Exit Portfolio – Interpretive Essay

"A Framework for Teaching and Learning with Information and Communication Technology (ICT)."

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Abstract

This exit portfolio includes an interpretive essay reflecting on what I have learned during the course of my graduate studies in the Master of Education in Educational Technology. This interpretive essay addresses the theory and practice of teaching and learning with ICT and proposes directions for future practice. There is also a collection of documents and web sites from my academic and professional work contained as part of this exit portfolio.

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Introduction

The purpose of this interpretive essay is to pull together what I have learned during my graduate studies in educational technology. Technology is defined as "any systematized practical knowledge, based on experimentation and/or scientific theory, which enhances the capacity of society to produce goods and services, and which is embodied in productive skills, organization, and machinery" (Ely, 1983, cited in Pinar et al., 2000, p.705). Educational technology, on the other hand, encompasses everything from "teaching programming, to utilizing drill and practice, to implementing integrated learning systems, to addressing computer literacy skills, and to participating in web-based communities" using information and communication technology (ICT) as a medium (Dias & Atkinson, 2001, p.2). ICT includes a full range of computer hardware, computer software, and telecommunications technologies. It also includes computing devices ranging from inexpensive handheld calculators to a full range of display and projection devices used to view computer output. Local area and wide area networks that allow computer systems and people to communicate with each other as well as digital cameras, computer games, CD's, DVD's, cell phones, telecommunication satellites, and fibre optics are also included (Moursund, 2003). The role of educational technologists is to

select appropriate ICT and weave it together with sound teaching pedagogy to create an effective and efficient learning environment. The focus of this interpretive essay is to critically analyze relevant literature in the theory and practice of teaching and learning with ICT and propose directions for future practice.

As an educator, my primary goal is to engage students into meaningful learning. Focusing on the process is critical in providing the best learning environment for students. Teachers should focus on uncovering the curriculum rather than curriculum coverage (Jacobsen, 2001). In the course of my graduate studies, I have come to realize that technology should be used as a learning tool that students learn with, not from. Technology does not teach students; effective teachers do (Whitesel, 1998, p.1). Teachers must teach students that there are three uses of technology in modern society – information technology (electronic resources), communication technology (telecommunication), and processing technology (software that help us do better, faster work) and that technology is a tool rather than an answer in and of itself (Serim, 2000, p.61).

More often than not, the issue is not technology itself, but how it is used in design and delivery of the course. Too often instructors do not design their lessons to take advantage of the technology presented which affects the overall quality of the instruction (Valentine, 2002). Improving learning does not mean using a smartboard instead of a blackboard or putting flashcard information in a PowerPoint presentation as all this does is change the method of delivery (Bailey, 2003). Using technology to support learning requires a change of roles. Students should be the teachers, representing what they know rather than memorizing what teachers or textbooks tell them (Jonassen et al., 2003, p.11).

This involves allowing students to take on more responsibility for their own learning and the teacher becoming more of a facilitator. This new role for the teacher would also mean changes in the way the classrooms and schools are organized and equipped (Reid, 2002, p.7). In this constructivist setting, students are educational partners with the cognitive responsibility for performing distributed by the part of the partnership that performs best (Jonassen et al., 2003, p.11). This constructivist philosophy of teaching and learning has been what I have strived to employ in designing and implementing technology in my professional practice as a high school information technology teacher.

In order to have an understanding of where I was, where I am, and where I am going, this essay will explore my insights in using technology first as an instructor and later as a graduate student. This essay begins with a brief description of policy reforms that have been a contributing force in putting technology into the classrooms. There will be an explanation of the importance of learning theories and pedagogy that guide the design process. Finally, a discussion will lay out a framework for teaching and learning with ICT using a blended project-based multimedia approach supported by Merrill's (2001) First Principles of Instruction. A collection of documents and web sites from my academic and professional work, which serves as a supplement in the exit portfolio, will give support to my journey.

My Experience using ICT as an Instructor

The concept of using technology to reform the educational process from the drudgery of traditional teaching has many implications for both teachers and students. When teachers are open to take risks, technology can open up new vistas as students now have access to places and experiences they might otherwise never encounter (Jonassen et

al., 2003, p.60). Moreover, when students use the technology to teach themselves and others, it brings about knowledge construction, conversation, articulation, collaboration, and reflection (Jonassen et al., 2003, p.15). All these are characteristics of a teaching and learning model that have the student at the core of the instructional design.

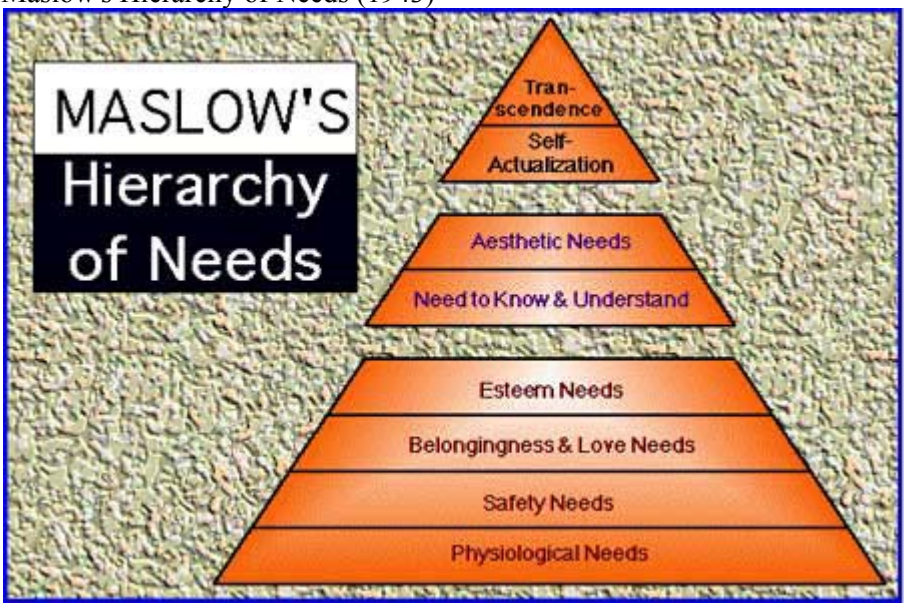
My experience in using technology in the classroom did not come about in the traditional sense. I did not study computers in university nor did I have any mentors to look up to. The depth of my knowledge using technology in teaching came about through self-study. Being a person who enjoyed tinkering with things, computing came relatively easy to me. Male accounts of their earliest computer memories according to literature are filled with wanting to know how the computer works, tinkering, and self-initiated exploration (Margolis et al., 2002). Although I was not the stereotypical computer fanatic with love of gaming and programming, my curiosity with technology led to hours and hours of self-exploration. Being a teacher, this was where I was learning more about planning and organizing technology-connected activities for my students. Dias & Atkinson (2001) calls this the adjustment stage. In this phase, although traditional instructional methods remain the dominant forms of classroom practice, there is marked increase in students' use of word processors, databases, some graphic programs, and computer-assisted instructional packages. At this point, teachers understand how to plan for technology integration and have begun acquiring additional skills to meet the new demands" (Dias & Atkinson, 2001, p.4). I was an early adopter of technology and the years of unguided exploration became the foundation of my knowledge.

My first job as a grade-four teacher made me intensely aware of the inadequacies of integrating technology into the classroom. The computer curriculum consisted of a forty-minute lesson once a week with a computer teacher. Within each classroom there was also one computer connected to a network. The idea of integrating technology into the curriculum was possible, but overwhelming for a first year teacher. Scheduling lab time, redesigning the learning material, and sequencing the unit to fit the technology was an exercise in patience and flexibility. My love for being overseas and the opportunity to teach computing solely made my next career decision to take a job as a junior high school computer teacher in China relatively easy. Since the private Chinese school was part of a pilot-project with the University of Victoria, the credibility of the program was enhanced. It was a newly developed parallel program that focused on English and Information Technology, both of which were delivered by an English-speaking teacher. The parallel program was to operate in the same way as the BC curriculum using BC certified teachers and Western teaching pedagogy.

From a designer's perspective, it was quite obvious that the parallel program was a great vision in the making. However, there were many factors that the designers deemed unimportant or blatantly ignored. This created much hardship for the teachers in the program. Nevertheless, the hardship that I endured in China gave me great insight into the use of technology and prepared me well as a teacher. Although the lab that was built was state of the art, weather conditions and an archaic power grid often interrupted the electrical supply. The computers were networked, but had no access to the Internet. Moreover, teachers not technicians maintained the labs. There were also many social problems that had a deeper impact in the education of the students in that area of China.

The students came from privileged families whose riches were acquired quickly through economic changes in the region. In addition, the parents placed unrealistic expectations on the teachers, which led the school to rethink its relationship with the university. The cost of the partnership had become exceedingly high. However, the most obvious element that should have been foremost in the minds of the designer's pre-planning was the adjustment of living overseas. The isolation and culture shock teachers felt living in a third world country was too much to handle for some. As Maslow's Motivational Theory (1943) attests, one must satisfy the basic needs in the lowest tier of the five levels before progressing on to meet higher level growth needs (see Figure 1).

