University of Alberta

Instructional Technology Roles and Competencies:

Preparing for the 21st century

by

S. Patricia Rempel ©

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Dedication

This thesis is dedicated to my Father

Henry Allan, and my husband Gary.

Abstract

This study sought to identify evolving changes in instructional technology practitioner competency requirements and consequent changes in IT curricula to enable practitioners to provide leadership in the field, utilize appropriate technologies, and effect learning in a direct, adroit, and cost-beneficial way.

The study identified four practitioner categories with different competency priorities and requirements and four domains basic to IT performance: design, development, implementation and evaluation. It concludes that key components are a strong ISDD program core within a structure that can accomodate diverse delivery modes and specialization options in a timely and cost-effective fashion. Comparative analysis of descriptive data for selected programs and prior competency survey results was carried out to generate a core course profile of such a program Market viability of the program, however, requires looking beyond just IT practitioners and requires instructors from the application disciplines and specializations who are brought in from the field.

Acknowledgments

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Chapter One Introduction

The Setting

Although audiovisual aids have long been part of learning, it was only in 1963 that instructional technology was defined as a field. The field, called audiovisual communications, was defined as "that branch of educational theory and practice primarily concerned with the design and use of messages which control the learning process" (Ely, 1963, p. 18). In 1977 Hubbard and Ghattas noted that development of instructional technology as an academic field had been "slow, spotty, and faddish and neither widely accepted nor understood" (p. 2198). Not much has changed in the intervening twenty years. While there has been some acceptance of the field, general understanding remains constrained, with the problem of diffuse field boundaries still having to be resolved (Gentry & Csete, 1995).

The problem of understanding and acceptance is further compounded by the fact that, although development of the field has been in an environment of rapidly escalating technology based audiovisual capabilities accompanied by rising societal expectations, the educational establishment has not generally endorsed the effectiveness of the evolving instructional technologies. As an Alberta Department of Education (1987) report notes, little has changed despite significant expenditures.

> Historically, the role of technology in education has been incremental and peripheral, with new technologies being added to the traditional teacher-centered model of instruction. This process has resulted in large expenditures and increases in teacher workload with no significant improvements to the performance of the education system. (p. 26)

In the 90's the instructional technologies based tools and resources available to learners are growing at an exponential rate. Enhanced personal computer and communication capabilities have greatly increased the number and extent of information resources now readily available for learning. The communication infrastructure delivers multimedia content to classrooms, work places and homes on a global basis. Television delivers programs on the Learning and History Channels in partnership with commercial sponsors and with institutions as institutional efforts to deliver credit courses outside the classroom increase. For example, Athabasca University offers *Destinos*, a program to learn Spanish, for university credit via cable TV. The Internet, that part of the communication infrastructure established in the 1960's to support the computer applications of military and academic researchers, now links children around the world as pen pals and internauts, and delivers mail, news, discussions and courses to our desktops. For example, the World Education Exchange (http://www.hamline.edu/~kjmaier/) has links to virtual classrooms worldwide, Gymnasia Virtuales™ (http://www.cybercorp.net/gymv/) delivers courses online, and Magellan University, a virtual university (http://magellan.edu), held its grand opening April 1 through June 30, 1997.

Concurrent with technological developments, is the maturation of the information based world economy which, in turn, results in an even greater requirement for individuals to be information literate, both for employment and citizenship. Instruction and information delivery now involve many of the same technologies. A definition of information literacy was developed in 1991-92 in preparation for the U.S. National Forum on Information Literacy. The definition (Doyle, 1992/1993) includes the attributes of an information literate person as well as a model of outcome measures:

> Information literacy is the ability to access, evaluate, and use information from a variety of sources. An information literate person is one who: recognizes the need for information; recognizes that accurate and complete information is the basis for intelligent decision-making; formulates questions based on information needs; identifies potential sources of information; develops successful search strategies; accesses sources of information including computer-based and other technologies; evaluates information; organizes information for practical application; integrates new information into an existing body of knowledge; and uses information in critical thinking and problem solving. (p. 3746)

