I.

ICTs AND TEACHER EDUCATION: GLOBAL CONTEXT AND FRAMEWORK

Information and communication technologies (ICTs) are a major factor in shaping the new global economy and producing rapid changes in society. Within the past decade, the new ICT tools have fundamentally changed the way people communicate and do business. They have produced significant transformations in industry, agriculture, medicine, business, engineering and other fields. They also have the potential to transform the nature of education—where and how learning takes place and the roles of students and teachers in the learning process.

Teacher education institutions may either assume a leadership role in the transformation of education or be left behind in the swirl of rapid technological change. For education to reap the full benefits of ICTs in learning, it is essential that pre-service and in-service teachers have basic ICT skills and competencies. Teacher education institutions and programmes must provide the leadership for pre-service and in-service teachers and model the new pedagogies and tools for learning. They must also provide leadership in determining how the new technologies can best be used in the context of the culture, needs, and economic conditions within their country. To accomplish these goals, teacher education institutions must work closely and effectively with K-12 teachers and administrators, national or state educational agencies, teacher unions, business and community organizations, politicians and other important stakeholders in the educational system. Teacher education institutions also need to develop strategies and plans to enhance the teaching-learning process within teacher education programmes and to assure that all future teachers are well prepared to use the new tools for learning.
GLOBAL CONTEXT

As noted in the UNESCO World Education Report, *Teachers and Teaching in a Changing World* (UNESCO, 1998), the young generation is entering a world that is changing in all spheres: scientific and technological, political, economic, social, and cultural. The emergence of the ‘knowledge-based’ society is changing the global economy and the status of education.

These new possibilities exist largely as the result of two converging forces. First the quantity of information available in the world—much of it relevant to survival and basic well-being—is exponentially greater than that available only a few years ago, and the rate of its growth is accelerating. A synergistic effect occurs when important information is coupled with a second modern advance—the new capacity to communicate among people of the world. The opportunity exists to harness this force and use it positively, consciously, and with design, in order to contribute to meeting defined learning needs.

As is the case for other sectors of the wider economy and society, education will need to come to terms with the new technologies. This could require substantial public and private sector investments in software research and development, purchase of hardware, and refurbishment of schools. It will be difficult for national policy-makers to resist finding the necessary resources, whatever their sensibilities for expenditure on education, although without international co-operation and assistance the poorest countries could fall still further behind. Parents and the public at large, in the industrial countries at least, are unlikely to accept for too long the notion that education should be less well equipped with the new technologies than other areas of social and economic activity (UNESCO World Education Report, 1998, pp. 19-20).

There is growing awareness among policy-makers, business leaders and educators that the educational system designed to prepare learners for an agrarian or industrially-based economy will not provide students with the knowledge and skills they will need to thrive in the 21st century’s knowledge-based economy and society. The new knowledge-based global society is one in which:

- the world’s knowledge base doubles every 2–3 years;
- 7,000 scientific and technical articles are published each day;
- data sent from satellites orbiting the earth transmit enough data to fill 19 million volumes every two weeks;
graduates of secondary schools in industrialized nations have been exposed to more information than their grandparents were in a lifetime;

there will be as much change in the next three decades as there was in the last three centuries (National School Board Association, 2002).

The challenge confronting our educational systems is how to transform the curriculum and teaching-learning process to provide students with the skills to function effectively in this dynamic, information-rich, and continuously changing environment.