Figure 1 - Maslow's Hierarchy of Needs (1943)



> Maslow, a humanistic psychologist, believed that human beings are pushed and pulled by mechanical forces, either of stimuli and reinforcements (behaviorism) or of unconscious instinctual impulses (psychoanalysis). Humanists focus upon potentials. They believe that humans strive for an upper level of capabilities. Humans seek the frontiers of creativity, the highest reaches of consciousness and wisdom. This has been labeled a fully functioning person, a healthy personality, or as Maslow calls this, self-actualization.

(Simons et al., 1987)

Between battling the noise of the constant construction of our accommodation and the unfamiliar food, it was difficult for everyone to concentrate on their duties as teachers. With the added communication and culture issues, there were often more problems than successes. This in addition to the unfamiliar life outside the gated walls of the school crippled the enthusiasm of the Canadian teachers within months. Even though the teachers were more than capable of moving up Maslow's hierarchy toward a level of self-actualization, there were so many lower level basic needs not being met that it hindered the teachers' motivation to create a successful program. With cultural differences, teacher attrition, communication problems, student motivation issues, unrealistic parent and school expectations, and poor living conditions, the program was a disaster. The program folded after the school year ended.

Classroom instruction in an English as a Foreign Language (EFL) culture is difficult at its best. Adding technology as a separate subject taught in English increases the difficulty, but opens up many possibilities. The goal of bridging the gap between cultures using education as a vehicle is admirable. China is a nation socially built on conformity, so changes have to make sense. English is an international language and technology has become revolutionized what we do on a daily basis. Therefore, it makes sense to have both sets of skills. However, introducing English with computing studies together was probably too much at one time. Although the expert developed computer curriculum was a strong selling feature, it did not meet the needs of learners. The intricacies of learning a new language and applying this to learning computing was more than what some students could handle. In fact, the successes that were seen in the

classroom were attributed to the skill of the teachers in the art of design and in effective technology use, not on the curriculum alone. Although the expert designed curriculum was a strong selling feature in the program, it was the front line personnel, the teachers, who were continually modifying their teaching pedagogy and instructional design to meet the demands of the learners and the dynamics of the technological infrastructure. Undoubtedly, this approach rests on the belief that the best teaching occurs when educators make choices about learning environments, learning tools, and learning experiences based on strategies drawn from a broad knowledge base.

Understanding how to design effective technology-based learning opportunities requires comprehending how profound changes in technology have impacted society, schooling, and curriculum (Norton et al., 2003, p.xi). In contrast to the previous example, the designers of the parallel program believed that a good classroom teacher using a well-scripted computer curriculum could teach technology successfully. Many of the teachers hired were still in the adoption phase. This is where "teachers begin to show more concern about how technology can be integrated into daily lesson plans. They begin to critically assess their assumptions about teaching and learning and explore options for new roles" (Dias & Atkinson, 2001, p.4). However, many teachers lacked the flexibility and understanding to plan effective lessons characteristic of the adaptation, appropriation, or invention phases. What the program lacked were teachers who could take advantage of their training and experience in adapting to the new environment. With the challenge of teaching in an EFL environment, learning how to integrate technology, and managing a lab, many teachers when faced with these challenges opted to leave the country.

China, as a nation with a vast history, conjures many images. For some, China is a country filled with undesirable elements. Corruption, propaganda, and human suffering are everyday occurrences. For others, China is a nation destined for changes, a country hungry for social, economic, and educational changes. I am privileged to have been a part of this educational change using technology as a teaching and learning tool. As education is paramount in Chinese society, there is strong pressure on the students to conform and succeed. However, the intense competition for university space has made a North American high school diploma a highly valued commodity. My experience in China prepared me well for my current position as a high school information technology teacher. There is a strong need for information technology skills, something that subject teachers would not have time to incorporate into their curriculum. I provide valuable skills that future employers deem important and useful. In the 2000 Employability Skills Survey, members of both the Conference Board of Canada Forum and the Business and Education Forum on Science, Technology, and Mathematics found that information technology skills were critical in the workplace (Conference Board of Canada, 2000). In areas such as communication, management of information, problem solving, and project participation, understanding how to use and implement technology ranked high. This further supports that educators must prepare students for their future by using technology to promote meaningful learning opportunities (Ertmer, 1999, cited in Dias & Atkinson, 2001). Similarly, Murnane et al. (1996) describes three sets of skills students need to be competitive in the workforce (cited in Simkins et al., 2002, p.7). In addition to the hard skills such as math, reading, and problem solving, soft skills such as the ability to work in groups and to make effective oral and written presentations were also included. More

importantly, they also see the ability to use a personal computer to carry out routine tasks such as word processing, data management, and creating multimedia presentation as part of this value added curriculum. Knowing that I am adding value to my teaching and to a young person's life gives me immense pride and satisfaction.

My Experience using ICT as a Student

Back in 1998 when distance education was still in its infancy, Cisco CEO, John Chambers had this to say, "The next big killer application for the Internet is going to be education. Education over the Internet is going to be so big it is going to make e-mail look like a rounding error" (Kettleborough, 2002). The number of courses available online has increased from less than 100 in 1996 to close to 1,000 in 1998, to more than 10,000 in 1999, and 15,000 in 2000. Today, there are more than 66,000 courses available online (New Brunswick TeleCampus Distance Education Statistics, 2003). John Chamber's vision has remarkably held true as Cisco, today, is a leader in computer hardware and distance education has held firm in its growth.

I was part of this wave of new learners. As a technology teacher, having the Internet at my fingertips brought me vast opportunities to use it as a teaching and learning tool. I already had in my repertoire a web site that catered to the courses I taught. The web site contained a description of my classes, the learning outcomes, my classroom expectations and procedures, and information on class assignments with their equivalent grading breakdown. As the web site was more of a supplement to my teaching, the design was more of a step-by-step approach on how to create projects with relevant examples and resources. It lacked feedback mechanisms on how well the lessons were completed and did not actively promote a community of learners. The web site was more

of a supplement to my teaching and did not actively engage the learners. Being self-taught in Technology, I wanted to bring more to the table other than what I learned from books and the Internet. This was, in part, my motivation to pursue a Master degree in Educational technology. As a strong believer in educational pedagogy, I wanted to know what the current practices were in integrating technology in the classroom. Having the flexibility to learn when I wanted was an added bonus and fit nicely into my professional growth plan.

My journey as a graduate student started a year and a half ago. As someone who had not attended school for over seven years, I was very apprehensive of my research and writing skills. Knowing my limitations, I decided to take one of the more difficult courses in quantitative research methods during the summer to give myself lots of time to digest the material without outside distractions. The course was completed synchronously using teleconference and asynchronously using First Class. Besides learning how to set up papers using APA style citations and how to do research online effectively, it was my time online reflecting on discussions from colleagues around the world that made learning meaningful. The communities that were formed made the work more collaborative and created collegiality among learners who, as individuals, brought in their own experiences as well as their biases. This was what distance education should be. The construction of knowledge from dialogue, critical analysis, debate, and individual research solidified the concepts learned from the synchronous meetings and from the textbook. Collaborative learning processes assist students to achieve deeper levels of knowledge generation through the creation of shared goals, shared explorations, and a shared process of meaning making (Palloff & Pratt, 2000, cited in Valentine, 2002).

The most difficult part of being an online learner was mastering the skills to be effective as a distance student. As the university did not require a pre-requisite in their distance courses before enrolment, most of the learning on how to be successful online was done through trial and error. It was assumed that if students can navigate the courseware being used, they should successfully complete the class. However, Palloff & Pratt (2001) found that students also needed training to learn what is expected of them in the online classroom (p.15). In my second course, I had an ingrained idea of how teachers facilitated their course and what I needed to do as an online student. By my twelfth course, after having had the opportunity to try out many of the courseware and teaching styles, I finally understood my role as an online learner. Online learners have certain characteristics that set them apart from classroom learners. All are expected to have a set of pre-requisite skills in order to actually get to the online course. For those who take advantage of learning new things, online learning is the place to be; however, it requires the learner to take on a different role. Rather than being a passive learner, online learners have to take a more proactive approach. This involves downloading all the required courseware, making sure the courseware is compatible with the computer system, printing a copy of the course outline with its associated assignments, signing in early for the introductory synchronous session to conduct a sound check, finding out which individuals in the online class to work with, and doing some preliminary research for the assignments. Following these simple procedures in the early part of an online course makes for better organization and leads to better results especially for students who take more than one course at a time. Nevertheless, there are many similarities in the profile of distance learners that are strongly correlated with student success. A study

conducted by the Institute of Higher Education Policy (1999) reveals that successful distance learners are:

- Students who are married.
- Students who are female.
- Students who rate themselves highly on various measures of persistence related to taking on new projects.
- Students who rate the consequences of not passing 'serious'.
- Students who rate their chances of success in their studies higher than non-competitors.
- Students who did not need support from others to complete difficult tasks and did not find it important to discuss work with other students.
- Students with high literacy levels.
- Students who rate themselves as well organized in terms of time management skills and said they generally had the time to do what they intended to do.
- Students who rate their formal and informal learning to be high in terms of preparing themselves for university studies.

(Brogan, 2001)

Being an online learner is hard work and those who choose this way of learning should not think otherwise. Students who do so will not only find their experience disappointing, but frustrating as well.