This continually evolving environment of increased literacy demands and technological capabilities clearly impacts how instructional technology professionals will do their work and deliver their product. In educating for the role, the question remains as to the impact of this environment on what these professionals do. To provide objective data for strategic planning in the technology education field, one often confused with the instructional technology field, Wicklein (1993) utilized a four round Delphi process to identify the critical issues and problems facing the field. From a beginning pool of 580 issues, the process identified the top 15. These were further refined to a core of three most frequently identified issues:

1. curriculum development concerns including curriculum development approaches, curriculum development paradigms, lack of consensus of curriculum content, and non-unified curriculum;

2. knowledge base concerns;

3. interdisciplinary approaches to the delivery of technology education content. (p. 62)

Wicklein, extrapolating on this basis "a strong need to design technology education curriculum that addresses a comprehensive approach to curriculum development", identified the need to establish a formal knowledge base as "foundational to the future of technology education" (p. 63). To advance the field of instructional technology (IT) there is a similar need to identify the core knowledge base of the field and develop a unified curriculum that reflects this core before addressing the next level of strategic planning issues. Such measures will contribute to an understanding of the role of instructional technology graduates and provide the foundation for planning how IT programs can be changed to incorporate future oriented competencies.

Purpose of the Study

In this context, the question to be addressed in this study is:

What are the key components of a graduate level instructional technology curriculum that would provide graduates with the subject knowledge, technical competencies, and attitudes necessary to provide leadership in the 21st century, for the design, development and evaluation of instruction and training, utilizing appropriate development and delivery technologies?

The sub-components of the study are to:

(a) review the relevant literature on instructional technology, multimedia design and development, distance learning, IT research foci and curriculum development;

(b) review the projected job market for instructional technology graduates;

(c) review societal expectations of the field as identified in the literature;

(d) review the instructional technology program objectives, competencies, core courses and structure of selected institutions;

(e) identify core instructional technology program competency inputs and outputs; and

(f) identify key instructional technology program structural elements.

Significance of the Study

The 1994 definition of the field of instructional technology is based on the assumption that:

> practice in this field is characterized by efficient, economical pursuit of ends. Another hallmark that differentiates the professional from the lay person is the ability to achieve effective, productive ends in a way that is most direct, adroit, and cost-beneficial. There are many activities conducted by professional instructional technologists that are also conducted by others, such as developing computer courseware, selecting materials to use with learner, or making video recordings. The difference, it is assumed, is that the professional will be able to conduct these activities with a more efficient use of human and material resources. (Seels & Richey, 1994b, pp. 2-3)

A component of the question to be addressed in this study is: what competencies would a graduate program need to encompass to train these specialists so that as practitioners they will be able to effect learning in a way that is most direct, adroit, and cost-beneficial?

Determination of this question is critical because significant public resources are currently being invested in the technology infrastructure of educational institutions and the Internet. The investors, primarily the taxpayer, expect that this investment will result in increased availability of information and lifelong learning opportunities which will, in turn, realize competitive economic advantage in an information based economy. If, for the moment, we assume that the investment will deliver economic advantage, the question remains as to how to maximize the return on this technology investment. What is the potential of instructional technology graduates to contribute to this objective? For instance, could the availability of a local pool of highly trained instructional technology graduates be expected to contribute significantly to achieving cost-effective utilization of those public resources dedicated to learning technologies? Graduates of an instructional technology program should be in a position to demonstrate leadership in the delivery of instruction that utilizes both print and non-print information and resources. As instructional leaders they will be expected to model the cost-effective utilization of technologies that contribute to learning — both face-to-face and distance independent. Instructional technology specialists will provide answers at a policy level to such questions as: How do multimedia resources contribute to learning? What are the costs attributable to their use? Is the use cost-effective or can it be made so?

If the profession is to be considered a source of such expertise, what competencies would a graduate program need to encompass to train these specialists? In addressing the question of future competencies it must be recognized that a further question could be asked: what is the basis for projecting future competencies since among stakeholders there appears to be little agreement now on what constitutes core competencies. However, the reduction of public funding, along with the increasing level of competition between competing visions and methods of delivery, requires educators to take a focused and responsive posture. In addition, that response must meet global competition in an increasingly standardized environment where the base from which everyone is operating is now being leveled.