The technology-based global economy also poses challenges to countries as national economies become more internationalized, with the increasing flow of information, technology, products, capital, and people between nations. This new economic environment is creating a new era of global competition for goods, services, and expertise. All of these changes are producing dramatic shifts in the political, economic and social structures of many countries around the world. In industrialized nations, the economic base is shifting from industry to information. This shift also demands new knowledge and skills in the work force. ICTs have changed the nature of work and the types of skills needed in most fields and professions. While they have, on the one hand, created a wide array of new jobs, many of which did not even exist ten years ago, they have also replaced the need for many types of unskilled or low-skilled workers. For example, the new ‘smart’ agricultural equipment, using advance digital and industrial technology, is able to do the work previously done with a large number of low-skilled agricultural workers. In addition, new manufacturing plants are requiring fewer low-skilled workers. A Canadian study notes, for example, that in high-tech companies only 10% of the work force is comprised of unskilled workers (National School Board Association, 2002). These trends pose new challenges to educational systems to prepare students with the knowledge and skills needed to thrive in a new and dynamic environment of continuous technological change and accelerating growth in knowledge production.

Education is at the confluence of powerful and rapidly shifting educational, technological and political forces that will shape the structure of educational systems across the globe for the remainder of this century. Many countries are engaged in a number of efforts to effect changes in the teaching/learning process to prepare students for an information and technology-based society. The UNESCO World Education Report (1998) notes that the new technologies challenge traditional conceptions of both teaching and learning and, by reconfiguring how teachers and learners gain access to
knowledge, have the potential to transform teaching and learning processes. ICTs provide an array of powerful tools that may help in transforming the present isolated, teacher-centred and text-bound classrooms into rich, student-focused, interactive knowledge environments. To meet these challenges, schools must embrace the new technologies and appropriate the new ICT tools for learning. They must also move toward the goal of transforming the traditional paradigm of learning.

To accomplish this goal requires both a change in the traditional view of the learning process and an understanding of how the new digital technologies can create new learning environments in which students are engaged learners, able to take greater responsibility for their own learning and constructing their own knowledge. Thomas Kuhn suggests that revolutions in science come about when the old theories and methods will not solve new problems. He calls these changes in theory and methods a "paradigm shift." There is widespread concern that the educational experiences provided in many schools will not prepare students well for the future. Many educators and business and government leaders believe that creating a paradigm shift in views of the learning process, coupled with applications of the new information technologies, may play an important role in bringing educational systems into alignment with the knowledge-based, information-rich society.

THE TRADITIONAL VIEW OF THE LEARNING PROCESS

The existing view of the learning process emerged out of the factory model of education at the turn of the 20th century and was highly effective in preparing large numbers of individuals with skills needed for low-skilled positions in industry and agriculture. The innovation of classrooms with 20-30 students was created along with the concept of standardized instruction for everyone. The traditional, teacher-centred approach to learning is illustrated in Figure 1.1. As shown, the teacher is the expert and the dispenser of knowledge to the students. It is largely a 'broadcast' model of learning where the teacher serves as the repository and transmitter of knowledge to the students. The traditional educational paradigm is often characterized by the following views of learning:

- Learning is hard. Many view learning as a difficult and often tedious process. According to this view, if students are having fun or enjoying what they are doing in a learning activity, they probably are not learning.
• **Learning is based on a deficit model of the student.** The system strives to identify deficiencies and weaknesses of the student. Based on noted deficiencies, students are tracked, categorized, remediated or failed. The impact of the deficit model of student learning is most obvious in compensatory education programmes. As implied by the term, compensatory education is designed to make up or remediate learning that some children, particularly poor minority children, do not have, but which the curriculum and structure of schooling assume are common to all children.

Bruer, in his book, *Schools for Thought*, notes that research overwhelmingly concentrates on the weaknesses of poor children. Very little research has been done on their strengths. In addition, the weaknesses identified are often deficiencies in terms of the traditional organization and content of schooling. Very little thought has been given to the idea of changing schooling to accommodate new kinds of students; all the effort has gone to changing the students so that they will fit into the schools. In addition, the underlying assumptions about poor students’ motivation, language, and conceptual development have..."militated against offering them a literacy of thoughtfulness and have favoured a low-level, atomized, concrete, basic-skills curriculum. The language of that curriculum has been so simplified that it is both boring and artificial. It has been stripped of its richness and context and made fundamentally meaningless, which is to say unabsorbable by normal people, except through memorization, whose effects last only a few hours or days.” (Bruer, 1993)
Learning is a process of information transfer and reception. Much of our present learning enterprise remains "information-oriented," emphasizing students reproducing knowledge rather than producing their own knowledge. It also remains teacher-centred. Many still see the role of the teacher as a dispenser of information and the role of the student as a passive receiver, storer and repeater of the transmitted information (see Figure 1.1). The prevalence of this view is supported by observations that teachers continue to rely on old standbys such as lectures, textbook reading, and fill-in-the-worksheets practices that reduce students to passive recipients of information and fail to develop their thinking skills.

