clear	Comprehension
What?	Make uncertain things clear	Integration

Table 1

As table 1 shows, the communicative goal of student's questions was changed. This transformation of the user's communicative goal leads us to consider the student's knowledge transformation. The initial questions: What–question (Goal: Acquisition) indicate that a student was only cognizant of an unknown thing in the subject matter. Also he did not regulate his knowledge. However the communicative goal of questions after receiving advice, which is Comprehension or Integration, was changed. The latter questions indicate the student's attempt to regulate their knowledge.

On the other hand, it is known that low ability performers are deficient in both knowledge and the resources for controlling that knowledge. And knowledge differences reflect processing differences. Poor learners are deficient in knowledge because of poor learning skills, in particular, the self-regulation skill (Campione 1987). Furthermore, there are many degrees of self-regulation skill but the distinction has not been made as clear. And conscious awareness and direction of thought rank lower than self-correction and regulation that can proceed below the level of consciousness (Brown 1987).

From these, we can see that the transformation of students' spontaneous questions indicates how they regulate their thinking.

4. A tutor's advice trains students' self-regulation skills

Here we will describe how a tutor's advice trains students' self-regulation skills from the viewpoint of the relationship between advice and the transformation of students' questionings. Before describing this claim, we will analyze the relationship between advice and the students' transformed questions.

4.1 What is advice?

There are three typical advice patterns in response to students' questions in the initial phase of tutoring.

Advice #1: You should be more specific when you ask somebody a question.
Advice #2: You should be more specific when you ask somebody a question. There are explanations about CPU's in magazines. Please read them. If you have questions after reading them, I can help you.
Advice #3: You should be more specific when you ask somebody a question. If you make the things you don't know clear, you will be successful and will enjoy learning.

This advice is representative of a tutor's own self-regulation skills, which are informed by the student's questionings and which regulate student's cognitive activities (Kayashima and Okamoto 1999a).

This is made clear when we see that all of the advising statements include the same phrase: " You should be more specific when you ask somebody a question." This phrase means that students should perform conscious cognition of their thinking. In other words, this phrase gives students insight into how a tutor regulates a student's thinking.

4.2 The relationship between advice and the transformation of students' questionings

Here we describe the relationship between the advice and the transformation of student's questions. We claim that the transformation was triggered by the student's appropriation of a advice. This claim is not new and can be found in various studies (Rogoff 1991, Wertsch 1998).

The tutor's advice indicates his monitoring and control: i.e. how the tutor monitored the student's knowledge structure, and how the student should regulate his knowledge structure if the roles were reversed.

What is important is whether students engage in conscious cognition when they receive this advice (Kayashima and Okamoto 1999b). This is important because metacognitive experiences are most apt to occur whenever one engages in conscious cognition (Flavell 1981). By engaging in conscious cognition, the student's thinking can become an object of his cognition. Some students, who engaged in conscious cognition, were aware of their deficient monitoring and then appropriated the tutor's regulation itself. Others did not appropriate it. Although the former student was transformed, the latter was not transformed in the light of questionings. The appropriation of a tutors' regulation might lead to modification of the student's knowledge structures, which then might transform his questioning. In other words, the transformation of students' questions does not necessarily mean that the student's self-regulation skills have developed. However, the development of self-regulation skill requires the appropriation of a higher self-regulation skill.

5. The training model of self-regulation skills

Now we shall describe how a student appropriates a tutor's self-regulation skill, using the following description:

Monitoring:	monitoring (Agent, Target, Level)	(1)
Control:	control (Agent, Target, Level)	(2)

Here we describe how a learner (Agent) monitors his own or another's cognition (Target) through some monitoring level (Level) as shown in (1) above. Additionally a learner (Agent) controls his own or another's cognition (Target) at some control level (Level) as shown in (2) above. The agent is a person who monitors or controls. The target is knowledge structures that are monitored by the Agent. The value of Agent or Target is shown as T and L, in which "T" refers to tutor and "L" to learner. The value of Level is "L_i" meaning that monitoring level is i, and "L_{i+1}" means that monitoring level is higher than "L_i".
We describe a learners' questionings and a tutors' advice as follows:

Questioning:	tell (Agent, Others, To do)	(3)
Advice:	want (Agent, Others, To do)	(4)

We describe that a learner (Agent) asks a tutor (Others) a question as shown in (3) above, because a learners' questionings imply that they tell tutors their immediate antecedent cognitive actions (To do). As tutors (Agent) want learners (Others) to engage in proper cognitive actions (To do), they advise. Therefore we describe advice as (4).

As students' questions at the initial phase of the tutoring represent their awareness of incomprehensible concepts, we describe them as (5). This monitoring level is "L_0", because students were only cognizant of incomprehensible concepts. The advice received from their initial questions represents that tutors want learners to regulate their knowledge structures in the same way the tutor regulates learners' knowledge structures. It is a higher level than one that was initially seen in their questionings. We describe it as "L_i"(i>0). This we also indicate as (6).

tell (L, T, monitoring(L, L, L_0)) (5)
want (T, L, control(L, L, L_i)) (6)

Now, we describe how a learner appropriates a tutor's self-regulation skill; especially regulation as follows. We describe that the learner appropriates the tutor's regulation skill following a learner's questioning and the subsequent tutor's advice as shown in (7) below. That is to say, the learner appropriates the tutor's regulation skill: control (L, L, L_i). It should be noted that "control (T, L, L_i)" is the same as "control (T, L, L_i)" in "want (T, L, control (T, L, L_i))". Thus the appropriation might engender the learner to modify his knowledge structures. The transformation of his knowledge structure leads the learner to ask a question that has a different communication goal from that of his initial question. This is shown as (8) below.

tell (L, T, monitoring(L, L, L_i)) (8)
<-tell (L, T, monitoring(L, L, L_0)) (5)
& want (T, L, control(L, L, L_i)) (6)
& control (L, L, L_i) (7)

This model of training self-regulation skill indicates that learners use appropriate questions by the appropriation of the tutor's self-regulation skill.

6. Conclusion

We propose a prototype model for training self-regulation skills. This model is based on question-answer dialogue, and is also based on the view of a user's internalization of another's self-regulation skills as users appropriate them.

If we develop the model, we can create a new, effective advice discourse and improve learning through changes in a student's self-regulation skills.

In further work we intend to explore what advice encourages a students' appropriation of a tutor's self-regulation skills, specifically, what advice becomes the object of conscious cognition. Solving this issue, we could then utilize more effectively this model for training self-regulation skills.

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How Do We Know Whether To Plug In Or Out: The Quintessential Question for Education/Learning Enhanced Through Technology?

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Abstract: How do we know whether or not to Plug-in or out" is the most important question educators must answer before the first dollar is spent on technology. And if money was spent on technology without improving learning, the plug should be pulled. Insights and criteria for such a decision are provided within this paper's analysis of brain operations, technology enhanced learning opportunities, research study comparing learning styles with technology self-efficacy, and a review of assessment strategies. The two guiding questions for this paper are: What technology-based activities are associated with brain-based learning and how is the effectiveness of technology assisted learning measured. The authors assert that technology can be a powerful tool for teaching and learning and more and different ways to assess technology's effectiveness are needed.

Brain Boosting with Technology

Brain boosting (analogous to rocket boosting) is the process of harnessing the natural powers and functions of the brain for effective and efficient learning. Brain Boosting requires an understanding of brain development potential components (multiple intelligences, brain operations, and types of thinking). The following tables offer a review of these components and link them with technology activities. They illustrate how technology can be an additional brain booster to launch the potential of students.

Multiple Intelligences

Howard Gardner revolutionized educators' understanding of the brain's potential through his Multiple Intelligences theory. He redefined intelligence as "the ability to solve problems or to make something that is valued in one or more cultures" (Checkley, 1977, p.9). According to Gardner, students are smart in a combination of at least eight different areas. Multiple Intelligences theory and categories within it should not be used to classify people, but should assist in understanding, planning, and evaluating the teaching and learning process. Each person has two or three dominant intelligences that he or she uses to complete daily tasks, solve problems and respond in stressful situations. Teachers should provide multiple opportunities for students to learn and demonstrate their learning through all these intelligences. Numerous opportunities to explore and develop different intelligences are found on the Internet (Table 1).

Multiple Intelligences and Internet Activities

Intelligences	Ability to create or use…	Internet Activities
Linguistic	Language, words and verbal expressions	Newsgroups, List Servers, e-mail, Chat Rooms, access to Libraries through the world, on-line journals, Bulletin Boards and text used in most sites
Logical-Mathematical	Sequential and deductive logic and reason, and mathematical and scientific methods of problem solving	Access to current researchers and data bases, information and site data analysis, math and science game sites, scientific gaming simulations, NASA's Quest Program, Global SchoolNet Foundation and sequential problem solving opportunities in most sites

Spatial	Colors, dimensional relationships and holistic and contextual reasoning	Tours of greatest museums around the world, virtual reality sites, video bits, 3-Dimensional representations, Clip art and colorful displays and graphical environments used in most sites
Bodily-Kinesthetic	Hands and body movement for expressions, coordinated movement and model building	Olympic coverage, Centers for Health Research and Statistics, NCAA online, Gaming Zone, and haptic and item manipulation skills found in basic keyboarding skills and most games
Musical	Hear, recognize, remember, manipulate and create sounds and patterns of music	Rock & Roll Hall of Fame, Classical Net, House of Blues, Music on the Web, Piano page and musical backgrounds in sites or sound files with various texts
Intrapersonal	Self understand, reflection and personal power	Personal Home Pages, on-line portfolios, personal thoughts and reflections expressed in E-mail, listservers and discussion groups
Interpersonal	Make connections among other people, influence, understand and produce well with others	Telementoring, Youth in Action sites, on-line discussion groups, travelers' guides, virtual tourists, electronic villages, CyberPals, Senior Sites, MicorMuse
Naturalistic	Discriminate among living things and sensitivity to features of nature	Electronic field trips, Natural Geographic Society for KidsNet, Save the Environment Sites

Table 1: Describes Gardner's different multiple intelligences and links these with potential Internet activities.