In order to truly understand distance education, one needs to be in the shoes of the teacher as well as the student. Being in the shoes of a student, I have found that a clear indicator of a good online class is dependent on the development of a collaborative learning community. Collaboration is working together jointly to accomplish a common intellectual purpose in a manner superior to what might have been accomplished alone (Simkins et al., 2002, p.4). Just as a good classroom requires the teacher to create a positive learning environment, distance education also requires facilitation in group development as a precursor to learning. The systems theory into group development as McClure (1998) proposes has seven stages. The stages he outlines are pre-forming,

unity, disunity, conflict-confrontation, disharmony, harmony, and performing (McLure, 1998, cited in Palloff & Pratt, 2001, p.126).

> In small groups, individuals come together, create a purpose, and forge a collective identity. Initially in that process, individuality is constrained as a group identity forms. The descent represents the collective forging process. The vertex depicts the crucial conflict stage. This is the turning point in groups where responsibility is shifted from the leader to the members. Once a strong bond is established, responsibility assumed, and a group identity emerges, individuality can be reclaimed, asserted, and expressed. The ascent signifies that reclamation process.
>
> (McClure, 1998, p.39, cited in Palloff & Pratt, 2001, p.126)

Although McLure's model is taken from working with face-to-face groups, it applies much the same in developing online groups. The chaos that is part of group development allows groups to change, evolve, and mature. Chaos theorists speak of systems change as being first order (linear) and second order (non-linear). First order change is gradual, sequential, and predictable. Second order change is turbulent and chaotic (Golby, 2000). Group development is a combination of first and second order change that has order giving way to chaos and chaos leading to order (Golby, 2000). The important tenet that McLure (1998) emphasizes is that of 'self-organizing capacity' (p.21). A designer must remember to refrain from imposing too much of a structure from the outside as it often produces a regressive group. "Living systems generate their own new forms from inner guidelines. If the leader adequately contains the group it will develop" (Golby, 2000).

In a distance course, group development must make students feel safe and comfortable in taking risks. Moreover, students need to feel a sense of affiliation working towards a common goal yet remain independent in their thoughts without jeopardizing their dependence on each other (Palloff & Pratt, 2001, p.127-128). Group dynamics cannot be forced yet there needs to be a structure in place to guide the learning.

The promotion of a collaborative community takes time to develop. Learning online can often be lonely. The process of reading and responding to discussions can be onerous, but can also be a benefit as postings can be re-read over and over again for a complete understanding. However, online communities are not faceless. With each class, there are new communities formed and with each community formed there is also a sense of collegiality. Students share resources and work together co-operatively towards a common goal. In an ideal situation, there would be a continuation of these communities. However, just as in life, we all take different directions in our online communities. Some classes end with no formal good-byes, particularly if the group will be interacting with one another in other classes, either face-to-face or online. The group interaction continues, in essence 'reforming' to suit other circumstances (Palloff & Pratt, 2001, p.126). Therefore, with each course a new community is re-established and with each new community, a new group dynamic appears. In these communities, communication and collaboration seem to be the elements that create the culture. Without them, it would be static and uninteresting. This give and take mentality goes a long way in completing assignments and projects, but most importantly, it is through reading, reflecting, and dialoguing within these communities that learners really find out how the information applies to their own settings.

As part of my belief that face-to-face courses have a place in distance education, I took two on-campus and two distance courses during the summer months. What I found in face-to-face courses is that it gives a balance to distance education. In fact, there has been an increase in the use of online classes for campus-based students, particularly with classes that combine face-to-face and online components (Palloff & Pratt, 2001, p.3).

This blended model of learning is also my personal preference. Although it is sometimes difficult to find the right mix in the design, the outcomes are often better than face-to-face or distance education alone. As a pedagogical tool, blended learning taps into the strengths of both the face-to-face and online approach to teaching students. The face-to-face component allows the teacher to gain input from participants in the design of the course and acts as a venue to lay out the concepts that will later be reinforced in the online component. The online component develops technology skills, maximizes participation, promotes collaborative learning, and creates a triple loop in the learning process to enable participants to reflect on their learning, themselves as learners, and the learning process (Palloff & Pratt, 2001, p.26). It reduces the amount of time spent in class and creates more learning, understanding, and retention (Sudzina et al., 2003). Blended courses are not traditional courses with a web site or merely information transferred to the Internet. It requires extensive course redesign that requires sound teaching pedagogy. Although the courses I took during the summer months were independent of each other, doing both at the same time created the feeling of a blended model of learning. I am interested in developing courses using a blended model of learning when I complete my graduate work.

Reform in Education

A Collaborative Institutional Culture

The role of education and its implication on society holds great importance. School reform concerns evolve from people wanting more say in where and how their children are educated. In part due to more people having more education, "people are insistent in having a voice on political issues (Levin, 2001, p.192). Governments today

are paying more interest to public opinion in education using satisfaction surveys to gather data (British Columbia Ministry of Education, 2003). Moreover, school planning committees (SPC) and parent association committees (PAC) have evolved to take more of a lead role in how the education landscape is shaped (BC Ministry of Education, 2003). In fact, there are written contracts that stipulate what schools need to achieve. These policy initiatives come from the increased demand from parents and students (Reid, 2002, p.5). Making teachers, schools, and school boards more accountable has created a rethinking of the overall organization of schools and has also allowed for more dramatic policy initiatives.

Information and Communication Technology (ICT) has brought about social change, which has also greatly altered the approach to education. The traditional brick and mortar schools with its "Pavlovian system, running from nine to three with 56 minute blurbs, with 30 people, is not going to satisfy people" (Reid, 2002, p.5). With schools handling more students, students are grouped by age and pushed through an assembly line of classrooms with teachers being forced to teach to the middle (Bailey, 2003). In fact, the current system still has a lot of artifacts from the industrial age and even the agricultural age, which is the reason why teachers have summers off. In the past, this was done not to be kind to teachers and students, but to tend to crops (Bailey, 2003). These limitations has created new educational initiatives such as year round schools, sports academies, science academies, outdoor schools, fine arts schools, fundamental schools, Montessori schools, challenge programs, and aboriginal programs. These schools have been brought about due to the social changes in our society, with ICT being one of the catalysts.

Futurists also see many trends that have ICT in a more dominant role in education. In fact, schools should not simply acquire new technology and apply it to reinforce old processes and structures, but to think about a new model of education (Bailey, 2003). Technology opens up the creativeness of teachers and makes the other tedious work such as record keeping, attendance, and marking less of a chore (Reid, 2002, p.5). The computer will also allow the creation of 'learn by doing' courses designed by the best and brightest experts in any field incorporating the technology of learning objects (Schank, 2000). The concept of learning objects, which is becoming widely popular among distance education hosts, is where material 'objects' can be modified and reused for a particular individual or course. This allows developers and users to leverage databases, Internet, and other digital technologies to prepare learning content in small chunks that can be used alone or dynamically assembled to provide 'just enough' or 'just in time' learning (Heins, 2002). This model of education focuses on reusable learning objects in customized modules with assessments for specific outcomes. With this chunking approach in place, distance learning can be customized and individualized. This distributed design gives learning more meaning and empowers students to pick and choose, just like a menu, on what they want to learn and how they want to be evaluated. This allows for greater accountability, as the methods in which they learn and are evaluated are personal choices rather than fixed tasks. Students are encouraged to express their learning in forms that are most revealing of and true to their strengths and interests (Simkins et al., 2002, p.vii). In such contexts students must, out of necessity, show a great deal of initiative. They are at the center of the system in the sense

that they must take charge of their education in a way that traditional students are not required to (Valentine, 2002).

Cultural Changes Among Educators

Technology will change how educators do things. When curriculum and instructional development is centralized, it lessens the time teachers need to plan lessons. When there is a repository of information that can be accessed with a touch of a button, teachers can focus on their true role in education. Teachers add the humanistic side to learning that technology cannot provide. In fact, teachers will be judge by more meaningful measures as society begin to value them for their human qualities (Schank, 2000). With this, the role of the teacher will also change. From the traditional sense, teachers will now have to give up control of the classroom because it is apparent that one person in the classroom is not enough anymore and that computers will open up a whole new learning environment for students (Reid, 2002, p.7). This will transforms the "role of the teacher from the frumpy old role of sage on the stage for the modern role of guide on the side" (Simkins et al., 2002, p.101). Teachers will become more of a facilitator as students take on more responsibility as learners. When this shared responsibility of learning is distributed amongst this partnership, it decreases the amount of information that needs to be learned. Students will now determine what they want to take in and teachers will not be burdened with having to know everything. Often it is this information overload that kills the love of learning in students and raises the stress level in teachers.

With students as productive team members, insightful peer tutors, supportive teaching assistants, and even creative curriculum designers, it will allows teachers to

instil more of the human qualities that is missing in the classroom (Simkins et al., 2002, p.vii). As teachers move away from their role as authority figures, this will also eliminate the roadblock that prevents them from connecting with students who need the most guidance (Schank, 2000). When this happens, there will be a resurgence in the emphasis on character, and personal and social responsibility development. What this creates are teachers that not only act as therapists, but are executives and liberationists as well. Fenstermacher & Soltis (1998) argue that teachers even if in theory cannot be true to more than one of these roles, they should combine them in practice (cited in Simkins et al., 2002, p.102) (see Table 1 below).