Learning is an individual/solitary process. In a study of schools in the United States, the National Assessment of Educational Progress noted that most students spend long hours working alone at their desks completing worksheets or repetitive tasks. A London Times survey of English school children indicated that students almost unanimously rejected this daily ordeal of dull and ritualistically solitary classroom activity and called for a broader and more exciting curriculum. Above all, they wanted more work allowing them to think for themselves. They wanted to design and make things, to experiment and to engage in first-hand observation. The Times reported, however, that there was little evidence of changes in the curriculum that would respond to the students’ wishes. (Resta, 1996)

Learning is facilitated by breaking content/instruction into small isolated units. The educational system is often geared more to categorizing and analyzing patches of knowledge than to sewing them together. Bruer (1993) notes that the technology of mass education is quite adept at “breaking knowledge and skills into thousands of little standardized, decontextualized pieces, which could be taught and tested one at a time.”

Neil Postman in his book, Teaching as a Subversive Activity, states that our educational systems break knowledge and experience into "subjects, relentlessly turning wholes into parts, history into events without restoring continuity." (Postman, 1969)

Learning is a linear process. Frequently, the textbook or teacher provides only one linear path through a narrowly bounded content area or sequence of standardized instructional units. For example, in a mathematics text only one correct problem solution trail may be offered for a specific subclass of problems. However, the problems
encountered in daily life (or in mathematics) seldom have only one solution path or sequence.

**CHANGES IN VIEWS OF THE LEARNING PROCESS**

In contrast to the traditional teaching-learning paradigm, a new paradigm of the teaching-learning process is emerging, based on three decades of research in human learning, that encompasses the following views of the human learning process:

- **Learning is a natural process.** The natural state of the brain is to learn, however, not everyone learns in the same way. There are different learning, perceptual and personality styles that must be considered in the design of learning experiences for the individual student. Given interesting and rich learning environments, and supportive and stimulating teachers, students will learn. Teachers have often noted that children who appear disruptive or to have short attention spans when confronted with typical classroom instruction, may spend long periods engaged in meaningful and interesting computer-related activities.

- **Learning is a social process.** The communal context of knowledge and learning is beginning to be rediscovered, as evidenced by the rapid growth of quality circles and computer-supported collaborative work in business, government, medicine, and higher education. As Vygotsky (1978) noted long ago, students learn best in collaboration with peers, teachers, parents, and others when they are actively engaged in meaningful, interesting tasks. ICTs provide opportunities for teachers and students to collaborate with others across the country and across the globe. They also provide new tools to support this collaborative learning in the classroom and online.

- **Learning is an active and not a passive process.** In most fields, people are faced with the challenge of producing knowledge rather than simply reproducing knowledge. To allow students to move toward competence, they must be actively engaged in the learning process, in activities such as solving real problems, producing original writing, completing scientific research projects (rather than simply studying about science), dialoguing with others on important issues, providing artistic and musical performances, and constructing physical objects. The traditional curriculum asks students only to recall and describe what others have accomplished or produced. While all pro-
duction of knowledge must be based on an understanding of prior knowledge, the mere reproduction of knowledge, without its connection to the production of knowledge, is largely a passive activity that neither fully engages nor challenges the student.