Brain Operations

Through brain mapping (observing and analyzing the neuron firings in human brains) the biological paths and processes for learning are defined. When these paths and processes are linked with variables of learning with technology, certain strengths of learning with technology appear and the surface validity of incorporating technology into the teaching and learning process is revealed (Table 2).

Linkages of Brain-Based Learning with Technology

Brain Based Learning	Learning with Technology
Affective Learning	It is fun, novel and students feel in control. Most Internet sites require students to hear, see and do the content.
Neural networks reinforced through repetition	Consistent communication protocols reinforce linear thinking process in some areas (not the Internet).
Concepts learned must be used for transfer from short term to long term memory	Active manipulation of data and/or skills on a site requires learners to do something with the information, thus aiding the transfer from short term into long-term memory.
New learning builds on past learning networks	Instructional design and hypertext allow learners to start and review basic concepts and build upon those with additional links.
Problem Based learning requires cross-brain neural activities	Many internet activities are contextual and problem based requiring students to research an issue and/or manipulate data. This requires brain activity across different brain operations and memory centers.
Ninety minute energy cycle of the brain	Activities and stimuli change so frequently in Internet and software programs that the sensory habituation is less noticeable.

Table 2: Links components and concepts of Brain-Based Learning with technology activities.

Types of Thinking

When types of thinking are added to the mix of understanding of brain capacities (intelligences) and how it works (brain operations), the foundation for knowing what and how to assess begins to appear. Blooms' Taxonomy, Scriven's Critical Paradigm, and Ouch's Creative Thinking steps are excellent schemas to provide an overview of types of thinking. Think of each of these as three rocket boosters to launch aspiring stars—your students.

Blooms Taxonomy

Bloom's Taxonomy, an educational benchmark of concept mastery for years, prescribes levels of thinking. These levels are matched with technology activities in Table 3.

Bloom's Taxonomy and Technology Activities

Type of Thinking	Technological Learning Activities
Level 1 = Recall	Drill & practice software, presentation and reference software, electronic spelling test, math drills
Level 2 = Understanding	Tutorial software, integrated learning systems, reading comprehension series, virtual field trips
Level 3 = Application	Problem solving, gaming, thematic software, virtual reality, Sciencelabs
Level 4 = Analysis	Databases, spreadsheets, reading for critical thinking series, "Science Court", "Carmen SanDiego"
Level 5 = Synthesis	Writing across curricula, Humanities software, Web page builders
Level 6 = Evaluation	Computerized testing, electronic portfolios, grade books

Table 3:Lists categories of Bloom's taxonomy and illustrates technology activities for integration into curricula.

Critical Thinking

Critical thinking is defined as a set of characteristics and steps to process and generate information.(Scriven, on-line and Elliott, 1966). Universal characteristics and steps for critical thinkers with potential technology activities are listed in Table 4.

Critical Thinking Characteristics and Steps with Technology

Critical Thinking Characteristics	Technology Based Activity
Illustrative Thoughts	Visual mapping and design programs
Accuracy	Internet and TV information examined for accuracy and conflicting data
Consistency	Use of spreadsheets and tables to track information
Relevance	How recent and credible is the author of sources of information.
Depth including complexities	Hyperlink branching for more knowledge in CAI and Internet
Breadth with others viewpoints	Discussion Boards and Chat Rooms
Fairness	Examine articles and videos for presentations of arguments & opinions
Precision with details	Table and charts to visually organize information for comparison
Logic	Programming logic. Discovery programs
Critical Thinking Steps	Technology Based Activity
Distinguish between fact & opinion	Analyze news and articles for facts
Recognize language bias	Compare and contrast viewpoints. Highlight in different colors bias

	and emotional language
Research for Accuracy	Check out assumptions with facts, search multiple sources
Analyze arguments based on facts	"Reading for Critical Thinking", "Science Court", "Thinking Things"
Explore all perspectives before making a decision	Problem solving software and games, integrated science and critical thinking curricula
Present and defend arguments	Videotaping of arguments, bulletin and discussion boards

Table 4: Describes Elder's and Paul's characteristics and steps of critical thinking and list activities for technology integration.

Creative Thinking

Creative thinking (third rocket booster) is related to critical thinking (second rocket booster) but not the same. Critical thinking does not require creative thinking. A comparison of the components of critical and creative thinking finds two clear distinctions. First, there is the presence of emotion in creativity and its controlled absence in critical thinking. Secondly, creative thinking requires divergent thinking (generating a range of acceptable ideas) and critical thinking process requires convergent thinking (one acceptable solution). These distinctions are critical to assessment and evaluation process and outcomes measures and instruments.

Howard Gardner describes a creative person as "one who regularly solves problems, fashions products, defines new questions in a domain that is considered novel but that ultimately becomes accepted in a particular setting" (1993, p. 35). Creative thinking includes problem solving, initial novelty, and ultimate acceptance by others. Eight stages of the creative process are identified and listed with technology activities in Table 5.

Creative Thinking Steps and Technology

Creativity Component	Technological Learning Activities
Germinal Phase	
Willingness to try new ideas	Fun and exploratory software, fantasy games
Explore new ideas	Internet, encyclopedias, "CAD" programs
Brainstorm without judgment	"Inspiration", "Semantic Mappers", "Kid's Pics"
Evaluate strengths and weaknesses	"My teacher is an Alien", "Dr. Brain", "Widget Workshop"
Rest awhile (incubate ideas)	Play musical CD or take a virtual field trip
Practical Phase	
Apply ideas to task	Create story book, "Metacreations", "Print Artist", "SimCity", drawing packages
Create something new or solve a problem	Problem solving software, Hyperstudio, SoundCompanion, Multimedia projects
Share product with others	Bulletin Boards, file exchanges, Web publishing, contests and activities

Table 5: Describes Oech's creative thinking steps and potential technology based learning activities.

Learning Styles and Technology

When traditional learning style theories are applied to teaching and learning with technology, it is expected that linguistic, visual, kinesthetic, global and specific learners will succeed with computers. An interesting study went beyond these traditional expectations and compared conceptual thought processes with computer usage.

In this study, three instruments (a computer technology questionnaire, a computer user self-efficacy scale, and a learning style inventory) were given to 152 employees (mostly teachers) in a large metropolitan school district who were enrolled in computer training. The findings included a significant relationship among convergers (people who prefer abstract conceptualization and active experimentation) and computer efficacy and no significant relationship between learning styles and a most or least preferred software application.

Interesting implications for staff development and integration of technology in teaching and learning activities emerged from this study. Among these implications are questions about how to effectively measure technology assisted learning activities.

Assessment/Evaluation Strategies (process & outcome) to Measure

How do we know if the teaching and learning process is conducive to brain potential, operations and types of thinking (rocket boosters) is the purpose of process (formative) assessments. Outcome (summative) assessments measure the learning outcomes. (Did the rocket boosters work and was the rocket successfully launched into the appropriate orbit?) Traditional assessments--essays, multiple choice tests, true-false tests and standardized normed tests—were and are frequently used to assess learning with technology. Traditional assessment are adequate in measuring some levels of thinking but need to complemented with newer assessment strategies to capture the variety of learning possible with technology enhanced learning. With new technologies in the teaching and learning process, there appears an emphasis on non-traditional forms of assessment such as authentic assessments (portfolios and journals), project based learning products, and rubrics. Different types of assessments are matched with types of thinking in table 6.

Current Assessment Strategies Matched with Types of Thinking

	Recall	Understanding	Application	Synthesis	Evaluative	Creative	Convergent	Divergent
Essays	X	X	X	X	X	X	X	X
Multiple Choice Tests	X	X	X	X	X		X	X
True-False Tests	X	X	X	X	X		X	
Standardized Normed Tests	X	X	X	X	X		X	
Authentic Assessments (Portfolios, Journals)	X	X	X	X	X	X	X	X
Project Based Learning Final Products (i.e. papers, videos, etc)	X	X	X	X	X	X	X	X
Rubrics*	X	X	X	X	X	X	X	X

(*Rubrics are tools used to measure process and outcomes in authentic assessments and project based learning.)

Table 6: Current assessment strategies matched with types of thinking.

As noted in the table 6, the traditional assessment will measure most types of thinking, but the reliability and validity with a variety of learners and learning outcomes are often questioned. Non-traditional assessments are critical for measuring creative thinking. The current practice of predominately using traditional assessments for basic skills and the non-traditional assessments to assess creative and problem solving products reflecting learning with technology creates a disbeneficial dichotomy.

A need for a new paradigm of assessment emerged with the integration of technology in the teaching and learning process and the predominance of constructivism theory or techniques in technology integration. As we are teaching and learning in new ways, we need to measure the process and outcomes in different ways. In order to fully capture the richness and vastness of teaching and learning that integrates technology, a bridge connecting the traditional assessments for convergent thinking and the nontraditional assessments for divergent thinking is needed. Normed quantitative tests measuring concept recall and understanding often miss the unexpected insights of creative problem solving. From another perspective, too often, qualitative portfolios and projects fail to explicitly assess basic concept mastery. Since standardized objective competences are predicted to remain an emphasis in school achievement, they need to be explicitly addressed in the constructivist and project based learning assessments.

Conclusion

How do you know when to plug in or plug-out? The plug-in or out decision should be made by examining whether or not the teaching and learning process is more effective and efficient (complementary to brain potential and processes and types of thinking) with technology. (Did the rocket boosters work to their full potential in combination with each other and was the human spirit—rising stars---students launched.) Individuals should make this decision based on: 1) the process and types of learning to be assessed and 2) findings from outcome instruments that measure basic skill competencies as well as creative meaningful application. Thus, the decision of Plugging-In or Out is an informed decision based upon assessment data and the potential of launching our students as all-stars!