Economic reality will force post secondary education programs to target markets in a manner similar to the way that countries, such as India, have targeted their efforts. India, with negligible software exports in 1985, has focused on the software market. With current exports of $1 billion, the Indian export market is now projected to exceed $5 billion per year within five years (Consulate General of India, 1997). Product quality is benchmarked against world standards with more than 55 companies having ISO 9000 accreditation and 16 having SCI Level II certification. Motorola's Indian software development subsidiary is one of only a few companies in the world with SEI Level 5 certification (3SE, 1997, p. 3 of 9). While the Indian output is qualitatively equal to that of western producers, their labour inputs cost less than 25% (India Information Inc., 1996, p. 1 of 3), giving them a decided market advantage in a global economy. Similarly, North American post-secondary institutions will be required to develop a market focus or "niche" for their programs and then convey, advocate and defend that niche. Being the "gatekeeper" — the traditional authority — is no longer enough to ensure sustainable market share in the global competition with other program providers.

Assumptions

This study assumes that:

- in the 21st century post secondary graduate programs in Alberta will have to be competitive on a global basis in terms of quality and cost;
- there must be a market for graduates if the program is to be offered and that local stakeholders will be able to assess this market both in terms of focus and extent; and
- identifying a dynamic structure for continuing change is as important as identifying specific competencies at this time.

The study shares with the 1994 definition of the field the assumption that "instructional technology has evolved from a movement to a field and profession" (Seels & Richey, 1994b, p. 2).

Limitations

This study recognizes that "curriculum development is indeed a dynamic process of political, social, and personal negotiations that must occur in a cooperative and collaborative context if it is to produce viable education plans" (Gay, 1989, p. 475). It is a key component of the institutional strategic planning process and hence the results of a study such as this can, at best, provide only a starting point for such a collaborative process.

Secondly, the current study relies on published program documentation with varying terminology and levels of detail. Any follow-up on the study recommendations may require site visits to selected institutions to validate the inferences drawn from that documentation and to identify through discussion undocumented factors that may be critical to implementation.

Furthermore, the study recognizes that although the program outline developed in this study is in keeping with the Alberta education and training environment, it has been developed based on global alternatives. Implementation of the objectives or courses may not be warranted in the Alberta market or acceptable given Alberta institutional priorities or resource constraints of a fiscal, structural, and staffing nature.

Delimitations

There is no clear consensus on the purpose or end product of education — even of publicly funded education. For some it is a socialization process that serves to convey values and morality. For others the purpose is the development of the individual. This study considers the purpose of education to be the development of career role competencies, specifically those required by instructional technology professionals.

Some instructional technology programs focus on media or collection management, often in relation to libraries and in particular to school libraries. This study will not address this focus. Other programs focus on commercial multimedia production. Although there is some overlap of competencies, this study will not address curriculum development from this focus.

The term instructional technology is frequently used interchangeably with information technology or with educational technology in the education literature. In the European literature, IT means information technology. This study will focus on the field of instructional technology, addressing educational and information technology only within that context.

This study will not address implementation aspects including staffing or costs attributable to introduction of the proposed curriculum approach.

Definitions

A number of terms are used within this thesis with a definition that is more specific than that in common usage. The most commonly used terms are defined here. Others will be defined as they are encountered in the text. The Glossary of Terms contains all technical terms and acronyms used in the thesis.

Instructional design process: the process of design of curricula, lessons and resource materials; includes needs analysis through to specification of evaluation and implementation parameters; encompasses design issues such as identification of instructional problems, classification of learning tasks, selection of instructional strategies and tactics; and design of effective and appealing instruction based on principles from visual design, human communication and learning theory; may include production of prototypes.

Instructional development process: the process of development of curricula, lessons and resource materials; includes developing and validating instructional products, lessons, procedures and systems of learning. It is directed at development of effective human and media based instruction that contributes to the achievement of learning objectives that have been specified in the design process.