- **Learning may either be linear or non-linear.** Much of what now happens in schools appears based on the notion that the mind works like a serial processor that is designed to process only one piece of information at a time in sequential order. But the mind is a wonderful parallel processor that may attend to and process many different types of information simultaneously. Cognitive theory and research sees learning as a reorganization of knowledge structures. The knowledge structures are stored in semantic memory as schema or cognitive maps. Students "learn" by augmenting, combining, and rearranging a collection of cognitive maps, many of which overlap or are interconnected through a complex network of associations. There are many ways that students may acquire and process information and assimilate it into their existing knowledge structures. Although some knowledge domains, such as mathematics, may perhaps lend themselves to a linear approach, not all learning can or should occur linearly.

- **Learning is integrative and contextualized.** Pribram’s holistic brain theory suggests that information presented globally is more easily assimilated than information presented only in a sequence of information elements (Pribram, 1991). It is also easier for students to see relations and to make connections. Jacob Bronowski (1990), in *Science and Human Values*, made the point that to discover the connection between what had seemed two isolated facts of existence is a creative act, whether the field is art or science. He calls it an act of unifying. This is not something that can be done for learners; these connections cannot be made in learners’ minds. Information can be given, the connection can even be stated. But even if the information is repeated, it cannot be assumed it is really known. The learners must discover it for themselves. That is not to say that learners must discover everything unaided. The teacher’s role is to help them in several ways to make connections and to integrate knowledge.

- **Learning is based on a strength model of student abilities, interest, and culture.** Based on the work of Howard Gardner and others, schools are beginning to consider the specific strengths and interests that students bring to the learning environment, and are designing learning activities that build on student strengths rather than focusing only upon remediating weaknesses. In addition, schools increasingly rec-
ognize diversity as a resource rather than a problem in the classroom. In contrast to the remedial and standardized concept of instruction, diversity and individual differences are valued and the learning process is designed to build on the strengths and assets brought by the learner to the classroom.

• **Learning is assessed through task completion, products, and real problem solving of both individual and group efforts.** Rather than simply evaluating students through paper and pencil tests, assessments are made using portfolios of actual performances and work in both collaborative and individual learning tasks.

The traditional view of the learning process is typically teacher-centred, with teachers doing most of the talking and intellectual work, while students are passive receptacles of the information provided. This is not to indicate that the traditional lecture method is without value, as it allows the teacher to quickly convey lots of information to students and is a useful strategy for recall or rote learning. However, it is not the most effective way to help students develop and use higher order cognitive skills to solve complex real-world problems. As noted by Driscoll (1994), we no longer can view learners as "empty vessels waiting to be filled, but rather as active organisms seeking meaning."

Don Tapscott, in his book *Growing Up Digital: The Rise of the Net Generation* (1998), notes that we are entering a new era of digital learning in which we are in the process of transitioning from "broadcast" learning to "interactive" learning. Today’s students no longer want to be passive recipients in the information transfer model of learning. Rather they want to be active participants in the learning process. There is growing recognition that today’s world requires that students be able to work collaboratively with others, think critically and creatively, and reflect on their own learning processes.

**A SHIFT FROM TEACHING TO LEARNING**

As technology has created change in all aspects of society, it is also changing our expectations of what students must learn in order to function in the new world economy. Students will have to learn to navigate through large amounts of information, to analyze and make decisions, and to master new knowledge domains in an increasingly technological society. They will need to be lifelong learners, collaborating with others in accomplishing complex tasks, and effec-
tively using different systems for representing and communicating knowledge to others. A shift from teacher-centred instruction to learner-centred instruction is needed to enable students to acquire the new 21st century knowledge and skills. The following table (Sandholtz, Ringstaff, and Dwyer, 1997) identifies the shift that will take place in changing from a focus on teaching to a focus on learning.