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IT Practice from Theory. The Need for a New Paradigm.

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Abstract: IT is seen as having the power to transform teaching and learning. Extensive commitments have been made to its use throughout education. In some ways IT has been successful but it has not always achieved its intended aims. It can be argued that this is because IT's introduction and implementation has not been based on an appropriate pedagogy. IT's power renders aspects of existing pedagogical understanding obsolete. What is required before we can be truly successful is a new paradigm. Within the area of electronic communication a social constructivist position can illuminate our current position and show how best to use the technology to support teaching and learning in undergraduate degrees in the future.

This paper is intended to be of interest to individuals involved in initial teacher education.

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Throughout the Scottish education system extensive investment has been made in Information Technology (IT). A number of reasons have been given for making greater use of this. Not only is it viewed as being cost effective it is also seen as encouraging flexible and independent student learning. Increasingly IT is used as a medium for delivering significant parts of degree programmes. More widely there appears to be an ever growing consensus that IT will continue to expand its role as a medium for learning. Often though claims regarding its efficacy are not fully substantiated. It is not uncommon for little detail to be given. At times it can seem that it is enough to describe the proposed practice without offering either an overarching rationale or an examination of the proposed pedagogy. Even when a theoretical justification is given it can be less than rigorous.

For example, Fischer (1997) argued that work was an increasingly collaborative effort among colleagues and peers and this process was being accelerated by the use of ICT. Learning was becoming, "a new form of labor." (p 9). Although the notion of the development of, "collaborating communities of practice," is appropriate the paper tends towards a restricted view of the nature of learning. Knowledge seems to be seen as a series of facts and the transmission of knowledge is emphasised. Fischer argued that the effective use of ICT allowed the delivery of the, " *right* knowledge at the *right* time to the *right* person and in the *right* way." (p 12). Although IT systems do allow access to vast numbers of facts, an overemphasis on this not only devalues knowledge itself, it also suggests a limited view of both the nature of learning and the complexity of the relationship between learner and teacher. Astleitner and Sams (1998) explain that there are numerous examples of such limited expectations and argue that the majority of World Wide Web sites designed to support student learning either directly or indirectly seem to equate learning with the transmission of facts. They go on to suggest that what is needed is a, "firm foundation based on pedagogical principles in order to provide the theoretically founded knowledge necessary for extensive and high-quality support for teachers." (p 85)

Personal experience suggests that although the use of IT in both schools and universities has made some impression it has not had the impact on learning and teaching some of its loudest proponents have anticipated. In Scotland a rationale for the introduction and use of IT in higher education was outlined in the MacFarlane report (1992). This initiated a series of developments throughout those institutions involved in initial teacher education (ITE). These included the development of policies confirming a commitment to the role of IT within teaching and learning settings, extensive investment in both hardware and software for academic staff and the introduction of relevant staff development programmes. Further provision was made to allow students access to both IT facilities and appropriate support. A number of innovative developments resulted including, SPRITE (1993), STARS (1997) LTDI (1997). It has been subsequently argued by Simpson *et al* (1998,99) that the innovative expertise developed by individuals through involvement in these activities has not been widely disseminated amongst staff in the institutions and that impact on the organization and structure of teaching activities has been limited.

Within the Edinburgh undergraduate ITE programme IT has been successful in changing the experience of students in lectures. For example the publication of notes in an electronic format means that students no longer need to take extensive notes and can focus on the lecturer. The lack of frequent pauses to allow for students completing note taking has meant that there can be more effective interaction with the content of the lecture. Students and staff now have access to a wealth of information so extensive it could be held by no traditional library. Email has proved to be a highly effective method of conveying administrative messages to students and dealing with their questions of a similar nature. Although somewhat reluctantly students have been prepared to use email to describe aspects of their professional activities. However the introduction of the technology has not proved to be as successful with the more academic aspects of student work. Students have not been prepared to use email to hypothesise, discuss or attempt to refine their understanding of professional issues. It would appear that this is not because they are unsure of how to use the technology, there is a lot of evidence of a high degree of technical proficiency in using the medium. It appears that young people use informal networks to effectively develop their skills in the use of this technology, at times innovatively adapting them to meet their own needs and priorities. Nor is it because students are unaware that it can be used for open-ended discussions, even a brief examination of student bulletin boards will show evidence of spontaneous discussions about a range of non-academic subjects. Some of these can show evidence of development in the participants' understanding. It can be argued that Astleitner and Sams (*ibid*) view that a stronger theoretical underpinning is required if IT is to be used effectively to support academic work, is correct.

An essentially Vygotskian perspective seems to be able to offer this theoretical underpinning. Vygotsky (1978) defined the zone of proximal development (ZPD) as the distance between the, "actual developmental level as determined by independent problem solving and potential development as determined through problem solving under adult guidance or in collaboration with more capable peers." (p 86) This implies not only that the mind has a potential for development but that it can develop in a range of different ways. The manner and direction of this development depends not only on the assistance given by adults and more capable peers but also on the socio-cultural environment. Tulviste (1991) argues that within any given society thinking develops in accordance with the types of activities in which people engage. By engaging in culture specific activities people develop higher mental processes that are appropriate for culture specific tasks. The mind itself constantly evolves as individuals find themselves facing new challenges.

According to Tharp and Gallimore (1988) to understand learning in the ZPD three concepts are important; situation definition, intersubjectivity and semiotic mediation. In any given situation an experienced practitioner may define it differently from a novice. For example, an experienced teacher tends to be more perceptive as to what is important in classroom situations and shows more sensitivity to the subtle characteristics of the classroom than a student teacher. This is situation definition. Once the novice has reached an understanding that allows him to generate a definition of a situation that is in tune with that of the experienced practitioner intersubjectivity has been achieved. This is a qualitatively different understanding of the situation to that held previously. Intersubjectivity is achieved through semiotic mediation, that is through dialogue between the experienced practitioner and the novice. It is through this that the novice's understanding of what needs to be done develops. With the experienced practitioner's support the novice moves towards their mentor's understanding of the situation. Intersubjectivity is achieved when their understandings overlap.

It is possible for the novice to progress through the ZPD. Tharp and Gallimore (*ibid*) suggested that this progression goes through two stages. Initially assistance is provided by the, 'more capable others,' who explicitly advise and support the learner. Over time intersubjectivity develops and the support becomes less explicit with the novice taking more responsibility for the situation. Eventually the processes become, "internalised, personalised, adapted and owned," by the novice. This is the end of the first stage.(p 252). Stage two is when the, "assistance is provided by the self." The responsibility for the task has shifted from the experienced practitioner to the learner. At this point the relevant processes are not automatic. Tharp and Gallimore argue that this stage is, "intermediate between external regulation and full individual competence. It may also be seen as the stage in which the voice of the regulating other is gradually acquired by the learner so that the regulations may be stated self to self, gradually taken underground, transmuted into thought and eventually discarded as behaviour becomes fully developed and adaptively automatic." (p 253).

Vygotsky (1986) suggested that intellectual development takes place on two planes. The first is the inter-mental plane which is between people in social and cultural situations and the second is the intra-mental plane which is the internalisation of the inter-mental processes. The implication of this is that higher mental functions are carried out in collaboration with others in a range of settings. Language, therefore, must play a central role in their development and internalisation. Vygotsky considered language to be an important tool for thought and problem solving. "Thought is not merely expressed in words, it comes into existence through them." (p 128) Language allows individuals to examine thought, clarify it, explore contexts, solve problems and identify connections. It is an important aid in structuring and refining thoughts.

Learning is a complex process. It is about developing understandings and making links rather than just the transmission of facts. It is influenced by the culture of the society in which the learner resides. It is not a solitary experience but something that happens in a social context. Interaction with others is central to the learning process. Language, both oral and written, has very close links to learning. Not only is it used as a means of communication but it is also central to the thought process and hence to learning itself.

As IT can be used to facilitate communication it could be seen as having a role to play in supporting this type of learning process. As with all activities that lead to learning its structure needs to be appropriate to its purpose. Electronic communication opens up possibilities for dialogue that could be used to support effective learning. It is not as spontaneous as oral language and does not contain the non-verbal cues that are involved in verbal interactions. It is less formal and more flexible than traditional methods of written communication. Although arguably not a totally new genre of communication it does have advantages over more traditional methods. These include:-

- allowing communication over distances that would otherwise be prohibitive;
- allowing access to expertise that would otherwise be unavailable;
- allowing groups of individuals with shared interests to exchange views in a common forum;
- helping the writer to express views they would be reluctant to share in a 'face to face' exchange;
- facilitating communication through its asynchronous nature.

It would seem therefore that it should be a highly effective medium for supporting learning and helping the learner progress through the ZPD. It has the potential to be used to develop thinking as well as communicating with both mentors and peers. Within the context of initial teacher education (ITE) there would seem to be potential for using electronic communication to develop student understandings during their times in the Faculty when they are not being directly taught. It would also seem to be an ideal medium for supporting students when they are involved in school placements outwith the Faculty.

This potential for IT to transform teaching and learning within educational establishments has been widely predicted. For example, Lewis (1999) argued the emergence of a pedagogy arising from, 'constructive learning,' stressing learner choice and multiple routes to outcomes. Pellegrino and Altman (1997) amongst others have speculated upon the processes of change, the forms these changes may take and their potential desirability or otherwise.

In the past it has proved difficult to bring about significant change in educational practice and, as stated previously, there is some evidence that pedagogical change relating to the use of IT is not unproblematic. In practice centrally planned initiatives tend to have only a limited impact on teaching and learning. Brown and McIntyre (1993) argued that within education, professional practice involves complex judgements, the process of which experienced practitioners have internalised to such an extent they appear to operate with a superficial simplicity. In contrast to a centralized approach to change it can be argued that a different approach is needed if a lasting change in educational practice is to be achieved. Within this model the educators themselves generate new concepts and frameworks through their roles as reflective and controlling participants in innovation.