Instructional systems development (ISD): a systematic way of designing, carrying out, and evaluating the total instruction process to cost-effectively bring about specific learning objectives; encompasses all of the design, development and evaluation activities from analysis (task, learner and organizational), through design and development of a solution, visual design and media production, formative evaluation and revision, implementation and summative evaluation (resources, student learning and instruction delivery); may include project management.

Instructional technology (IT): "the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning" (Seels & Richey, 1994b, p. 9).

Summary

There is a need for the integration of future oriented competencies in instructional technology curricula that are based on the recognized knowledge base of the field and contribute to the cost-effective development and delivery of instruction utilizing both instructors and media. This chapter outlined this need and described the problem to be studied.

Chapter 2 provides an overview the literature relating to curriculum development outside the K-12 level, instructional technology and such related areas as program delivery and graduate expectations of the job market and society. Chapter 3 outlines the methodology of the study. Chapter 4 presents the findings related to identified core competencies of the field and program structure and objectives. The concluding chapter presents the major recommendations arising from the study along with their potential implications.

Chapter Two Literature Review

This review begins with an brief overview of curriculum approaches to program development. Following is an overview of the field of instructional technology including identified graduate roles and market demand, as well as research issues and trends. The review concludes with an overview of various quantitative characteristics of current graduate programs with descriptive highlights of leading or innovative institutions.

Curriculum Development

Skilbeck and Cotter (1988) noted that curriculum can most simply be defined as "the content of a program or a course of study; the 'what' of teaching in classrooms" (p. 138), although "for many, curriculum connotes basic or fundamental knowledge and skills to which are added a variety of enlightening, useful, and socially relevant accomplishments" (p. 139). Stark and Lattuca (1997) propose that curriculum be defined as an 'academic plan' or a "blueprint for action, including purposes, activities, and ways of measuring success. A plan implies both intentions and rational choices among alternatives to achieve the intentions" (p. 9-10). They note that "curriculum developers like Posner and instructional developers like Diamond come relatively close to implementing in practice a view of curriculum as an academic plan" (p. 38). Instructional developers might say that the process which Stark and Lattuca propose comes relatively close to Instructional Systems Development (ISD), a process already well established in the field of instructional technology.

Although a number of curriculum development models have been identified, three — the objectives model, the process model and the research model — are particularly relevant to ISD. For educational programs targeted to a particular field, such as instructional technology, the objectives approach increases the probability that program graduates will have the required job market skills.

Objectives Model

Duffy and Jonassen (1992) note that instruction and instructional design in the US emerge from an objectivist tradition. They observe that since objectivists believe that knowledge exists independently of instruction,

> an objectivist need not look at the instructional activities to see what is learned. Rather, designers produce a test that stands separate from the instruction and is designed to probe the knowledge acquired in an objective way. Furthermore, we can look for mastery of learning; an assumption that everyone has acquired the same basic information and now has it available to use. (p. 3)

The objectives or subject centered model, as outlined by Tyler (1949, 1966/1996) and Bloom (1956) and reflected in the curriculum development approach of the 1960's and 70's, was "a planned national-level educational enterprise, based on specific projects carried out by specially assembled task forces" (Skilbeck & Cotter, 1988, p. 142). Content or subject knowledge was the focus in this approach which was characterized by the techniques of managed change — pre-defined objectives and pre-planned dissemination of curriculum products. This model continues a long tradition of job analysis in vocational curriculum development and its continued use in technical education is reflected in competency based instruction.

The job analysis approach was utilized in the *Jobs in Instructional Media Study* (JIMS) (Wallington, Hyer, Bernotavicz, Hale & Silber, 1970) where, "in order to meet the need for media-support personnel with training relevant to the kinds of tasks needed to be performed," JIMS "analyzed jobs and set up guidelines for job structures and training curricula for work performed in the field" (p. 1).