Table 1 - Approaches to Teaching (Fenstermacher & Soltis's, 1998)

The Executive	The Therapist	The Liberationist
▪ Plans, implements, measures, and revises. ▪ Manages people and resources. ▪ Makes decisions about what people will do, how they will do it, how long it will take, and standards for performance. ▪ Ensures that students acquire predetermined and clearly specified knowledge and skills.	▪ Enables students to find meaning, gain self-knowledge, and become authentic. ▪ Attends to individual differences. ▪ Are essentially a supporter and helper; avoids exerting unnecessary control. ▪ Wants students to knowingly accept responsibility for the choices they make and their consequences.	▪ Emphasizes content especially broad and conceptual understanding. ▪ Sees moral and intellectual values as part of the content of teaching. ▪ Believes that teachers must set the example for students and that students will learn as much from how their teachers teach as from the explicit content that is taught. ▪ Avoids purely instrumental approaches, demands that work has values and purpose.

Teachers will find that they will need some time to adjust their new roles. They will no longer be in a position of power. As classroom dynamics change, so too will the determination of autonomy in the classroom. In an environment that has teachers in many roles, teachers will assume the role appropriate to the moment, the needs of the students, and the situation (Fenstermacher & Soltis, 1998, cited in Simkins et al., 2002,

p.103). Teachers will be left to provide things that technology cannot: personal one-to-one tutoring, teaching students how to work in groups, and teaching crucial interpersonal skills (Schank, 2000). With these changes, there will also be a move from teacher-centered practices characterized by rote memorization techniques. As a replacement, teachers will create advanced learners utilizing student-centered approaches. Student-centered approaches substitute learning from lectures, holding students responsible for their learning, and using team based learning (Stamper, 2002, p.15). Despite this shift in control, teachers and students will find that a mutual partnership will develop once there is a mutual understanding of each other's roles.

Future Models of Learning

Schools for the most part will be better than they have been before. Teachers will be better prepared and the curriculum more diverse and challenging. Hands on project-based learning that is relevant to the learner will be used predominantly in the classroom. The learning will be scaffolded to teach the basic skills, yet will still require students to learn more on their own outside of class. Schools in the future will have classes that are shorter in duration, yet will still allow the teacher to introduce the essential concepts that students need to know. Similar to Singapore where "they believe learning to do a few problems well and really understanding why you got the answers is much more important than doing a lot of problems without that understanding", this design forces students to do the basics well and apply these skills to higher level projects (Houston, 2003).

The focus on depth is emphasized in a constructivist learning approach. The new design will apply technology to create an online environment that allows students to reinforce the concepts learned in class. The modularity of the design will give schools

more flexibility in offering more customized programs and more individualized learning programs. Handy (1997) refers to this type of learning as a marathon not a horse race (p.215). This will allow people to learn at their own rate not at the rate of the textbook, teacher, or school dictates (Reid, 2002, p.6). 'Just-in-Time Examinations' can be accessed using technology. With this type of organization, "young people have something to aim at, something attainable, something retakeable, something which he or she can hold up as a mark of their achievement irrespective of age" (Handy, 1997, p.216). This blended approach offers the social elements in a face-to-face classroom and employs the latest technology to sift through the course content created by experts. In addition, technology is used to create a community of learners who collaboratively reconstruct the learning through a project-based approach to make the learning more meaningful to them.

Future models of learning are initiatives that are grounded in the classroom. Much discussion about school reform adopts the view from 30,000 feet up, where high-sounding philosophy can be of little practical value unless grounded in real classrooms and the lives of real teachers and students (Simkins et al., 2002, p.vi). "The greatest single weakness of reforms is that it stops at the classroom door. It is an inefficient and inequitable producer of the old basics and simply incompatible with the new" (Ashenden, 1994, p.13, cited in Caldwell, 1997, p.66). A blended project-based multimedia model of learning brings ICT reform back to the classroom where teachers are allowed to teach and students are excited to learn. However, education reform is a complicated process that involves "putting together a program, having that program adapted, and then having it put into practice so as to produce the desired outcomes" (Levin, 2001, p.190). Gerstner et al. (1994) reports that:

> …schools as institutions have lacked the mechanism for self-renewal. Unlike businesses that are periodically forced to respond to new technologies, new demands from their markets, or the obsolescence of their products, no external forces have demanded that schools change. Schools have been able to ignore the revolutionary possibilities of technology, to keep the same hierarchical organizational structure, to preserve traditional rules governing the numbers of students in each class and type of school, and to stick with the traditional curriculum and teaching styles used throughout the century. The school have gotten worse; they have not changed for the better.
>
> (cited in Caldwell, 1997, p.66)

The challenge is to bring the reform into the classroom and in turn improve learning. Nevertheless, reform can be very unpredictable as it does not merely depend on political factors, but also includes social factors. With big budget advertising campaigns, governments have "massive power to coerce the public" (Levin, 2001, p.193). However, reforms that stay and those that last depend more on the relationship of the reform to the larger social context. Reforms, which are consistent with changes in society such as rights for the disabled, have more of a lasting impact than those that pertain only to education (Levin, 2001, p.195). Reforms are also subject to the changed demographics in our society. Baby boomers who now make up a large part of the demographic are more concerned with health care policies than educational reforms. Most have moved through school and no longer have much attachment to the education system. Consequently, enrolment is down and funding has also been cut. Major reforms cannot operate on this model, as large-scale changes require the proper funding. No longer are people accepting the "rhetoric that education is an investment", but rather want results for their money (Levin, 2001, p.14).

Society is now at the crossroad of deciding what value technology has in education and the real world. The presence of technology in society is a major factor in

changing the entire learning environment. In our global community, technology skills are continuously in demand. If schools are to keep up with this demand, they, too, should change. As Levin (1995) points out, "More knowledge is becoming available, more widely, and more interactively. This means that we no longer need an education system that requires standardized mass production organization, where we require all students to do the same thing at the same time in the same place" (p.2). Schools today are lagging further and further behind the society it is intended to serve. Therefore, using technology should not be as an add on, something used for reinforcement or enrichment, but as a central focus of school programming which will allow for greater individualizing of instruction thereby giving more choices to learners (Levin, 1995, p.5). When learners have more control on what and how they learn, it promotes life long learners who have balanced perspectives, who care about each other, and who can think critically. It is also important to recognize the exciting learning opportunities that ICT presents. No longer should ICT be defined as its own separate subject, but should be liberated to be used across the curriculum. Integration functions to "interweave curricular elements such as concepts, skills, and values so that they are mutually reinforcing" (Goodlad & Su, 1992; Aceland, 1967; cited in Pinar et al., 2000, p.697). When students take isolated concepts that are most meaningful to them and synthesize them together to give sense of the situation, they discover for themselves how things are interrelated. This creates purposeful learning that is fun.

Major educational reform utilizing technology comes with cost. There are costs related to hardware, software, infrastructure, set-up, security, maintenance, course design, and training (Palloff & Pratt, 2001, p.58). In addition, there are ongoing costs with

upgrades, course redesign, and telephone line rental. The true cost of ownership involves more than setting up a network of computers. Failure to recognize and fund the true cost of ownership will severely limit results and cause actual failure (McKenzie, 2003). Moreover, there is considerable debate on whether technology actually enhances the learning outcomes of students. Some researchers say conventional classroom instruction is just as effective, others say, "technology is not as nearly as important as other factors such as learning tasks, learner characteristics, student motivation, and the instructor" (Phipps & Merisotis, 1999, p.5, cited in Palloff & Pratt, 2001, p.18). However, as Phipps & Merisotis (1999) emphasize, "the bulk of the research on technology ends up addressing an activity that is fundamental to the academy, namely pedagogy, the art of teaching and the key question that arises is: What is the best way to teach students" (cited in Palloff & Pratt, 2001, p.18). When a framework is used to guide how technology is incorporated into lessons, this allows for more purposeful learning (New Zealand Education Review Office, 2001). Nevertheless, whether we are speaking of technology or pedagogy, "educational reform without an infusion of money will either transform the educational system deeply or break it down and be replaced by new social structures" (Papert, 1995, cited in Stanway, n.d.).

Design for Integration

Instructional Design Defined

Instructional design by definition as Berger & Kam (1996) indicate is more than a process. Although it is first and foremost described as a process, instructional design is also a discipline, a science, a reality, and a system (see Table 2).

Table 2 - Instructional Design Definitions (Berger & Kam, 1996)	
A Process	Instructional design is a systematic development of instructional specifications using learning and instructional theory to ensure quality of instruction
A Discipline	Instructional design is that branch of knowledge concerned with research and theory about instructional strategies and the process for developing and implementing those strategies.
A Science	Instructional design is the science of creating detailed specifications for the development, implementation, evaluation, and maintenance of situations that facilitate the learning of both large and small units of subject matter at all levels of complexity.
A Reality	Instructional design can start at any point in the design process.
A System	Instructional design is the systematic process of developing instructional systems and instructional development is the process of implementing the system or plan.