It is not enough to introduce electronic communication into any learning situation and expect it to transform learning and teaching. Although applying existing pedagogical principles helps its effective use what is needed is a further exploration. The technology does have potential to transform but before this can truly happen we need to revisit our theoretical understandings. What is needed is a new paradigm.

Instructional Technology:

Practical Application Alignment With Theory In Student Teaching Field Placement

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Abstract: This case study explores what student teachers learn about practical classroom instructional technology applications within their elementary field placement and any underlying influences on student teachers implementing instructional technologies in the elementary are described along with their cooperating teachers' accounts of factors in the school that either promote or inhibit professional technological growth.

Student teacher/cooperating teacher participants were placed into *buddy system* configurations. These pairings served to investigate a) What effects do instructional technology using educators have on non-instructional technology using educators? And, b) What effects do non-instructional technology using educators have on instructional technology using educators?

When looking for ways schools of education can successfully merge instructional technology theory with classroom practice, three themes emerged: a) collaboration and rapport; b) self-directed learning; c) equipment: time and availability.

Introduction

Seventeen years ago, *A Nation at Risk* (United States Department of Education, 1983) addressed the need for secondary students to take a computer course prior to high school graduation. Standard course work emphasized programming in BASIC. Computer literacy was rarely considered in preservice education curriculum. Today, The Department of Education officially views technology as a change agent for public school systems.

With a new century upon us, educators are witnessing a convergence of brain-based research, technological innovations, a new culture of students, *au courant* learning theories, and a federal agenda to place computer-based technology into the nation's K-12 classrooms. This notable amalgam of developments combined with the exponential growth of the World Wide Web and newly published National Educational Technology Literacy Standards (International Society for Technology in Education, 2000) for teachers and students provide promising new implications for teaching and learning. As a result, schools of education are becoming points of egress for encouraging, modeling, and training preservice teachers to effectively synthesize computer-based technology into their newly developing classroom methodology. "The effect of computer-based learning technologies in facilitating student learning and performance is seen only when participants have the knowledge and skill to use the technology" (Fulton, 1998, p. 1).

The United States Department of Education (2000) found 66% of public school teachers integrated technology into classroom curriculum "compared to 47% of teachers who reported feeling somewhat prepared and 14 % of teachers who reported feeling unprepared" (p. 89).However, schools of education infusing the technology standards to already overcrowded teacher certification programs have developed into a slow course of action. According to Thomas, Larson, Clift, and Levin (1999) technology is best infused in all preservice education coursework. The "autonomous course model" subtly promoting learning technology applications was "not valued by students" and they were "seldom able to incorporate technology into their own curriculum" (pp. 4 - 5).

A predominate inconsistency exists between many schools of education faculty technology knowledge base and what they are training preservice teachers to do. Only 40.4% of faculty members indicated moderate to high proficiency in instructional methods for integrating technology (Vannatta, 1999, p. 1485). Queitzsch (1997) discovered major technology concerns directed toward faculty curriculum integration and student field placements. Students deserve teachers who model the best that technology can bring to learning (Topp, Thompson, & Schmidt, 1994; Jinkerson, 1995; Kortecamp, 1995; Queitzsch, 1997).

How can schools of education successfully merge instructional technology theory with classroom practice? This study is primarily concerned with investigating the student teaching practicum from the student teachers' viewpoints of being prepared to effectively integrate computer-assisted learning and instruction into their classroom practice. This will include underlying influences on student teachers implementing instructional technologies in their classroom practice. Emphasis will be directed toward revealing any internal and external support mechanisms and/or curriculum methods to better encourage appropriate proficient integration.

The Study

Participants for this naturalistic case study consisted of three elementary education student teachers enrolled in their final student teaching semester and their respective cooperating teachers. The field experience study site has a national reputation of being one of the premier school districts in the area and a reputation of one of the best and most progressive especially in the area of technology. Each classroom teacher is equipped with a personal use windows platform networked computer. All classrooms has four or five additional networked computers as well as a color printer. Teachers have access to the school server for bulk license purchased educational software, Internet access, and student project storage.

By placing student teachers in the same field placement elementary school site, participants had access to the same technology. This was important in investigating individual views of a technology-enhanced teaching environment and its underlying influences on implementing instructional technologies during the student teaching practicum. Noteworthy student teacher study outliers included technology experience prior to admission to the education program, school of education instructors, and cooperating teacher designation.

Paring was in a *buddy system* configuration (Carlson & Gooden, 1999). It intended to provide insight into how partnering of differing technology competencies translated into practical classroom application as well as the advantages and disadvantages of these field experience pairings. Individual cooperating and student teacher technology ratings were determined by unbiased evaluators served to establish commonalities as well as distinct technology abilities - a key in considering their field placement classroom pairings.

Participants	Pair 2	Pair 3	Pair 4
Student Teacher	Novice	Nearing Proficiency	Proficient
Cooperating Teacher	Nearing Proficiency	Proficient	Proficient

Table 1: Study Participant Pairing Configuration by Instructional Technology Competencies

Patton (1990) subscribes that there are three classical methods of generating qualitative data: reading (document analysis), talking (interviewing), and watching (observation). The general design of this study incorporated all three classical methods.

The first phase of the case study is biographical in nature. Participating preservice and cooperating teachers participated in an informal interview early in the student teacher's field placement experience. The informal interview introduced the study and allowed the researcher to better understand each participant's interests and concerns regarding the study. Interview questionnaires and informal interviews were also used throughout the semester to gain some perception into what teaching and computer-based technology means to each interviewee.

To better understand the participants' classroom experiences and gather first hand information necessary to furnish detailed accounts, student teachers were observed in their classrooms during the second phase of the study. The primary observational resource was videotaping and the observer remained as non-participatory as research conditions allow. The first observation was made on the first week the student teacher took over the classroom from the assigned cooperating teacher. The middle two videotaped sessions were equally spread as circumstances allow between the first and the last formal week of the student teachers' field placements.

The third phase of the case study entailed reflection and comparison. Student teachers and cooperating teachers were asked about their involvement with technology following their student teaching semester. Additionally, each student teacher's School of Education Summative Assessment of Student Teaching, filled out by both their cooperating teacher and university supervisor prior to teaching certification and filed in the Office of Curriculum and Instruction, was studied for any pertinent commendations (strengths) and recommendations (weaknesses) significant to this study.

Data analysis was the fourth and final phase. After perusing and careful analysis, the themes that became the foci of this report emerged from the data. Even though key factors at times coalesced, overlapped, and intertwined, themes remained distinct. After constructing a matrix of tables delineating the themes and the number of times each of them was backed by the data, I focused on the three that were most heavily supported: a) Collaboration and Rapport, b) Self-Directed Learning, and c) Equipment: Time and Availability.

Findings

The study recognizes that many of the student teacher participants' field experience perceptions corresponds to substantial national data regarding obstacles to and facilitation of a national thrust toward technology literacy. Time quickly emerged as an overlying theme. Data became predisposed to a multiplicity of participant time perceptions influencing technology integration decisions on many levels. The present analysis is congruent with existing research findings citing time as a critical implementation component (Beggs, 2000; The United States Department of Education, 2000; Mitchell & Hutchinson, 1998; Nantz & Lundgren, 1998; Kane, 1994; Sheingold & Hadley, 1990).

Since the first day of the study, participants wrestled with a responsibility overload. Weekly research focus groups were scaled down to bimonthly scheduling. I opted to end the focus group in favor of preceding and / or following each video observation with informal student teacher interviews as well as conversing with participants when I was visiting the study site for supplementary data. However the overlying issue throughout this study was how much time influenced the field placement experience (c.f. Fisher and Dove, 1999; United States Department of Education, 1998).

During many classroom video observations, I witnessed schedule conflicts with technology-enhanced projects. Student teachers related that it is not uncommon for technology acute teachers to sacrifice other content areas for a technology-integrated assignment. Further investigation using informal interviews revealed a pattern of the teaching staff engaging in unofficial reprioritizing of subject area scheduling.

The need and motivation to integrate technology during the field experience waned for two of the three student teachers as the semester progressed (c.f. Thomas, Larson, Clift, & Levin, 1996). Lesson planning was time consuming enough and incorporating goals and objectives involving technology made a demanding endeavor even more so. I witnessed a student teacher's good intentions overridden by not enough time to effectively integrate technology into the lesson plan, to choose software content to supplement the subject area, to prepare the computers for the project, and apprehension about not enough time in the schedule to work all the students through the computer station component (c.f. Medcalf-Davenport, 1999; Larson, Clift, & Levin, 1999; Queitzsch, 1997).

Each student teacher often became frustrated over the amazing amount of time it took their young students to work through technology-integrated assignments and to use technology not typically located in their classroom. A majority of student and cooperating teachers often spoke to considering the time it took to locate and set up technology into viable working mode as a major consideration when integrating it into his or her curriculum.

The preoccupation with time led to a parallel investigation into what factors contributed to these student teacher's coping mechanisms (support system) during their field placement experience. The bonding element between the participant pairs in the study underscored the heavily researched and proven phenomenon of student teachers readily implementing their cooperating teachers' classroom practices in lieu of the university professors' with which they have spent two years of preparatory work (c.f. Calderhead, 1988; Pratt, 1993; Merriam, 1993; Richardson-Koehler, 1988). I observed a direct connection evolve between this study's participant pairs' collaboration and rapport and their individual self-directed learning characteristics. Classrooms became settings for experiential learning - self-directed learning activities involving gleaning and synthesizing knowledge placing student teachers with personal responsibility for their own learning.