> JIMS employed Functional Job Analysis [FJA] as modified by Dr. Sidney Fine. Functional job analysis provides a methodology for objectively describing what the worker does in a job and for systematically classifying the tasks involved. The individual tasks which have been identified can then be regrouped or clustered according to the level of Functional Skill required to perform each task. The training required to perform the tasks at a satisfactory level of competency can be derived logically from such clusters.
>
> In order to relate the generalized skills identified through FJA to the specific objectives and products of the instructional media field, a model of the field, the Domain of Instructional Technology (DIT), was developed. The DIT describes the field of instructional media in terms of its components. (p. 1)

Using the FJA and DIT data, a two-dimensional matrix was constructed that provided "a rich variety of ways to organize and structure jobs, career ladders and curriculum according to the particular philosophies, constraints and objectives of the job location or training center" (Wallington et al., 1970, p. 3). It was intended that the curriculum would vary depending on the trainer's perceptions and choices including the choice of whether to focus on teaching general functional skills or specific content skills. The authors felt that the most important contribution of the matrix was that "for the first time jobs and curriculum can be coordinated" (Wallington et al., 1970, p. 206).

Also using detailed job analysis data, the Association for Educational Communications and Technology (AECT, 1974) developed competency-based guidelines for certification of personnel in media management, media product development and instructional program development. Although practitioner certification remains an unresolved issue (Bratton, 1995), the guidelines were also used in the design and accreditation of advanced programs in educational communications and technology. Later instructional technology studies continue to link competencies to curriculum (e.g. Pinto & Walker, 1978; Kennedy, 1982; Kennedy, 1994; and Office Systems Research Association, 1996). However, they address competencies at the role level rather than the task level of the workplace situation.

The job analysis process, requiring aggregation and analysis of very detailed information, tends to generate highly specific syllabus objectives. At a time when the rate of technological change was slow relative to the current rate, Skilbeck and Cotter (1988) questioned whether it was "economically practical or even possible to pre-specify vast and structured minutiae of technological learning when technology is changing so rapidly" and "whether this provides a suitable learning environment for the development of flexibility and openness, which are required for social and technological change" (p. 147).

Process Model

The question of the learning environment was addressed by the Dewey (1902) and Piaget (1950) process models of curriculum development. In contrast to competency based learning, the process model focuses on the learning experience and increased student understanding. Building on the work of Dewey and Piaget, Bruner developed the concept of constructivism (Deeves, 1968). For Bruner (1962) the objective of education is to "develop the power and sensibility of the mind" (p.

115). In the constructivist view, meaning is imposed on the world. Constructivists, therefore, "emphasize 'situating' cognitive experiences in authentic activities. For example, cognitive apprenticeship is an instructional strategy that is particularly appropriate to providing authentic experiences" (Duffy & Jonassen, 1992, p. 4).

In contrast to objectivists, constructivists argue that meaning is rooted in experience and that individuals construct their view of the world. Meaning is not something that exists independently, not something that we come to know, not something we learn. Variations of these alternative views have been under discussion for centuries. Among philosophers of the seventeenth century,

> the main issue was that of the root, the ultimate source, from which human knowledge originates. The rationalists attributed this to the constructive power of the mind, whereas the empiricists insisted that the mind could impose no formal reality upon the world; that it was nothing but a blank *tabula rasa* on which experience writes its own message. Some time later, in the mighty works of Immanuel Kant, the whole problem of knowledge was re-examined in a way which included both perspectives. (Peterson, 1970, p. 119)

Kant concluded that "the world of sense and the world of mind might indeed interact, but neither sense nor mind could rise to a superior position to achieve that absolute certainty which is the goal of metaphysics" (Peterson, 1970, pp. 119-120). Similarly, the instructional systems development (ISD) curriculum approach does not assume superiority of either a competencies or learning environment approach. Rather, both are addressed: competencies in course objectives, and learning environment in course approach. The continuing debate is evident within the IT field, however, in the Pennsylvania State program where students with a corporate training emphasis take the courses on 'Performance Technology' and 'Instructional Design Models, Strategies, and Tactics' while those with an education system emphasis take the 'Designing Constructivist Learning Environments' course. Even though the debate continues, both objectivists and constructivists concur that authenticity in the learning environment increases learning transfer.