In education, the process involved in the development of an instructional design model utilizes learning and instructional theory to create an efficient learning environment. Moreover, it utilizes the knowledge gained in the discipline of instructional design to add effectiveness to learning. Instructional design involves the systematic process of translating principles of learning and instruction into plans for instructional materials and activities (Smith & Ragan, 1993, cited in Lakey, n.d.). "The model should be flexible, adaptive to change, and outcome based. Moreover, it should have parallel processing, contextualized learning, and continuous feedback and evaluation" (Hammond-Kaarremmaa, 2003, p.12). When all these components are present, it allows the model to be more dynamic, responsive, and rapid. The science of developing an

effective instructional design not only requires looking at the learning theories, the instructional design theories, the setting, the learner, but it also requires "the designer to identify his or her background and biases and how this may influence the design process" (Hunter, n.d.). When this process is followed, *performance* (the achievement of results, outcomes to which purposeful activities are directed), *efficiency* (accomplishing goals without unnecessary expenditure of effort, time and/or money), and *effectiveness* (getting things done), are achieved (Rothwell and Kazanas, 1998 cited in Lakey, n.d.). The reality of instructional design is that it can occur at any point in the design process. Often a glimmer of an idea is developed to give the core of an instruction situation. By the time the entire process is done the designer looks back and he or she checks to see that all parts of the science have been taken into account. The systematic arrangement of resources and procedures to promote learning is then written up as a model (Berger & Kam, 1996).

Instructional design is deliberate and an ever-evolving discipline. The goal of programmed instructional lesson design deals with how to effectively structure a lesson for maximum learning impact" (Molenda, 2002). However, just as the world outside of education has shifted from a static, simple traditional world of work to one that is uncertain, indeterminate, and unpredictable. We have also seen this in the world of education. Education is no longer prefigured, it is configured, dynamic, and requires problem solving as work evolves (Hammond-Kaarremmaa, 2003, p.8). When technology is added to the mix, instructional design requires an even more dynamic approach that allows for configuration and re-configuration of the landscape at the time.

Instructional design for the most part follows the ADDIE approach: analysis, design, development, implementation, and evaluation. A model such as this provides a framework from which a designer can work with. However, it can be also be taken apart and reassembled depending on the context of learner and the learning environment. The importance of engaging the students and allowing them to construct their knowledge is often on the minds of instructional designers. However, when technology is used, there are other issues that come to the forefront.

> Issues such as bandwidth inequality, levels of technical expertise, platform compatibility, copyright infringement, online intellectual property, netiquette, identification validity, online community development, and the need for orientation to online environments are just a myriad of online specific concerns that instructional designers need to deal with.
>
> (Tweedle, 2003)

As a result, the role of the instructional designer and the instructional design models has to reflect the conditions of this shifting paradigm (Gustafson & Branch, 1997).

Learning Theories

Learning principles are derived from research data. When research data accumulates, ways are suggested to organize this data into a single conceptualization called a theory. A learning theory is designed to explain several specific facts that have been independently observed by relating these facts to a conceptual model. Learning models are designed to generate predictions of behaviour and when predictions are not verified, the theory is either modified or rejected (Williams, 1998).

For instructional designers, learning theories are often referred to in each stage of development. According to both the behaviourist and cognitive approaches, the learner is at the core of any instructional design model because the metaphor for the learning has

the student acting as the designer (Gros, 2001). This is an integral element as every learner possesses different kinds of minds and therefore learns, performs, and understands in different ways (Norton & Wilburg, 2003, p.31). According to Gardner (1999), every human being has all nine multiple intelligences (MI) in varying amounts. Each form of intelligence can be nurtured by giving learners an opportunity to "share a wide variety of kinds of intelligence, which in turn adds to their confidence and belief in themselves as being intelligent and competent" (Conway, 1997).

Learning, however, is a personal act where each of us place our own personal stamp on how we learn, what we learn, and when we learn (Thirteen Ed Online, n.d.). Instructional designers are cognizant of this and strive to create learning that engages learners so that they are so engrossed in learning that everything else does not matter. This moment of focused learning is what psychologists Czikszentmihalyi and Langer (1990) label in their respective theories, as moments of "optimum flow" or "mindfulness" (Forrester & Jantzie, 2000). According to psychologist Mihaly Czikszentmihalyi, optimum flow occurs when:

> Alienation gives way to involvement, enjoyment replaces boredom, helplessness turns into a feeling of control, and psychic energy works to reinforce the sense of self, instead of being lost in the service of external goals.
>
> (Czikszentmihalyi, 1990, p.69, cited in Forrester & Jantzie, 2000)

Each of the learning approaches described below aim to create these moments of optimum flow in their own way. The challenge for instructional designers is to assess each situation for its particular uniqueness and decide how these theories fit into the design of instruction.

Behaviourist Approach

Instructional design has learning theories imbedded in its roots. Educational technologists abide by these theories, as they are essential in determining the framework for design. B.F. Skinner's behavioural approach was the first to have a major influence on the thinking of educational technologist (Molenda, 2002). Behaviourism, as a learning theory, sees learning as a sequence of stimulus and response actions in the learner. It deals with changes in observable behaviour, ignoring the possibility of any processes occurring in the mind (Mergel, 1988). With this approach, teachers can link together responses involving lower-level skills and create a 'chain' to teach high-level skills (Conway, 1997).

Instructional design using the behaviourist approach is linear in fashion. This lock step order in design adheres to Popham's (1971) four principles, to provide relevant practice for the learner, to provide knowledge of results, to avoid the inclusion of irrelevancies, and to make the material interesting (cited in Molenda, 2002). Direct instruction, which is also known as explicit teaching, is a model of instruction that uses behavioural goals as part of its design. In explicit teaching, "material is presented in small steps, pausing to check for student understanding and eliciting active and successful participation from all students" (Conway, 1997). Software program designs such as 'All the Right Type' allow for individual guided practice in keyboard review or mouse review in the learning lab section. When a student correctly performs the function, a message appears congratulating the learner. This drill and practice programs with positive reinforcement as its reward is part of the operant conditioning that behaviourists propose. Linear and branching tutorials are also a part of this approach.

"A linear tutorial gives the same instructional sequence and feedback to all learners. A branching tutorial directs learners along alternate paths depending on how they respond to questions and whether or not they show mastery of certain parts of the material" (Roblyer, Edwards, and Havriluk, 1997, p 89 cited in Conway, 1997). Tutorials that are part of software programs such as Flash, Dreamweaver, Fireworks, and Photoshop are also examples of linear types. Interactive lessons that deal with health and safety issues (WHMIS, CPR) and computer literacy that inform and then test its learner are part of the branching design. Using these tools, lessons can be taught interactively or directly using drill and practice.

Cognitive Approach

The emphasis on internal mental processes of the mind and how they could be utilized in promoting effective learning rather than focusing on external behaviour started the shift towards cognitivism (Mergel, 1998). This theory emphasizes the importance of the cognitive and affective processes in learning. It indicates that socialization within learning has a profound effect on the construction of knowledge. With this approach, teachers build upon the learner's experiences. Then they provide moderately challenging tasks using scaffolding to help children learn and progress through the different stages of development.

Both cognitivism and behaviourism are governed by an objective view of the nature of knowledge and what it means to know something. Instructional design using the cognitive approach requires an analysis of the task, breaking it down into smaller steps or chunks, and using the information to develop instruction that moves from simple to complex, building on schema (Mergel, 1998). This structure of learning allows the

learning to organize information into meaningful units (Molenda, 2002). This is specifically done to build upon existing knowledge. Scaffolding is an important part of this approach as it allows lower level skills to be built sequentially in order to master higher-level skills. Scaffolding is defined as a communication process where presentation and demonstration by the instructor are contextualized for the learner; performance of the student is coached; and articulation is elicited on the part of the learner (Winnips, 2003). It involves the teacher in executing parts of the task that the student cannot yet manage. When the students have managed to learn the task, a process called fading gradually removes this support until the students are on their own (Collins et al., 1991). This type of linear design according to Bloom's Taxonomy of Learning (1956) uses objectives or learning criteria. When goals and objectives are aligned, teachers are able to teach more directly from their objectives. However, when prescribed learning goals are outlined, as Dick and Carey (1996) emphasize, it makes creating instruction easier, but does little to prepare learners for the unknown realities of tomorrow (cited in Dwight, n.d.). Mager (1997) suggests that no room is given to emergence, transaction, or adaptation to change that frequently happens in the emerging reality of a classroom: instruction is only successful to the degree that it succeeds in changing students in desired ways (cited in Dwight, n.d.). Bloom's Taxonomy of Learning is organized into six levels like floor in a building. Each floor indicates a kind of thinking skill needed to complete an assignment. These thinking skills are:

1. Knowledge – recall of information
2. Comprehension – interpret prior learning
3. Application – transfer selected information to a life problem
4. Analysis – examine, take apart, and draw conclusions
5. Synthesis – combine and integrate parts of prior knowledge into a product that is new

6. Evaluation – assess or criticize on the basis of a specific standard
(Bloom, 1956)

The design process allows learners to apply and synthesise their knowledge in making comparisons to established protocols (Burgess, 2002). In this instructional design, new information is compared to existing cognitive structures, also referred to as schema. The schema is then combined and altered to accommodate new information. The process of acquiring and reorganizing the cognitive structures through which the learners process and store the learning is what cognitivism claims to be (Good & Brophy, 1990, p.187, cited in Mergel, 1998). However, in ill-defined content domains, learners who have the flexibility to adapt to the learning environment excel further than those who do not.