Cooperating teachers served as the student teachers' fundamental ongoing transitional support system toward becoming skilled educators. Field experiences provided a mentored trial-and-error authentic learning environment where, hopefully, theory may connect to practice. Participant pairs became collaborators working together in real time, not just in theory - a missing element in their university-based teacher education program. Feedback was immediate. These elementary classrooms represented the bell jar wherein student teachers had daily opportunities to synthesize previous academic coursework, including two previous semesters of school observations, on a conscious level.

Pair One complemented each other's contributions toward increasing curriculum technology integration. The technology literate novice student teacher and nearing proficient cooperating teacher expanded each other's technology literacy base and energized further learning toward a common goal – creating and facilitating a challenging engaging learning environment.

Pair Two's experiences appeared more one-sided. The cooperating teacher's proficient computer-assisted learning and instruction integration methodologies put theory into action for the student teacher. The proficient technology literate cooperating teacher largely affected the nearing proficient student teacher by making him an active participant. Even though the cooperating teacher greatly appreciated her student teacher's technology abilities and contributions to her classroom, she did not learn from the student teacher.

Pair Three's proficient technology literate team appeared an anomaly to this research. The student teacher did not flourish in this technology-rich professionally modeled learning environment. Eventually he reengaged his self-directed learning abilities to become better prepared for class. However, neither the student teacher nor the cooperating teacher grew exponentially in technology integration. Both voiced frustration about the experience.

Recommendations

Teacher educators and administrators working in technology accommodating university environments are ultimately responsible for working toward setting functional integration priorities in motion throughout preservice curriculum. Implementing priorities will emphasize focus on a necessary goal of the educational institution – preparing teachers for the new century of students. Largely, classroom technology integration debates have shifted from *if* to *how* in the last decade – *How can schools of education successfully merge instructional technology theory with classroom practice? How* cannot possibly be approached until priorities shift to facilitating the process.

Recommendation 1: Begin Now

Appropriate computer technology integration should become an automatic response to specific methodological needs prior to student teaching. Teacher educators must begin to transition their own curriculum design toward facilitating this goal. Once the student teacher enters his or her field placement experience, time elements are often weighed against exploring technology integration. Unless more student teachers establish a better comfort level with the latter, integration is often bypassed. So, if and / or when a student teacher becomes overwhelmed from his or her field experience demands, with the proper preservice training, integrating technology should not be interpreted as an overwhelming additional curricular chore.

Recommendation 2: Infuse Technology Into Every Course

Holistic integration is the key. Systematically infusing educational technology into the every teacher education course in some way will assist the curriculum transition toward graduating technology competent new teachers. As teacher educators enhance their own technology-based skills by connecting computers with each facet of school curriculum and instruction, preservice students will begin to connect with technology to contextual learning activities involving age-appropriate, competency-building learning experiences to be used in student teaching. Even beginning observation course could require students to locate instructional technology within the building site and establish a familiarity with reservation procedures.

Educational technology courses estranged from the main body of educational coursework further perpetuated the notion that technology is an entity to be dealt outside the mainstream academic courses. A danger lies in isolating technology from an authentic learning environment. Isolating may translate primarily into a computer application course. However, courses of this type could be renovated to include authentic learning environments where preservice students design and implement technology integrated activities in K – 12 settings.

Recommendation 3: Do Not Assume Assimilation

It is doubtful that teacher educators teach curriculum methodology and content standards around machines. Think of the disservice to education if teacher educators certified new teachers who built lesson plans around equipment, like pencils or color markers, not concepts. Laughable perhaps but novice educators need to be able to assimilate the difference between computer technology applications and integration. Just because preservice teachers can assemble a PowerPoint presentation does not guarantee that they can conceptualize and construct a curriculum implementing PowerPoint that engages higher-order thinking skills. Teacher educators should never assume preservice students have the ability to assimilate theory into practice. The ability to assimilate is not a given for every undergraduate - especially since they have most likely spent at least 13 years in educational systems primarily entrenched in drill-and-practice and memorization.

Recommendation 4: Model, Model, Model

Research proves its importance in student teachers' ability to integrate technology into their classroom curriculum. School of education instructors and administrators must evaluate how to make prevalence in every preservice classroom every day - then set the practice into action as soon as possible.

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Virtual Worlds, Real Minds:
an investigation about children, videogames and cognition

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Abstract
The Virtual Worlds, Real Minds project aims to investigate and understand the cognitive processes that take place when young people play videogames and to provide educators with some insights based on this understanding. Preliminar findings show that traditional, Cartesian ways of thinking can be perceived, along with new, more emotional and interactive forms of viewing and making sense of external stimulae.

Children resemble more their times than their parents
Ibn Kaldum, Arabian thinker, XIV century

Introduction
This research project started when my nine year-old boy asked me to go with him to a videogame rental shop. A new game had just arrived from Japan and he wanted to get it ahead of his friends. He didn't know exactly what the game was about. Needless to say, neither of us knew a single word in Japanese, spoken or (of course), written. This basic fact didn't stop him at the least. He rented the game, we went back home, he inserted the cartridge in his console and wonderfully – started playing. Just like that.
How? It became immediately clear to me that important mental processes were being mobilized at that moment. He was enjoying himself, he was having a good time, but he was learning as he played.
In order to be able to play a new and still "uncracked" digital game, in which written and spoken word were in a different and unknown language, my son had to rescue and apply everything he knew about games and how to play them. And he had to do it "on the fly". The pace and sheer speed of the game didn't allow him time to think. Or maybe it is better to say that he couldn't think in cartesian ways, racionalizing everything as he went along.
It was then that I decided to investigate the processes of thinking and learning that are involved in the act of playing videogames, in the hope of reaching further understanding about the ways the new generations think, communicate and interact. If we could advance our comprehension of the young minds, maybe we could devise more efficient educational methodologies. In other worlds: it is time to develop educational systems that are "in sync" with the generation we are supposed to teach – or to help in their learning.
Videogames were chosen as a particularly relevant subject also because they are pervasive: kids' main use of technology.

The research project
The research has been going on for a little more than an year and some results are being obtained. These preliminary results are the topic of this paper.
The research is part of a broader project being conducted at the Pontificia Universidade Catolica do Parana, a private-owned university in south Brazil. It is a medium-sized institution by Brazilian standards, with about 20,000 students and 1,500 staff members. The Faculty of Education started in 1998 a new area of research called "the Centre of Tomorrow Education", with the aim of studying new educational technologies and methodologies, of evaluating the

impact of these innovations in different educational environments and of helping teachers and academic staff in the difficult task of applying new technologies and methods in their day-to-day work as educators.
The "Virtual Worlds and Real Minds" project is one of the projects presently being carried on at the Centre. It started formally in the beginning of the 1999 academic year (which in Brazil is March) and is expected to take on more year to reach final results.

Methodology
The project comprises field work and analysis. Field work is being done in three different environments: home, videogame rental stores and arcades. The Home environment is itself divided into two categories: console-based videogames and computer games.
The first part of the observation was directed towards videogame home users. Young people from 4 to 14 years old, mainly middle class, living in three different neighborhoods. They were observed and interviewed, both at their home and at six videogame rental shops which agreed to cooperate with the researcher, allowing an interesting comparison between these two playing environments. All in all, the universe of this first stage totalized 54 "regulars" (50 boys and 4 girls) and about a little more than a hundred other kids who contributed to the research in more open ways (some were interviewed but not observed while playing, others were observed only once or twice and were not follow-up, for a number of reasons). Data were collected and registered in a spread-sheet/data base/graphics integrated software. A control group of 8 kids who claimed not to play games at all was identified and interviewed regularly.
Apart from direct observation and interviewing, a large number of materials was selected and analised, such as specialized videogame magazines, fanzines, web sites, books, posters and other related stuff which belong in the gamers universe. Videogames of many different types and systems were seen in detail and played by the researcher (as far as I was able to go...).

Preliminar Findings
For explanatory reasons, preliminary results are shown in three groups:
- classical processes and patterns of tought
- non-cartesian and emotional intelligences
- social behaviour and sociability patterns

Thinking Digital
First, it could be observed that many ways of thinking that educators put a lot of effort into to develop in their students are already being employed by kids when they play their games. Association, generalization, analysis and sintesys, tranfer, projection, simulation, trial and error and a number of others forms, alone or combined, are put into action by the gamers all the time.
It is not in the scope of this paper to present and discuss all those "ways of thinking" and how they operate in the gamers minds and actions. But let's take generalization, for instance. One of the main components of Cartesian/Newtonian processes, generalization occurs when there is not enough data to proceed – so we start from what we have and try to extrapolate the ideas we consider as generic enough (and so, applyable) to the new situation; generalization also happens in the opposite direction, when we have too much data and must discard what is not relevant (for not being generic enough) in order to proceed within a safety error margin. Well, that is what we can see young people doing when they put a new game in their favorite console or when they get to new phases of a game. They advance by grasping – in a wink of an eye – what is relevant and what is not, what must be discarded and what must be fulfilled so they can deal with new situations. Surely educators would love to see their students doing the same when they tacked the contents of a traditional course...
One of the aspects which may present teachers and educators with food for thought is the way gamers deal with error. They are not afraid of making mistakes, of following the wrong turn or of choosing a bad weapon. They know that to err is to learn: error is a natural, necessary part of a learning curve. How different from what they get in schools, where they are taught that to make a mistake is something bad, something to be ashamed of. No wonder they accept a passive role as students while they are so very active playing games.

Thus, kids are not discouraged to play a new game. On the contrary, they love the challenge, they yearn for the new and are nor afraid of facing new obstacles. When dealing with a new game or screen within a game, they think – fast – and they act, without hesitation, on the basis of what they decide, after considering, with mind and body, what should be done.

Emotional Intelligence on the Fly

This complex structure of trial-and-error, of thinking and acting, of seeing and doing, of feeling and knowing, of risk and feed-back, is quite amazing for an adult who were raised believing in the power of rational, logical, processual thinking.