The absence of authenticity contributes to decontextualization of learning — the differences between experiences in school and in the real world — and results in a failure to transfer course based learning to practice. In the view of the Cognition and Technology Group at Vanderbilt "authenticity arises from engaging in the kinds of tasks using the kinds of tools that are authentic to that domain" (Duffy & Jonassen, 1992, p. 9). Dick (1992) proposes a similar view namely that teaching students to think effectively, to reason, to solve problems, and to develop learning skills "can be done by anchoring learning in meaningful contexts" (p. 92). This is done by "focusing on the context in which skills must be used and trying to replicate that context in the learning situation" (p. 95).

Structuring work-like contexts within IT programs again raises a difference in perspective between practitioners working with adults and those in the K-12 setting. The work context for those IT practitioners who work with adults is often project based and involves peer working relationships where the IT specialist may be working either as an employee of an organization or under contract. Team projects, portfolio development and presentations are approaches used in IT curricula to attempt to replicate this work context. This context is however not typical for IT practitioners who work in K-12 organizations. Internships, a key component of most IT programs, further allow students, who have performed the tasks and used the tools in a controlled setting, to do so in situations more closely approaching the complexity of the work environment.

Research Model

A third model of curriculum design, that of research-development-diffusion, was promoted by Havelock at the University of Michigan and internationally through the Organisation for Economic Co-operation and Development (OECD). Havelock (1973) referred to the process as one of "planned innovation" (p. 5). The development-diffusion focus of this approach was reflected in the 70's in the creation of applied educational research laboratories which delivered training, developed instructional materials and fostered diffusion. These Regional Educational Laboratories (http://www.nwrel.org/national/regional-labs.html) in the U.S. now utilize the Internet for immediate and global diffusion of applied and policy research developments. Included in the links on the Web page of the North Central laboratory is a link to the WWW Constructivist Project Design Guide (http://www.ilt.columbia.edu/k12/livetext/curricula/general/webcurr.html) prepared by Columbia University, where any teacher, student or parent could learn how to design a constructivist learning project on the World Wide Web. There is also full public access to the ERIC/IT Digests (http://ericir.syr.edu/ithome/digests.htm) which provide overviews on such topics as electronic portfolios and virtual reality. Others outside the education establishment, such as Jostens Learning Corporation (http://www.jlc.com/) and Discovery Channel School (http://school.discovery.com/), are also utilizing the Internet to provide instructional materials to be used either in partnership with teachers or for self-directed learning

The research focus in Havelock's model generally comprised reviews of research literature to extract generalizations, data, or perspectives which could be applied to development tasks (Skilbeck & Cotter, 1988, p. 144). This approach is currently continued in the overview of educational technology research presented annually in the *Educational Media and Technology Yearbook*. It is this strong research and diffusion tradition that leads IT practitioners to view themselves as change agents and ISD as a systematic and iterative process for improvement.

Instructional Systems Development

Instructional systems development (ISD) is a systematic method of developing workshops, courses and curricula through analysis, design, development, implementation, evaluation and revision. Branch (1994) speaks for many in the field who perceive that "true applications of systems based instructional planning stimulate creativity, are dynamic, non-linear, holistic, systematic and systemic" (p. 27). However, an unsolicited response to his instructional design survey characterizes much of teacher sentiment about the process:

> Survey was organized in an ivory tower and not from a person on the front lines. Be realistic, there are only 24 hours in a day. Performing 5-6 interesting and difficult lessons done the way you imply would take all 24 hours with nothing left for eating, sleeping, or going to the bathroom. (p. 33)

This perception would be reinforced by Overfield's (1996) contribution to ISD practice, a template for monitoring and maintaining progress of ISD projects. At the key decision point of each phase, documentation of status, decisions and reasons provide management with the information required to initiate commitment to the subsequent phase. Conversely, when the ISD process is presented as a review checklist, it is often characterized as simplistic. The training evaluation checklist developed by International Board of Standards for Training, Performance, and Instruction (1986, p. 11-20; see Appendix A) indicates the decision parameters behind each step and, as a result, does not convey simplicity. Anticipating reaction to the detail, it is however prefaced by a caution on selective and intelligent use.