**Table 1.1 Teacher-Centred and Learner-Centred Learning Environments**

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<tr>
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<th>Teacher-centred learning environments</th>
<th>Learner-centred learning environments</th>
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<tr>
<td>Classroom activity</td>
<td>Teacher-centred, Didactic</td>
<td>Learner-centred, Interactive</td>
</tr>
<tr>
<td>Teacher role</td>
<td>Fact teller, Always expert</td>
<td>Collaborator, Sometimes learner</td>
</tr>
<tr>
<td>Instructional emphasis</td>
<td>Facts’ memorization</td>
<td>Relationships, Inquiry and invention</td>
</tr>
<tr>
<td>Concepts of knowledge</td>
<td>Accumulation of facts, Quantity</td>
<td>Transformation of facts</td>
</tr>
<tr>
<td>Demonstration of success</td>
<td>Norm referenced</td>
<td>Quality of understanding</td>
</tr>
<tr>
<td>Assessment</td>
<td>Multiple choice items</td>
<td>Criterion referenced, Portfolios and performances</td>
</tr>
<tr>
<td>Technology use</td>
<td>Drill and practice</td>
<td>Communication, access, collaboration, expression</td>
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</tbody>
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Shifting the emphasis from teaching to learning can create a more interactive and engaging learning environment for teachers and learners. This new environment also involves a change in the roles of both teachers and students. As shown in Table 1.2 (adapted from Newby et al., 2000), the role of the teacher will change from knowledge transmitter to that of learning facilitator, knowledge guide, knowledge navigator and co-learner with the student. The new role does not diminish the importance of the teacher but requires new knowledge and skills. Students will have greater responsibility for their own learning in this environment as they seek out, find, synthesize, and share their knowledge with others. ICTs provide powerful tools to support the shift to student-centred learning and the new roles of teachers and students.
Table 1.2 Changes in Student and Teacher Roles in Learner-Centred Environments

<table>
<thead>
<tr>
<th>Changes in Teacher Role</th>
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<tbody>
<tr>
<td><strong>A shift from:</strong></td>
</tr>
<tr>
<td>Knowledge transmitter, primary source of information,</td>
</tr>
<tr>
<td>content expert, and source of all answers</td>
</tr>
<tr>
<td>Teacher controls and directs all aspects of learning</td>
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<table>
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<tr>
<th>Changes in Student Role</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A shift from:</strong></td>
</tr>
<tr>
<td>Passive recipient of information</td>
</tr>
<tr>
<td>Reproducing knowledge</td>
</tr>
<tr>
<td>Learning as a solitary activity</td>
</tr>
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<td></td>
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</table>

(The Table adapted from one developed by Newby et al., 2000).

THEORIES SUPPORTING THE NEW VIEW OF THE LEARNING PROCESS

The new views of the learning process and the shift to student-centred learning have emerged based on cognitive learning research and the confluence of several theories that have informed our understanding of the nature and context of learning. Some of the most prominent theories include: sociocultural theory (based on Vygotsky’s intersubjectiveness and Zone of Proximal Development), constructivism theory, self-regulated learning, situated cognition, cognitive apprenticeship, problem-based learning (Cognition and Technology Group at Vanderbilt), cognitive flexibility theory (Spiro et al, 1988), and distributed cognition (Salomon et al, 1993). Each of these theories is based on the same underlying assumptions that learners are active agents, purposefully seeking and constructing knowledge within a meaningful context. The learning environment that may be derived from this view of the learning process is shown in Figure 1.2.
The student-centred environment illustrated in this figure shows that the learner interacts with other students, the teacher, information resources, and technology. The learner engages in authentic tasks in authentic contexts using authentic tools and is assessed through authentic performance. The environment provides the learner with coaching and scaffolding in developing knowledge and skills. It provides a rich collaborative environment enabling the learner to consider diverse and multiple perspectives to address issues and solve problems. It also provides opportunities for the student to reflect on his or her learning.