For emotions, intuition, sensibility play a very important part in the world of the gamers. Many times, when a problem arises which is not solvable by association with past experiences, by generalizing, analyzing, transferring, previewing or any other rational way, they trust their feelings, their intuition. "I don't know how, but I was sure I should go that way". They also know that you must keep a delicate balance between being "cool" and relaxed and being keen, attentive, adrenaline-driven if you want to be a good gamer. Emotional intelligence applied...

Sociability in the gamers' world

Other interesting considerations in the educational point of view can be made at this point. For instance, research is very import in the world of videogames. Gamers publish and read magazines, web sites, fanzines and other printed materials. They look into these materials to find and share tricks, suggestions, opinions, open and secret codes, even illegal or a least unauthorized information that show how to defeat a tough enemy, how to get more money or new lives, how to go faster, how to find that secret passage. They also consult more experienced gamers (nothing to do with age: experience is measured by the time one have already spent playing); they build and use a highly integrated network of players; they interact.

In a way, gamers tend to form a kind of "urban tribe" as defined by French sociologist Michel Mafesoli: a post-modern pattern of sociability, in which individuals behave in certain pre-defined ways accepted and valued positively by the group, who derives its own identity as a group from these shared values. This pattern affects the way kids play (and the way they learn) since the ones who interact tend to be more effective in reaching their goals. The isolated individual gamer must rely on his own habilities and often thet are not enough to win ("to zero", to "
tough game. Thus, we may be facing a very interesting case of cooperative, collaborative learning environment.

This may conflict with the highly competitive nature of games, digital or not. In the specific case of videogames, it seems that competition is seen more like a dispute against the machine than against the other players. We can see that in a boy's party (if there is a videogame console available, there is where kids will gather around): young and older kids helping each other to defeat the mean phantom. They don't really care if a friend killed the monster in less time (they will try to better their scores latter); they want to learn how to do it, or how to do it faster or more efficiently.

There is a lot more to games than simple hand-eye coordination. Among other capacities, it can be observed a gain in visual understanding, in media awareness and in the development and use of a multimediatic, interactive language.

Problems over the horizon

On the other hand, an educator can easily see a number of problems in the games kids play. There is violence, for sure. A kind of sublimated violence, as some psychologists argue, or at least the representation of violence. Videogames – a boy's world, for sure. Many games are "politically incorrect", since kids look into virtual worlds usually through the eyes of a white-macho-american hero, who kills everything that moves. They go beyond a sexist view. Here are Nazi fundamentals: everyone who is not like me wish to do me harm; better to eliminate them before they get a chance to eliminate me.

This arguments are nor to be discarded lightly. They suggest a deeper investigation on the sociological and psychological aspects of videogaming, which are beyond the scope of this research. Even so, it can be pointed out that violence, racism, sexism are not inventions of the games industry and would not disappear from the world if games were abolished (as some propose). It is out task as parents and educators to contextualize these issues, to discuss them, to amplify the world of references and values children have access to – then they will be able to make right choices. Is

was noted in this research that some very violent and bloody games are popular, but not played as much as other, more involving and challenging games.
Other negative aspect perceived during this investigation was a tendency, shown by some kids, of over-self-valueing. A good gamer considers himself "the best". He can always find a way to defeat his enemies, to win a challenge, to find hidden treasures. He is so good that nothing is beyond his capabilities. Life outside the game must be the same. He will always be a winner. There are some considerable dangers here, from a narcissistic isolation to a self-centered, egotistic individualism.

Next Steps
Field work will continue with the groups mentioned above and with two new groups: computer-game players and arcade gamers. Those two groups were left out of the first stage of the research because they tend to involve kids older than 14, and in the case of arcade players, from other social stratus.
Analysis of data will be carried on with more attention to statistical procedures and methodologies. Observation and interviewing will continue, with special attention to the control group. Cognitive aspects will be the main issue to be tackled, in the hope that we will be able to deepen our understanding about the ways the new generations think, communicate and act.

As author Douglas Rushkoff pointed out,

"To look into the children's world is not to look back to what we were. Is is to look into the future".

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Communication Technologies: Post-industrial Infrastructure

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Abstract: This work addresses the complex relationship between the post-industrial society and communication technologies. This interaction results in the acquisition and the codification of theoretical knowledge and information that influences the key aspects in the social and technological development, namely: social, political, economic changes. A model was developed to represent the balanced coexistence of technical and human infrastructures in our information era. As a result of the presentation of this model, the readers will gain a new perspective on their position within the multi-level human-technology infrastructure.

Introduction

Technique possesses a universal significance,
for through it a new cosmos comes into being.
Nicholas Berdyaev.

This work investigates the relationships between the two essential components of the technological infrastructure: technical and human factors, represented, respectively, by the communication technologies and the post-industrial society. The paper presents the conceptual macro view of the infrastructure and its surrounding issues discussed in the historical and analytical works by contemporary thinkers in the field of technology and culture. Technology reshapes traditional society, its values, and its routines. Most of the contributors recognize the potential benefits of technology, however, they also express the genuine concern about human mind and freedom. Alongside the infrastructure related topics, the writing introduces multiple interpretations of the impact of modern technological world on the nature of human experiences in social aspects of life. In order to address contemporary issues about communication technology, it is essential that we define what is meant by technology in modern world. The illustration of the evolution of its definition will give us a better picture of the subject matter of our discussion.

What is Technology?

Feibleman defined technology as "the name for the invention and employment of artifacts, and artifacts as materials altered through human agency for human uses. Another name for artifact is tool" (Feibleman, 1982, p. 74). Neil Postman (1997), the author of the article "Defending ourselves against technology," makes a distinction between a technology and a medium. He states the following: "As I see it, a technology is a medium as the brain is to the mind. Like the brain, a technology is a physical apparatus. Like a mind, a medium is a use to which a physical apparatus is put. A technology becomes a medium as it is given a place in a particular social setting, as it insinuates itself into economic and political contexts. A technology, in other words, is merely a machine, a piece of hard wiring. A medium is a social creation" (p.229). He also presents the idea that it is possible for a technology to be used in a manner in which "its social, economic and political consequences are quite different from one culture to another" (p. 229). In different cultures and languages, philosophers defined technology in different ways.

The French word *technique*, and German *Technik*, are usually put into English as "technology" (except by Lewis Mumford, who calls it "technics"), and the English word "technique" means something else: "a technical method of accomplishing a desired dream" (Webster). Ellul's usage of *technique* in both French and English is vastly broader still: the totality of all rational, efficient methods in every field of human activity. In other words (those of his translator, John Wilkinson), technique is "nothing less than the organized ensemble of all individual techniques which have been used to secure any end whatsoever"(Susskind, 1973, p. 89).

Jacque Ellul (1964) sees technology, *la technique,* as an ensemble of technical means, a totality of means that operates at its best efficiency. Langdon Winner (1977) in Chapter II "
widely recognized work *Autonomous technology* views technology in the following way:

A technique is a structure of human behavior designed to accomplish a definite outcome. A technical organization is an assemblage of human beings and apparatus in structured relationships designed to produce certain specific results. A technical operation, to the extent that one engages in it, determines what one does (p. 75).

It is certain that technology does not exist in a vacuum. The interaction between humans and technology is taking place at many levels. The technological phenomenon is a constant of human history. The paradox is that culture cannot exist without technique and technique will not exist without culture. According to Marx, humans make their world, but they are also made by it. *The idea of paradox, the dualism, "the double edge sword" type of relationship is the characteristic of the interaction between humans and technique of modern era. This very idea of paradox, the dualism is one of the central themes of this work.*

To Ellul, the greatest wonder of our time is the integration of people and society into the complexity of the technical world. The final definition of the technology in this paper can be formulated as a multi-complex interrelation with life, society, and the environment. Lewis Mumford (1983) in the article "Technics and the nature of man" refers to the classic Greek usage for technics that "makes no distinction between industrial production and art; and for the greater part of human history these aspects were inseparable, one side respecting objective conditions and the functions, the other responding to subjective needs and expressing sharable feelings and meanings" (p. 81).

Technique may be understood in a broader and narrower way. One word stands for both industry and art: another means to make, to create with skill. We speak not only of an economic, industrial, military technique, a technique of transport and the comforts of life, but also of a technique of thought, versification, painting, dancing, law, even of a spiritual technique (Berdyaev, 1983, p.203).

In connection to the definition of the *technique* that contributes to the understanding of its meaning, it appears necessary to present its defining characteristics in the context of modern time due to its special position in our life.

The Characterology of Modern Technique

According to Jacque Ellul (1964), "the technique of today has the same characteristics as all preceding techniques" (p.62). Yet, "primitive techniques have no reality in themselves; they are merely the intermediary between man and his environment" (p. 63). Modern phenomenon is that due to the advancement of its features" today's technical phenomenon has nothing in common with the technical phenomenon of the past" (p. 78). Rationality and Artificiality are two obvious characteristics of the technical phenomenon. Self-augmentation "can be formulated in two laws: 1) in a given civilization, technical progress is irreversible; 2) technical progress tends to act, not according to arithmetic, but according to a geometric progression" (p. 89).

Winner (1992) writes: "any suggestion that there be a slowdown, limitation, or moratorium on scientific inquiry, research, and development is unthinkable at present" (p. 66)."Technological determinism stands or falls on two hypotheses: 1) that the technical base of a society is the fundamental condition affecting all patterns of social existence; (2) that changes in technology are the single most important source of change in society" (p 76). A restricted technology does not exist.

The Technological Imperatives show instrumental and economic requirements. "Vertical integration is the state of affaires in which the output of one operation becomes input for the next. Ellul labels the same phenomenon "monism" and "the necessary linking together of techniques" (Winner, 1992, p.101). The technological systems have an inherent tendency to set a complex of linkages that continues beyond society's original anticipation. We do not know the outcome. We are not able to decide what is best, or what should be.