Collaborative learning is a model of instruction indicative of cognitivism. In this model of learning, "students work in teams to master academic materials; teams are made up of high, average, and low achievers, and are radically and sexually mixed, reward systems are group-oriented rather than individually oriented (Arends, 1994, p.344, cited in Conway, 1997). The cookie cutter approach where students create an identical replication of the teacher's work following the directions of the teacher is not what collaboration entails. It is only when students create a final product that would have been impossible without the combined contributions of their hands, heart, and brain that collaboration takes form (Simkins et al., 2002). Software programs such as "word processing programs (Word, WordPerfect, spreadsheet programs (Excel, Lotus 1-2-3), database programs (Access, FoxPro), drawing programs (Paint, Corel Draw, Photoshop), desktop publishing programs (Publisher, Print Shop), and multimedia programs (Power Point, Hyperstudio)" are all tools that students can use to represent their learning as a project and share with their class or publish to the entire world via the World Wide Web

(Conway, 1997). When work is debated and decisions made, it enables students to share their knowledge and skills and to build on one another strengths (Simkins et al., 2002, p.56).

> In collaborative learning situations, students are often attempting to help others work with skills that they themselves have only marginally mastered. Collaborative learning situations provide opportunities for these students to revisit unfamiliar material and move from a superficial level of knowledge to understanding. Explaining something to someone else, providing explanations, and responding to questions requires a depth of understanding that students themselves may not impose on themselves as learners.
>
> (Norton & Wilburg, 2003, p.20)

Using these tools, lessons can be taught collaboratively utilizing the strengths of each individual in the group.

Constructivist Approach

Constructivism is not a theory about teaching, but a theory about knowledge and learning (Brooks & Brooks, 1993, p.vii, cited in Boethel & Dimock, 1999). It is an unique learning theory that may be associated with cognitive psychology because as a theory of learning it focuses on a learner's ability to mentally construct meaning of their own environment and to create their own learning (Forrester & Jantzie, 2000). Constructivist notions of learning start with a simple proposition: individuals construct their own understanding of the world in which they live (Norton & Wilburg, 2003, p.34). The basic premise of constructivism is that teaching and learning should begin by understanding what the learner brings to learning (Shapiro, 1994, p.xiv, cited in Boethel & Dimock, 1999). From here, learners continue to construct their own perspective of the world through individual experiences and schema (Mergel, 1998). Through this process, their ideas gain in complexity and power. With appropriate support, the learners gain

critical insight into how they think and what they know about the world as their understanding increases in depth and detail (Strommen, 1999).

One such approach that embraces many of the ideals of constructivism is problem-based learning (PBL) (Barrows & Tamblyn, 1980; Savery & Duffy, 1995, cited in Brush & Scott, 1998). Problem based learning starts with a problem and works towards the understanding or resolution of the problem. This is in contrast to traditional instructional approaches in which the content is usually presented first and then a related problem is presented as an example or assigned as an exercise (Brush & Scott, 1998). Problem-based learning is determined by the complex interplay among the learners' existing knowledge, the social context, and the problem to be solved (Tam, 2000, p.4). Through an active process of collaboration, learners socially construct a solution to the problem. The dialogue that results from this combined effort provides learners with the opportunity to test and refine their understanding of the problem (Tam, 2000, p.4).

In a constructivist environment, meaning is negotiated and constructed; therefore, it is unique to the each learner. In situations that require conformity, divergent thinking and action may cause problems (Mergel, 1998). Learners always hold a subjective and self-chosen position in constructivism (Boethel & Dimock, 1999). Consequently, this makes the constructivist approach to instruction difficult to design, manage, and support. The assumptions of extreme constructivism jumble indiscriminately ideas about teaching and ideas about learning:

> that content cannot be pre-specified because every learning task is unique; that learners learn in idiosyncratic ways; that objectives or learning outcomes are content specific; that there is no domain independent instructional strategy; that there can be no external control of the instructional events except that which the learner chooses; that there can be no isolated tasks, only real world tasks; that there can be no

> simplification of content; that content cannot be separated from use; that the teacher must model the process, but must not be scripted; and that there must always be alternative views.
>
> (Merrill, 1992, cited in Boethel & Dimock, 1999)

Constructivism is a learning theory and should not be confused with its application to teaching. However, often these two distinct elements are confused for one another. The idea of moving from constructivist learning theory to constructivist approach to instruction requires more than giving students sufficient time to work collaboratively with their peers to construct knowledge through authentic real-world problems. It is not an add-on to instruction, but requires a new way of learning and teaching.

The application of technology in the schools has paved the way to an ideal constructivist environment because now the learners are in control. Interactive technology allows learners with a push of a button to access and exchange information instantaneously. Traditional classroom tools, on the other hand, such as pencils, notebooks, and texts are still vital, but for learners to assemble and modify their ideas, access and study information, they are still inadequate (Strommen, 1999). The potential of telecommunication technology lies in its ability to function as a gateway: a gateway to resources, collaborative learning, and individual achievement (Tam, 2000, p.11). "It can be used to honour the construction of knowledge by supporting conversations, reflections, and shared exploration rather than as a tool for delivering rote definition and answers. It can provide a vehicle for moving beyond problem solving by enabling issues, dilemmas, and problems to emerge from authentic activity" (Norton & Wilburg, 2003, p.34). Jonassen (1994) identifies eight attributes of a constructivist-learning environment:

1. Provides multiple representation of reality
2. Represents the natural complexity of the world
3. Focuses on knowledge construction, not reproduction
4. Presents authentic tasks (contextualizing rather than abstract instruction)
5. Provides real-world, case based learning environments, rather than predetermined instructional sequences
6. Fosters reflective practice
7. Enables context and content dependent knowledge construction
8. Supports collaborative construction of knowledge through social negotiation

(cited in Norton & Wilburg, 2003, p.33-34)

The constructivist approach to learning suggests that there should be a focus for structured activities, which are learner-centered with students taking responsibility for the construction of their own learning. This epistemological shift to learner- centered brings with it a shift in thinking about a new concept of instructional design (Hammond-Kaarremmaa, 2003, p.8). Technology when used as a tool for learning rather than the object of instruction or as the instructor can assist teachers as they strive to:

- Uncover student's prior knowledge
- Tap into student interests and provide increased motivation
- Based instruction on the posing of problems
- Provide a variety of experiences, experimentation, and negotiation of meaning
- Take on the role of being the facilitator
- Increase the ability of students to test multiple scenarios and thus challenge preconceived notions or misconceptions
- Increase the authenticity of the content and context
- Broaden the circle of social interaction to include students' peers and experts beyond the classroom, the school, the community, and even their own country

(Boethel & Dimock, 1999)

However, knowing what a constructivist environment looks like and applying it to instruction is a challenge that involves a complex array of tasks. While constructivism does give suggestions of teaching strategies, it does not provide a framework for the design of learning opportunities for creating of an instructional plan for students (Norton

& Wilburg, 2003, p.36). Furthermore, the absence of specific learning objectives and outcomes has earned the criticism of constructivism as inefficient and ineffective because they are costly to develop (Dick, 1992, cited in Tam, 2000, p.13). Without specific learning objectives, performance in a constructivist environment requires a different method of evaluation.

Instructional design in a constructivist environment requires the designer to arrange for the necessary resources and facilitate the process to allow the learners to set their own goals and teach themselves (Roblyer, Edwards, and Havriluk, 197, p.70, cited in Conway, 1997). This type of design contrasts sharply to the traditional approach to instructional design. The constructivist view "summons instructional designers to make a radical shift in their thinking and to develop rich learning environments that help to translate the philosophy of constructivism into actual practice (Tam, 2000, p.7). Willis (1995) offers a model that he termed the 'Constructivist-Interpretivist Design Model' which follows these design principles:

1. The design process is recursive, non-linear, and sometimes chaotic.
2. Planning is organic, developmental, reflective, and collaborative.
3. Objectives emerge from design and development work.
4. General ID experts do not exist.
5. Instruction emphasizes learning in meaningful context (the goal is personal understanding within meaningful contexts).
6. Formative evaluation is critical.
7. Subjective data may be the most valuable.

(cited in Tam, 2000, p.8)

A constructivist design within the context of this framework leads to a "variety of learning environments and instructional models" (Tam, 2000, p.8-9). Within this learning environment, there is a need to embed learning into authentic and meaningful contexts. According to Jonassen et al. (1995), "the most effective learning contexts are

those that are problem or case-based, that immerse the learner in the situation requiring him or her to acquire skills or knowledge in order to solve the problem or manipulate the situation" (cited in Dodge, 1998). Problems such as this are viewed as the effective anchor that captures the imagination and legitimizes the disciplinary content they integrate (Barab et al., 1997, p.53, cited in Brush & Scott, 1998). "They should be specific enough so that the students and the teacher understand and agree on the topic. It must be also be general enough to be pursued from multiple perspectives based on individuals' prior experiences and knowledge"(Brush & Scott, 1998). Technologies that support this include various types of "simulation, strategy software, video disks, multimedia, hypermedia, telecommunications (email and Internet)", and other courseware that promote a collaborative learning community (Tam, 2000, p.10). "One of the most useful tools for the constructivist designer is hypertext and hypermedia because it allows for a branched design rather than a linear format of instruction. Hyperlinks allow for learner control, which is crucial to constructivist learning" (Mergel, 1998). Instruction based on constructivist principles is, nonetheless, extremely demanding and requires subject-matter knowledge, general pedagogical knowledge, pedagogical content knowledge, as well as knowing how to fit technology into the mix (Boethel & Dimock, 1999). Although there is a growing interest in constructivism in education, developing a true constructivist environment requires new skills from teachers and students that take time and effort to achieve.