Although the new learning environment can be created without the use of technology, it is clear that ICTs can provide powerful tools to help learners access vast knowledge resources, collaborate with others, consult with experts, share knowledge, and solve complex problems using cognitive tools. ICTs also provide learners with powerful new tools to represent their knowledge with text, images, graphics, and video.
The new view of the learning process is based on research that has emerged from theoretical frameworks related to human learning. Many reflect a constructivism view of the learning process. In this view, learners are active agents who engage in their own knowledge construction by integrating new information into their schema or mental structures. The learning process is seen as a process of "meaning-making" in socially, culturally, historically, and politically situated contexts. In a constructivism learning environment, students construct their own knowledge by testing ideas and approaches based on their prior knowledge and experience, applying these to new tasks, contexts and situations, and integrating the new knowledge gained with pre-existing intellectual constructs.

A constructivist environment involves developing learning communities comprised of students, teachers and experts who are engaged in authentic tasks in authentic contexts closely related to work done in the real world. A constructivist learning environment also provides opportunities for learners to experience multiple perspectives. Through discussion or debate, learners are able to see issues and problems from different points of view, to negotiate meaning, and develop shared understandings with others. The constructivist learning environment also emphasizes authentic assessment of learning rather than the traditional paper/pencil test. Some of the most influential theories that relate to new views of the learning process include:

**Vygotsky’s Sociocultural Theory**

Vygotsky’s sociocultural theory of human learning describes learning as a social process and the origination of human intelligence in society or culture. The major theme of Vygotsky’s theoretical framework is that social interaction plays a fundamental role in the development of cognition. Vygotsky believed everything is learned on two levels.

First, through interaction with others, and then integrated into the individual’s mental structure.

> Every function in the child’s cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals. (Vygotsky, 1978, p.57)
A second aspect of Vygotsky’s theory is the idea that the potential for cognitive development is limited to a "zone of proximal development" (ZPD). This "zone" is the area of exploration for which the student is cognitively prepared, but requires help and social interaction to fully develop (Briner, 1999). A teacher or more experienced peer is able to provide the learner with "scaffolding" to support the student’s evolving understanding of knowledge domains or development of complex skills. Collaborative learning, discourse, modelling, and scaffolding are strategies for supporting the intellectual knowledge and skills of learners and facilitating intentional learning.

The implications of Vygotsky theory are that learners should be provided with socially rich environments in which to explore knowledge domains with their fellow students, teachers and outside experts. ICTs can be used to support the learning environment by providing tools for discourse, discussions, collaborative writing, and problem-solving, and by providing online support systems to scaffold students’ evolving understanding and cognitive growth.

Jean Piaget

Based on his research on the development of children’s cognitive functions, Piaget’s work is regarded by many as the founding principles of constructivist theory. He observed that learning occurs through adaptation to interactions with the environment. Disequilibrium (mental conflict which demands resolution) gives rise to Assimilation of a new experience, which is added to the existing knowledge of the learner, or to Accommodation, which is modification of existing understanding to provide for the new experience.

Specifically, Piaget posited that the existing cognitive structures of the learner determine how new information is perceived and processed. If the new information makes sense to the existing mental structure of the learner, then the new information item is incorporated into the structure (i.e., Assimilation). If, however, the data are very different from the existing mental structure of the learner, they are either rejected or transformed in ways so that it fits into the structure (i.e., Accommodation). The learner has an active role in constructing his or her own knowledge in both of these ideas. He observed that, as children assimilated new information into their existing mental structures, their ideas gained complexity and power, and their understanding of the world grew in richness and depth. These ideas are core concepts of the constructivism view of the learning process. (Jean Piaget Society, 2001)
Jerome Bruner

Similar to Piaget, Bruner emphasized that learning is an active process in which learners construct new ideas or concepts based upon their prior knowledge and experience. He identified three principles to guide the development of instruction. These include: (1) instruction must be concerned with the experiences and contexts that make the student willing and able to learn (readiness); (2) instruction must be structured so that the student can easily grasp it (spiral organization); and, (3) instruction should be designed to facilitate extrapolation and/or fill in the gaps (going beyond the information given).