For Winner, technological advancement is characterized by industrialization means in social, technical, economic structures to support the large-scale production of goods, mechanization, rationalization, modernization (dynamism, extension, size and concentration, division, complex interconnection, interdependence, centralization, apraxia, universality, pervasiveness, irreversibility, inevitability, positive destiny), growth or "progress". Langdon Winner, altogether with the characteristics of modern technique, presents one aspect of the paradox, the master-slave paradox, the issue of control. He asks why technology is problematic. And he answers: "It changes itself and its development generates other kinds of changes. The major concern is the issue of human autonomy and the loss of mastery. One idea is that technique is believed to be a reality in itself and to have its own special laws. On the other hand, the modern history of technological change is "a diverse collection of patterns rooted in the specific choices that individuals, groups, and nations have made for themselves and imposed on others" (p. 54).

Ellul agrees with Winner that in technological society we are all technicians who do not have much of a consciousness, which puts us into a position of peasants who could not control their destiny. The rules of the game have changed. Technology has a trend to be a new God. Technological impact is so great and complex that men no longer can cope with it as a means, and therefore, it is more an end-in-itself. Men must adapt themselves to it.

Winner is also concerned about this very issue of reversed adaptation and the dual nature of technology that in not neutral in his view. It is ambivalent. Technology is not neutral. It is both, good and bad. It constantly interacts with humans who are praising it and trying to escape from it at the same time. It always produces "winners" or "looses." Postman (1997) is in agreement with Winner in his statement: " Only those who know nothing of the history of technology believe that a technology is entirely neutral or adaptable" (p. 229). To Ellul, however, technique is about the choice of its use, It is human responsibility to make ethical choices, which becomes more plausible if we, as a post-industrial society, gain a better understanding of our place within the complex, multi-level communication technology infrastructure.

Post-Industrial Infrastructure

In order to develop a successful network, the members of a global society need to know the core components of a complex system called communication technologies infrastructure. This infrastructure is a multi-level system where all its parts are interconnected and function together to achieve common goals.

Originally, 'infrastructure' referred to the military support system (e.g. Roman roads, city walls, etc.) The concept of infrastructure includes technical and human aspects. According to Byrd, Turner (2000), "Information Technology (IT) infrastructure is the shared IT resources consisting of a technical physical base of hardware, software, communications technologies, data, and core applications and a human component of skills, expertise, competencies, commitments, values, norms, and knowledge that combine to create IT services that are typically unique to an organization''(p.167). Sometimes there are three aspects of the communication technologies infrastructure specified, namely: hard, soft, and economic. In *The technopolis phenomenon: smart cities, fast systems, global networks* (1992) infrastructure is seen as a comprehensive three-tier integrated system comprising hard, soft (education, government), and economic components. Table 1 demonstrates the conceptual model of communication technologies infrastructure signifying a more detailed strategic approach to establishing a deep hierarchy of inner systemic relationships among all the core elements of the infrastructure.

Post-Industrial Society

The boundaries are very likely to be marginalized between the Post-Industrial Age (1950-1969) and the Cybernetic Age (1970-present). Why then are we talking about 'the post-industrial society and not about the information society, the knowledge society, the professional society, maybe? Bell (1973) writes: "In Western society we are in the midst of a ...change in which old relations, existing power structures...are being rapidly eroded...What the new social forms will be like is not completely clear" (Dordick, 1993, p. 11) From the model [Table 1], we gain an understanding that there are five groups of knowledge-producing activities: education, research and development, media and communication, information machines, and information services-constituted what Bell defined as the knowledge industry. Post -industrialization is a process with new technical, social, cultural components where the integral parts are professionals as the established ruling class, risk, and control (Nelson, 1998). "Despite early predictions that information workers would be riding high in an information economy, they are often the first to lose their jobs as firms consolidate their activities and relocate work, made less valuable by information technology, to low-wage-rate countries "(Dordick, 1993, p.5). There is no contradiction of terms in the remarks about the leading role of technical elite and its unstable market value due to increased competition resulting from rapid diffusion of postindustrial innovations.

Communication Technologies

According to the conceptual model of infrastructure [Table 1], communication technologies are to be examined at different levels. The first layer is the four core elements: telecommunications, computers, visual and acoustical technologies (Maughan, personal communications). No nation can expect to maintain a technological advantage for too long. What will matter is how well that nation can utilize the market to its advantage and for how long. This requires marketing skills, organizational innovations, and educated work force. These are the "technologies" that are crucial in the twenty-first century. Dordick (1993) notes that technology, then, should be seen not in terms of hardware or software alone (the next level of information objectification) but also as a way of managing, educating, and organizing which is a macro level of communication technologies structural analysis.

The end product of all information service markets is knowledge. The link between the post-industrial society and communication technologies, the "axial principal" if we use Daniel Bell's expression, is the acquisition and codification of theoretical knowledge. Information itself has three dimensions economic, scientific, and behavioral. The key idea of the social life is development. Its progressive nature is best described through the examination of the numerous variables that comprise development.

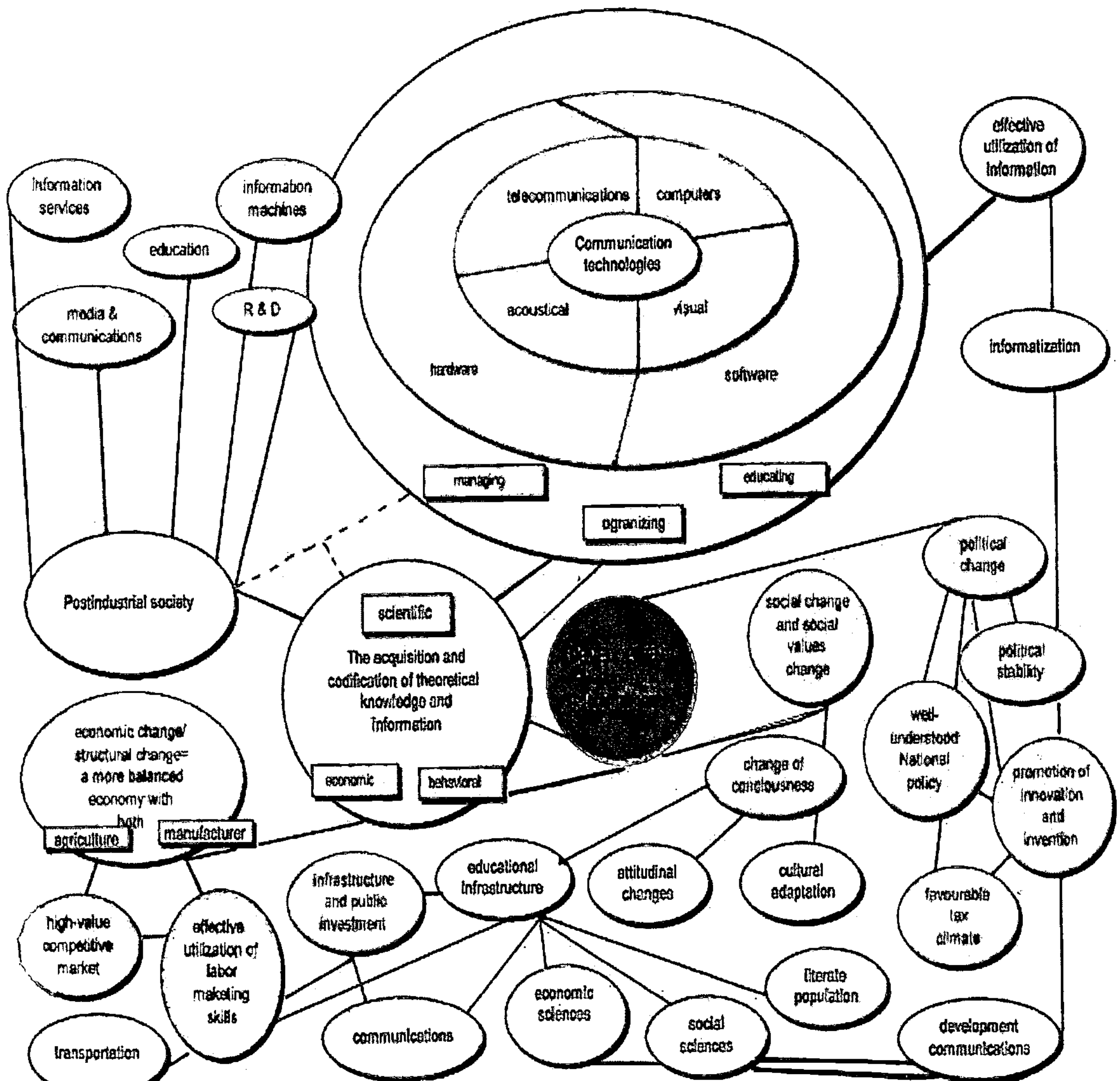

Table 1: A model of communication technologies infrastructure in the post-industrial society.

Development Variables

Contemporary problems of the well-established and developing nations are caused by several factors, for example, the cultural differences among nations, money constrains, time constrains, and inadequate training. Economic growth is a necessary but not sufficient condition for development. Development is more than economic growth. Development is a complex process that encompasses economic, social, and political changes. Development requires *attitudinal changes, cultural adaptations, a trained and educated work force, and a political structure.* Communications and communications technology are agents of *economic, social, and political change.*

Economic Change: Technology is a significant determinant of economic growth. The measurements of the economic scope in the information society are: 1) *the size of the information force* (as a percentage of the total labor force), 2) *its contribution to the nation's Gross Domestic Product*, by sectored analyses of labor force and contribution to GNP. Within the economic pyramid, the shift to a more balanced economy in which an agricultural sector and a diverse manufacturing sector are key factors in the development process. *Social Change:* For development to continue, there must be a trained and educated work force, an effectively functioning government, public investments in basic infrastructure, communications, and transportation, and a positive attitude toward progress. *Political Change:* There has to be *a well-understood national policy* that encourages the development of high-value industries, and there must be a policy that encourages *competition* among firms, emphasizing innovation and invention. In order to encourage long-term investments there must be *political stability and a favorable tax climate.* The following points help explain the variables associated with political change.