The Value of Learning Theories

With a solid understanding of the different learning theories, instructional designers are able to assess the characteristics of a learner to match the learning

environment. When instructional designers understand the strengths and weaknesses of each learning theory, this knowledge allows them to optimize their use in an appropriate instructional design strategy (Mergel, 1998). However, there is no one best theory for instructional design as the circumstances surrounding the situation helps decide which approach is most appropriate. The goal is to align teaching and learning so that they work together as a system and not as independent entities.

Discussion – A Framework for Teaching and Learning with ICT

Rationale

Technology alone is not the solution to teaching and learning. It requires the restructuring and redesigning the existing teaching and learning practices with incorporation of technologies (Lim, 2001). The integration of technology should not be technology driven. Rather it should be pedagogical-driven focusing on teaching and learning problems, needs, and learning styles (Lim, 2001). Tapscott (1998) outlines eight shifts he believes instructors and students need to make if they want a more powerful and effective learning paradigm. These shifts are:

1. From linear to hypermedia learning
2. From instruction to construction and discovery
3. From teacher-centered to learner-centered education
4. From absorbing material to learning how to navigate and how to learn
5. From school to lifelong learning
6. From one size fits all to customized learning
7. From learning as torture to learning as fun
8. From teacher as a transmitter to a teacher as a facilitator

(Tapscott, 1998, cited in Reid, 2002, p.3)

According to Tapscott, learning has transformed from broadcast learning to interactive learning, as today's generation of learners are no longer satisfied in being the passive recipients of the traditional teaching process (Forrester & Jantzie, 2000). The penetration

of new technology into the learning process has also placed profound consequences on how learning takes place. Technology has given teachers and instructional designers more capabilities in developing more diversified and socially rich learning contexts (Tam, 2000). However, there is still an estrangement of the schools from society and from the children who live in it. Schools have not kept pace with students and their needs. In the classroom, knowledge is still presented to them in a linear, didactic manner that differs dramatically from children's previous experience outside the school (Strommen, 1999).

In order to bring learning more inline with societal changes and student learning, I am proposing a framework for teaching and learning with ICT. This blended project-based multimedia model using Merrill's (2001) First Principles of Instruction is an eclectic approach assimilating a broad range of instructional theories and principles.

Instructional Approach

Blended Project-Based Multimedia Model of Learning

Blended learning is not a new approach. Blended learning is a mix of self-study and human interaction. It is a learning solution that includes face-to-face, live online learning, and self-paced learning (Valiathan, 2002). Driscoll (2002) determined that blended learning involves four concepts:

1. To combine or mix modes of web-based technology (e.g. live virtual classroom, self-paced instruction, collaborative learning, streaming video, audio, and text) to accomplish an educational goal.

2. To combine various pedagogical approaches (e.g. constructivism, behaviorism, cognitivism) to produce an optimal learning outcome with or with out instructional technology.

3. To combine any form of instructional technology (e.g. videotape, CD-ROM, web-based training, film) with face-to-face instructor-led training.

4. To mix or combine instructional technology with actual job tasks in order to create a harmonious effect of learning and working.

There are different applications for blended learning. The blended model that I am suggesting takes an eclectic approach, which combines a project-based component within a blended model using Merrill's (2001) First Principles of Instruction. It has four components:

1. Web-based Delivery – this is where web pages are pushed to the learner.
2. Face-to-Face Processing – information given via the web is processed and built into knowledge.
3. Creating Deliverables – the new knowledge is used to make deliverables that are served on the web.
4. Collaborative Extension of Learning – learners are grouped to meet periodically face-to-face or online. This extends learning, shares new learning, and gives feedback on improving the process.

(Barnum, 2002)

The sequencing of the elements in this model is more of an attitude driven design rather than a skills driven or a competency driven design. Attitude driven design blends collaborative learning events through instructor led sessions and learning and interactions and discussions through technology (Valiathan, 2002). Group projects, live web conferences, discussion forums, and instructor led sessions which are scheduled after learners have gone through self-paced knowledge modules are all part of the techniques used in this model (Valiathan, 2002).

Web-based delivery allows for chunking of the materials over a period of time. This modular design allows student to revisit the subject matter or tutorial as often as they need it (Barnum, 2002). This shift in teacher-centered instruction to a student-centered learning involves active participation on the student's part, which is critical for effective learning (Felder et al., 2000; Rogers, 2000, Ritter & Lemke, 2000, cited in Lim,

2001). This push technology includes a "provision of learner control over pace, time, place of accessing materials as well as selecting or skipping of materials as required" (Lim, 2001). It is grounded in the Cognitive theories and reflects a constructivist philosophy of instruction where students are learning and doing work simultaneously in order to develop procedural knowledge and link it to conceptual knowledge (Brush & Scott, 1998).

Face-to-face processing provides for the human interactions that are necessary to build deeper understanding (Barnum, 2002). The classroom brings individuals with different background knowledge, experience, and interests to the learning situation to make unique connections in building their knowledge from their own learning on the web (Tam, 2000). Students are encouraged to question each other's understanding and explain their own perspectives. Using both mediums to learn, students are taking smaller steps in making change easier to accept (Driscoll, 2002).

Project-based multimedia learning is integrated into the creating deliverables component and can be completed online or face-to-face. Within this component, students acquire new knowledge and skills in the course of designing, planning, and producing a multimedia product such as text, graphics, video, animation, and sound to convey their understanding (Simkins et al., 2002, p.2-3). This shifts the paradigm away from the focus on superficial assessment of rote learning to student portfolios, oral presentations, multimedia presentations, and reviews by experts and peers (Simkins et al., 2002, p.vi). Project based multimedia learning has seven key components:

1. Core Curriculum – a clear set of learning goals are drawn from the curriculum, which lends itself well in its integration across the curriculum.

2. Real World Connections – seeks to connect students' work in school with the wider world in which the students live.

3. Extended Time Component – is not a one-shot lesson, but extends over a significant period of time. Students experience a succession of challenges that culminates in a substantial final product from which they can derive pride and a clear sense of accomplishment.

4. Student Decision Making – teachers are clearly in charge of the direction of the project; however, students make decision on the form and content of their final product.

5. Collaboration – students work in teams of five or six and are involved in making separate contributions to the final work in order to have the whole to be greater than the sum of its parts.

6. Assessment – the final work does not represent a full picture of the student learning. Students are gaining content information, becoming better team members, solving problems, and making choices about what new information to show in their presentations. In project-based multimedia context, assessment involves activities for developing expectations, activities for improving the media products, and activities for compiling and disseminating the evidence of learning.

7. Multimedia – students do not learn simply by using multimedia produced by others, rather they learn by creating it themselves. As the students design and research their projects, instead of gathering only written notes, they also gather and create pictures, video clips, recordings, and other multimedia objects that will later serve as the raw material for the final product.

(Simkins et al., 2002, p.3-5)

The collaborative extension of learning involves taking the concepts and continuing to refine them to create an even deeper understanding of the topic. Although this activity can be done face-to-face or online, this component is more effective online. With technology, it can offer considerable data, considerable bits of information, and considerable interesting ideas that can be shared, discussed, and used (Burgess, 2002). A negotiated discourse enhances the student's capability to be a divergent thinker and more creative in nature (Burgess, 2002). When teachers play the role of a mentor and manager of this dialogue, their action directs the individualization and metacognitive skills to help

the learner through the learning process (Akins, 1993, cited in Burgess, 2002). Moreover, when students are engaged in carrying out various online learning tasks and activities, which involves self-reflection and self-evaluation, archived transcripts of online conferencing are available to help the facilitator / designer revise the course to suit the audience or context (Lim, 2001). This can make the design more dynamic and flexible.

The target population and their preferences dictate the balance in the blended learning environment. Nevertheless, these are two essential elements that designers must keep in mind. The first is what the target population needs to learn as not all subjects are well served by an online component. The second is the learning styles of the population (Elfstrom, 2002). Blended learning requires computer skills in using a browser and basic software applications. Because online learning is text heavy, the target population must also be able to read, write, and type (Elfstrom, 2002). For schools that are experiencing a shortage of classrooms and for commuter schools, a blended solution works to their benefit as it has the potential to reduce costs and save people time and money.