Problem-Based Learning

The goals of problem-based learning (PBL) are to develop higher order thinking skills by providing students with authentic and complex problems and cases. This approach to learning provides a more authentic context for learning and engages students in authentic tasks. It is used frequently in fields such as engineering, medicine and architecture, and has been increasingly applied to K-12 settings. Through the process of working together, articulating theories, creating hypotheses, and critically discussing the ideas of others, students move to deeper levels of understanding of the problem. The self-directed learning strategies developed in PBL may help foster students' lifelong learning.

Anchored Instruction

Anchored instruction is an approach to designing instruction that is ‘anchored’ in a real world context, problem or situation. Technology has been used to help create ‘real world’ contexts and situations through the use of video. The video segments provide the context for the subsequent learning and instruction. (Bransford & Stein, 1993)

Distributed Cognition

Distributed cognition emphasizes that cognitive growth is fostered through interaction with others and involves dialogue and discourse, making private knowledge public and developing shared understandings. Tools for online collaboration have been designed to support collaborative knowledge construction and sharing in the classroom. (Oshima, Bereiter, and Scardamalia, 1995)
Cognitive Flexibility Theory

This theory asserts that people acquire knowledge in ill-structured domains by constructing multiple representations and linkages among knowledge units. It also notes that learners revisit the same concepts and principles in a variety of contexts. The theory is useful in understanding how knowledge is transferred in ill-structured knowledge domains. (Spiro et al., 1988)

Cognitive Apprenticeship

Cognitive apprenticeship is a term for the instructional process in which teachers or more experienced or knowledgeable peers provide 'scaffolds' to support learners’ cognitive growth and development. Cognitive apprenticeship permits students to learn through their interactions, construct knowledge, and share knowledge-building experiences with the other members of the learning community. ICTs provide powerful new tools to support cognitive apprenticeships, enabling groups to share online workspaces to collaboratively develop artifacts and intellectual products. They also make possible tele-apprenticeships, in which an expert is able to work with or mentor a student who may be thousands of miles distant.

Situated Learning

Situated learning emphasizes the use of apprenticeship, coaching, collaboration, authentic contexts, tasks, activities and cognitive tools (Brown, Collins & Duguid, 1989). It occurs when students work on authentic tasks that take place in real-world settings (Winn, 1993). Learning is viewed as a function of the activity, context and culture in which it occurs, which contrasts with most classroom learning which is abstract and out of context (Lave, 1988). Situated cognition theory emphasizes providing an authentic context for the learner and encouraging social interaction and collaboration in the learning environment. Through collaborative problem solving, dialogue, and discussion students are able to develop deeper levels of understanding of a problem or knowledge domain.
**Self-Regulated Learning**

Self-regulated learners are those who are aware of their own knowledge and understandings, i.e., what they know and what they do not know or need to understand. It combines self-observation, self-judgment, and self-reaction. Self-regulation plays a crucial role in all phases of learning and has the potential to increase the meaningfulness of students’ classroom learning (Schoenfeld, 1987). ICT tools can be used to make students’ tacit knowledge public and to help them develop metacognitive skills and become more reflective and self-regulated learners (Hsiao, 1999).

These theories that undergird the new views of the learning process help shape the new pedagogies for learning. Ultimately, the power of ICTs will be determined by the ability of teachers to use the new tools for learning to create rich, new, and engaging learning environments for their students. The UNESCO World Education Report (1998) notes that:

> There are indications that the new technologies could have radical implications for conventional teaching and learning processes. It notes that, in reconfiguring how teachers and learners gain access to knowledge and information, the new technologies challenge conventional conceptions of both teaching and learning materials, and teaching and learning methods and approaches.

The challenge for ICTs in Teacher Education is to assure that the new generation of teachers, as well as current teachers, are well prepared to use new learning methods, processes and materials with the new ICT tools for learning. The following sections provide a road map to help teacher education institutions meet the challenge.

**REFERENCES**