Innovation / Invention in a postindustrial world is more process-oriented than product-oriented. Carley (1995) notes: "mass-communication technologies that enable greater competition among messages and greater message complexity will enable faster information diffusion than those technologies that inhibit competition and message complexity" (p.547). Companies differ in the speed with which they adopt innovations.1) Innovators-the first firms to adopt a new idea 2) Initiators-the firms who adopt the idea soon after the innovators 3) Fabians-the firms who adopt the idea only after its utility is widely acknowledged in a particular industry 4) Drones-the last firms to adopt new ideas" (Mueller, 1971, p. 54).There are *four states in the process of innovation:* 1) The scientific discovery, when the theoretical principle behind an innovation is discovered. This results from basic research; 2) the invention, when it is for the first time made clear that the production of a given product or process is possible. This results from applied research; 3) the innovation, when the product or process is for the first time applied successfully in practice. The innovation is the result of product development; 4) the innovation diffusion process, by which an innovation spreads from the first innovator to other potential innovators" (Pedersen, 1975, p. 74) *Informatization* is an important determinant of development.It is a process of change leading to an information society. ere is a relationship between informatization and the global economy, and national development and economic growth.

The Role of Communication Technologies in the Post-industrial Society

Nowadays, people question the domineering role of technology in their social organization. Strijbos (1997) in the article "The paradox of uniformity and plurality in technological society" illustrates the duality of the human and technology relationship: social unification and pluralism at the same time. There is no doubt that a technological universalism in a geographical and a qualitative aspect is a fact of life. There are two distinct visions on the results of technological influences. Some people believe that a growing pluralism and disintegration is a distinct characteristic of our time.

However, the contrasting phenomenon of uniformity, mechanization might be just the other side of this technological culture we live in. The author examines the relationship between technology and culture from a historical perspective beginning with the early rise of technology in the tenth century in Europe to the present. The author warns us that technocracy realizes its potential in a totalitarian technology. Technology in its modern form becomes a reality to the laws of which man doesn't have access. At the same time there is another angle: the level of uniformity rises in parallel with the advancing technology. The works of different philosophers, including Ellul, Mumford, Postman, Winner present the paradox that technology makes us uniform in our thinking and at the same time gives us opportunity for diversity.

Conclusions

The key to the effective utilization of newly produced objectified information is access to that information. The National Information Infrastructure is a measure of this access. The maturity of the infrastructure is measured in terms of hardware/software purchase patterns, policy (access, control), real/perceived value, skills of information workers (knowledge workers, data workers) and users, maintenance and upgrade, leadership, change acceptance or resistance.

The negative aspects of postindustrial technological autonomous expansion are the separation between labor and private life, an enormous social mobility, and the identity crisis. Technology makes our life easier but it also makes it extremely complex. *The complexity of our relationship with technology makes us seek direction:* Where are we going? Who is in control: man or machine? These issues are highly disputable in regard to the direction we are taking technology vs. it is taking us. The answers to these and many other questions the readers are called to seek for themselves. " In a complex technological society, "almost every one, in fact, can find his niche in a public world where all things must work somehow together" (Feibleman, 1982, p. 87). Despite the marvelous paradox of the world we live in that is characterized by ambivalence, dualism of the nature of technology and its interaction with humans, we exist in a dynamic, yet a balanced system.

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Creation of a new paradigm for the roll of educators through in service training that facilitates innovation and improves the process of imperfectly seeking emerging technology in tandem with the evolving market place.

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Abstract Change is the name of game in the hyper - competitive international market place - radical, unrelenting and ever accelerating change. It is not an event. On the contrary, it is a journey that has no end. In this whirlwind of change, only such educational institutions of higher learning that are prepared to take the leap beyond the traditional hierarchies would thrive and survive. Educators should understand the deeper forces that operate on the Teaching Learning process and the market place. The paper attempts to find this synergy through a case study.

Introduction

Observations

* In depth and complete knowledge of subjects are not sacrosanct.
* Academic excellence is a myth.
* New treatise is to be evolved.
* Educational system churns out hordes of "one dimensional" people.

The advent of the new technology is creating unprecedented ,yet fleeting opportunities .The educational Institutes that fail to act now and build newer Teaching -Learning methodology that capitalize on these opportunities will find themselves relegated to mediocrity or will obsolesce in the emerging market place. There are some critical challenges that incumbents need to overcome to succeed in the global market place. The incumbents fail to attract the right talent by crippling the new Teaching -Learning process with old educational models and methodologies. The world is complicated, demanding and unforgiving It is clear that the complexity of building a sustainable educational –training model will only increase.

New imperatives

Educational process is the source of almost all value creation, knowledge based industry thrives on this; the efficacy of intellectual capital depends on the training model one choose to implement. What is new is that the stakes are now much higher and competition is intensifying dramatically.

Leaders of education should give focus and direction to the process of innovation even at cost of in depth knowledge of any one subject. Design of curriculum should be with a mission statement. It needs to take a holistic approach of Teaching Learning process and training to develop skills and disseminate information.

"Instead of fixing problems, the millennium humans will chase opportunities, they will not seek to optimize. Instead, they will be hard wired to innovate. They will not seek to perfect the known. Instead they will seek to create wealth by imperfectly seeking the unknown", quoted in a leading newspaper, which manifests the attitude of all and sundry. Keep this in mind while preparing the course and training material.

The time has come to terms with "Education by objective". The curriculum design process should be left to market force, but then the roll of educationist should be to develop physical content and logical sequence to satisfy the market aspirations, which dictates that, "Content is the king". The practice of concurrent engineering can be applied in the curriculum design by simultaneous interaction with the interested and all concerned parties. The technological innovations like video conferencing, chat facility through internet and dedicated web sites for university curriculum design department, facilitates and gives thrust to holistic approach to the training program.

Our study shows that this improves the perception and participation of teaching learning process by all concerned parties involved. The market appreciates the removal of the process of "reinventing the wheel" and appreciates the cultivation of temperament for the emerging technology and the proactive role of universities in bringing about a cultural revolution in the name of technology integration in all walks of life.

The paper discusses ways and means to create a skill set to enable the teachers to change gear to innovate and assimilate the emerging information technology and evolves a practice to figure out the non-essential part of the subject domain to optimize the creative energy of the people involved.

Case Study

A technique like ABC analysis in the realm of inventory control is to be discussed in the paper at large. Most importantly the paper address the pedagogy involved in the Teaching-Learning process of computer programming languages such as Object Oriented Programming in C++, JAVA and other Internet technologies and methodology to innovate to understand and follow the technology, with out a time lag, so that state of art technology can be offered to trainees and students.

Programming languages are the pace setter for developing mastery over the emerging technology in the realm of technology convergence. Object Oriented Design, Analysis, and Programming introducing students to a new paradigm in implementing and practicing any of problem solving strategies.

It is observed that teachers handling the programming language classes tend to distanced away from newer languages and related technologies and exhibits inertia to be comfortable with ongoing process of pushing technology to it's limit. On the contrary the market dictates to produce more and more technology savvy educators and administers. Our experience in conducting refresher courses for teachers, introduce them to a new paradigm in seeking knowledge and capability to study and assimilates newer and ever unfolding technologies. The teachers were told to give priority to certain areas rather than trying to master every bit of the available forms and literature on the subject. They were advised to give importance to the process of "conversion of problem to logic".

The need not elaborate on data types, Compatibility, Portability, Multithreading Capabilities of the language or even java virtual machine. There is lot of parallel between previous programming language and newly evolving programming languages, try to figure out the similarities in the newly created language or software packages. Teach and learn in the mould of previously developed methodology, but with new constructs. Develop computer program for same set of exercise problem definitions which were developed for earlier languages. The fundamental understanding in interdisciplinary subjects, data structure, Numerical methods, Operations Research techniques, mathematics of Graphics and human behavioral psychology gives us a deeper understanding and helps us to translate the nuances of any problem definitions. These self sufficient modules not only contained, tried and tested code but also had programming capabilities built in to make holistic 'building blocks' that make application development easy.

ABC Analysis approach applied to innovate Teaching – Learning process of fast emerging technology.

This is a classification which attempts to distinguish the 'Vital few from the trivial many'.In inventory management the basis is annual value . A, B and C are categories of importance. Different controls are adopted for each category. ABC analysis is the widely used approach for classifying the inventories on the basis of cost and use in the realm of Industrial Engineering practices. This is a type of *Pareto analysis and* some times also referred to as *Always Better Control* approach. We created categories of varying importance amongst Object Oriented Analysis, Design, programming in Java and C++ and interdisciplinary subjects which cater to the supply of problem definitions to be converted in to computer program.

Findings

One cannot overemphasize that the single key priority for Teacher educators is to rapidly reposition themselves for extreme competitive preparedness without any further delay .The direction of flow of value, whether into or out of the educational Institutions, will depend upon the relative competitiveness of the Institute. Educational process of an institute needs to be calibrated for there ingenuity on the basis of the net value that they capture for the national economy . It is the Institutions endeavor to continuously explore opportunities for growth by establishing synergy and blending its multiple core competencies to create new epicenters of growth. The market mechanisms are essential to engender efficiency and add value to the Teaching Learning process. Yet, they must be supplemented with a much broader growth strategy to create and retain value to uplift the Standards of institutions of higher learning.

Application of ABC analysis like technique on training model, witnessed a sharp response from among teacher's undergoing refresher course on Object Oriented programming in C++ and Java programming languages. Majority of the incumbents (92%) embraced this technique to improve their ability to assimilate newer technology at a faster pace.

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