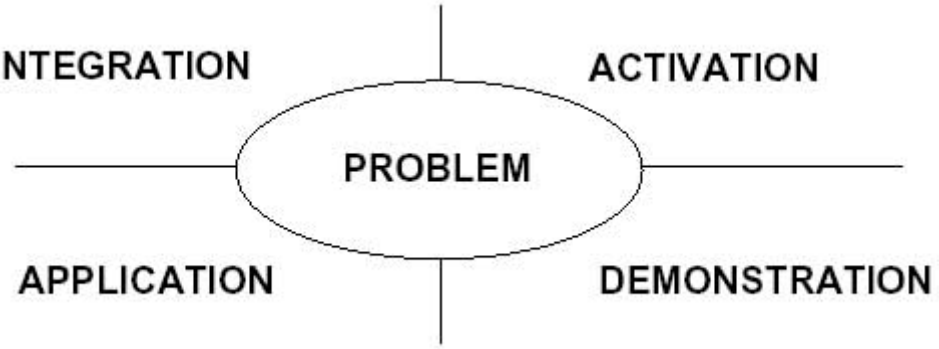
First Principles of Instruction (Merrill, 2002)

Merrill emphasizes that instructional design requires the identification of goals and involves a process of planning, developing, implementing, and evaluating. However, he argues that this type of detailed implementation is not the most efficient or effective. A more significant element is the emphasis on the process involved in the developing of instruction rather than the basic learning principles that this process should emphasize (Merrill, 2002b, p.39). Merrill's First Principles of Instruction (2001) is based on the premise that there are a set of principles that can be found in most instructional design

theories and models and even though the terms used to state these principles might be different between theorists, the authors of these theories would agree that these principles are necessary for effective and efficient instruction (Merrill, 2002a, p.44).

The 'First Principles of Instruction' (Merrill, 2001) proposes five phases to the instructional process (see Figure 2 below):

Figure 2 - Merrill's First Principles of Instruction (2001)



1. Learning is promoted when learners are engaged in solving real-world problems.
2. Learning is promoted when existing knowledge is activated as a foundation for new knowledge.
3. Learning is promoted when new knowledge is demonstrated to the learner.
4. Learning is promoted when the learner applies the new knowledge.
5. Learning is promoted when new knowledge is integrated into the learner's world.

(Merrill, 2002a, p.44-45)

The 'Blended Project-Based Multimedia Model of Learning' is based on the "First Principles of Instruction". The web-based delivery component specifies a typical problem that represents the whole task that the student will be able to do following the instruction broken down in the modules (Merrill, 2002b, p.41). The common practice is to state learning objectives at the beginning of modules or lesson materials. However, Van Merriérnboer (1997) recommends that the first problem in a sequence should be a worked example that shows students the type of whole task that they will learn to

complete (cited in Merrill, 2002a, p.46). The whole task involves four levels of instruction: the problem, the tasks required to solve the problem, the operations that comprise the operations, and the actions that comprise the operations (Merrill, 2002a, p.46). Effective learning begins by engaging the students in solving real world problems

The activation phase is more than pre-testing of knowledge. It requires the teacher to start where the student is and to activate relevant experiences that lay the foundation for the new knowledge (Merrill, 2002a, p.46). This is important because instruction that immediately jumps to new material only overwhelms students whereas if the students have experiences that are relevant to the material this can be used to build upon the new knowledge. Metacognition is used quite often in the activation phase and takes the form of internal dialogue. It include the ability to predict outcomes, explain oneself in order to improve understanding, note failures to comprehend, activate background knowledge, plan ahead, and apportion time and money (Knibb, 2001). Using themes within each of the modules would allow the knowledge to be structured as advanced organizers.

Whether it is in the web-based delivery or the face-to-face processing component, instruction must demonstrate what is to be learned rather than merely telling what is to be learned (Molenda, 2002). Showing students what and how to do a problem via a worked out example and modeling examples are important first steps (Merrill, 2002a, p.48). More specifically, providing multiple representations of the ideas being taught delivers even better results. Spiro & Jehng (1990), Schwartz, Lin, Brophy, and Bransford (1999), and Clark & Blake (1997) all stressed the importance of alternative points of view, especially for ill-defined domains and non-concurrent skills (cited in Merrill, 2002a,

p.48). For both web-based and face-to-face delivery, using graphics and audio work best in demonstrating the new knowledge. Some combinations of multimedia (text and graphic) compete for attention and therefore increase the cognitive load of the learner. Graphics and audio support one another and promote more effective learning (Mayer, 2001, cited in Merrill, 2002a).

Project-based multimedia learning involves creating deliverables with the new knowledge. Practice promotes retention of the new knowledge. Gardner (1999) and Perkins & Unger (1999) both emphasize the necessity of many opportunities for performance (cited in Merrill, 2002a, p.49). Learning is promoted when the practice is consistent with the learning goals and involves doing real-world tasks or problems. Project-based multimedia learning requires collaboration and seeks real-world connections. Within this component, there is coaching early on and feedback is continuous. However, gradual fading will allow students to take more responsibility in performing the various parts of the task to create the final multimedia product.

Integrating the new knowledge works within the collaborative extension of learning component and requires students to create personal adaptations of the new knowledge and skills (McCarthy, 1996, cited in Merrill, 2002a, p.50). Project-based multimedia learning finishes with a final deliverable; however, this has a temporary effect on motivation. The real motivation for learners is learning. Learners should be given the opportunity to showcase their work, "defend their new knowledge, and modify their new knowledge for use in their everyday lives" (Merrill, 2002a, p.50). Reflection also has the effect of promoting learning, as the learner now has to re-visit the problem to

create avenues for improvement. This in turn creates a deeper understanding of the new knowledge transforming the factual information into useable knowledge (Knibb, 2001).

Merrill's First Principles of Instruction (2001) is a more efficient development process as the content is developed first and overcomes some of the problems associated with instructional systems development. "That being too slow, clumsy, of claiming to be technology when it is not, of producing bad instruction, and of being out of touch with today's training needs" (Gordon & Zemke, 2000, cited in Merrill, 2002b, p.39). It also works well within the blended project-based multimedia model of learning. However, most importantly, it confirms what teachers do well already, identifying gaps and grounding teaching practice in complex, but manageable ways (Knibb, 2001).

Conclusion

While there is no universal best teaching practice, it is important for teachers to have a skill set that will help them make good decisions regarding the match between different instructional methods, goals, and types of learners (Knibbs, 2001). Merrill's First Principles of Instruction (2001) provides the guideline for this decision-making. It examines instruction from the point of view of the five principles and suggests that the most effective learning products or environments are those that are problem-centered and involve students in four distinctive phases of learning: a) activation of prior experience b) demonstration of skills c) application of skills d) integration of these skills into real-world activities (Molenda, 2002). The blended project-based multimedia model of learning is an approach that works within Merrill's framework.

Technology has also revolutionized how students learn. It has created a generation of children weaned on multidimensional and interactive media sources. If we

are to give these children the education necessary to succeed in technological advanced global economy, a new form of educational practice, one that builds on these children's native learning abilities and technological competence, must replace our existing methods (Strommen, 1999). However, undertaking "systemic reform" (sustained, large-scale, simultaneous innovation in curriculum, pedagogy, assessment, professional development, administration, incentives, and partnerships for learning among schools, businesses, homes, and community settings) requires policies and practices different from fostering pilot projects for small-scale educational improvement (Means, 1994, cited in Dede, 2000). In fact, new tools alone do not create educational change (Riel, 1990, cited in Strommen, 1999). The power is not in the tool, but in the community that can be brought together and the collective vision that they share for redefining classroom learning (Strommen, 1999).

The blended project-based multimedia model of learning used within Merrill's First Principles of Instruction focuses on the competencies that students already have. The use of technology to develop learning is essential because it is a medium that most students know and are comfortable with. The key to success lies in finding the appropriate points for integrating technology into a new pedagogical practice, so that it supports a deeper, more reflective self-directed activity students must use if they are to be competent adults in the future (Strommen, 1999). There are many barriers to this initiative. There is a systemic lack of awareness of the appropriate uses of technology in the classroom. As well, teachers are resistant to change. If the skeptics "understood that once they mastered the approach, their daily work will be sustainable without extraordinary exertion", it would create more buy in (Dede, 2000). Students, too, have

been socialized with certain expectations about schooling and success and are unwilling to change (Boethel & Dimock, 1999). There is also an absence of new forms of assessment to measure the effectiveness of the new forms of classroom learning (Strommen, 1999). Finally, these dramatic changes require a solid foundation in the subject matter, teaching pedagogy, and technology skills, all areas that most teachers are woefully under prepared (Boethel & Dimock, 1999).

We are in a new era of education. Technology encompasses what we do on a daily basis. As teachers, we are failing our students if we do not face our own fears of learning technology. It is also socially irresponsible not to change our teaching pedagogy to make learning more effective in a technological environment. However, those teachers who are willing to implement innovative pedagogies and curricula are the true pioneers. These are the people who see continuous change and growth as an integral part of their professional practice and are willing to swim against the tide of conventional operating procedure often at considerable personal cost (Dede, 1998, cited in Dede, 2000). An important attribute of leaders is their ability to displace deeply held, cherished, misconceptions with alternative visions that more accurately depict reality (Serim, 2000, p.47). With my experience as a Master student in the Educational Technology program, I have gained the knowledge to lead as a pioneer and the confidence to dispel mistaken beliefs that most people hold about teaching and learning that often form a barrier to improvement.

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