> Though the checklist format used here implies that every training product must meet every criterion every time, experienced training professionals know that such rigidity is neither possible nor desirable. There will be cases, for example, where the criteria for a needs assessment will not apply, because doing the assessment would take longer than simply solving the problem, or because the client is so

> fixed on a solution that no amount of data will change the decision. (p. 12)

Such reality checks, implicit in the adult education field, are clearly not being adequately conveyed to K-12 teachers. Rezabek and Cochenour (1996) addressed another aspect of the perception that the ISD process is "rigid, inflexible, fixed, and perhaps not very relevant for use in a real-world K-12 classroom" (p. 583). They found that if education students are first introduced to instructional design (ID) using Kemp's circular model, instead of traditional straight line models, the students perceive that "the process is somewhat flexible and adaptive and may be beneficial to them as teachers" (p. 583).

In the corporate training area, Allen (1992) concludes that "the utility of this [ISD] approach is limited in post-industrial organizations for the same reason that hierarchical, authority-based management schemes are limited: they cannot keep up with rapid change" (p. 199). He suggests that "empowering employees involves reallocating authority and responsibility for decisions not only about information, but about development of competence" (p. 200) and suggests that, rather than making provisions for instruction or training in advance, a new model of 'just-in-time' learning systems may be more appropriate. He considers the benefits of just-in-time learning to be "analogous to those of just-in-time inventory control: investments of 'intellectual capital' are committed to learning activities near the time when they will yield a return through productive activity" (p. 200).

Lanham (1993) points out that the post secondary educational sequence follows a similar top-down, linear model, and that it is increasingly inappropriate, even at the undergraduate level.

> Students now often come older to the university, attend in broken times, often more than one institution, and take more than four years to graduate; more of them work, and work more. This fragmented, discontinuous pattern is now more norm than exception. To it we may add the conceptual dislocations they feel hourly as they change classes from one disciplinary universe to another. Yet our thinking about the undergraduate curriculum continues to assume the four-year, upper- and lower- division, linear sequence and ignores the conceptual bewilderment it imposes on students. (p. 104)

Despite these criticisms, which must be addressed in program content, activities and structure, it does seem particularly appropriate in this study to apply the ISD process in developing a future-oriented IT curriculum. It accommodates the theoretic foundations of other established models. It could accommodate increased student or employee responsibility for determining competency needs, and address them in a more timely and less linear manner, by modularizing the program as outlined by Friedlander (1996) — a practice well established in the development of computer assisted instruction. Perhaps it can also contribute to bridging the gap between teachers and technologists who "view both teaching and technology differently" (Earle, 1994, p. 9), despite the fact that teachers and instructional designers "are so closely tied to a common goal: to facilitate and improve human learning" (p. 7).

Before addressing how an instructional technology curriculum might be structured in a dynamic, just-in-time mode, it is important to establish the domain of the field for which graduates are being prepared to enter as professional practitioners. This will set the boundaries of theory and practice that will define the core content and competencies of the program.

Instructional Technology

In the introduction to the first AECT endorsed definition of the field (Ely, 1963), Finn pointed out that "definition and terminology in the expanded audiovisual field — instructional technology, if you will — is of crucial importance to the educational community" (p. vii). The definition demarcates membership and ownership, and the common terminology arising from it is essential for member communication. Shulman (1986) sees "common training and enculturation; common conceptual values and goals; and common experiences" as providing the foundation for communication, and considers that the "ability to communicate is a central definer of community membership" (p. 4).

As for ownership, the conventional connotative meaning of a term, "the most important aspect for purposes of definition and communication, . . . is the total set of characteristics common to all the objects that make up that term's extension. It does not vary from interpreter to interpreter" (Copi, 1986, p. 149). To define is to render precise. From this it would appear to follow that having the characteristics common and peculiar to instructional technology can be considered to be the criterion for deciding whether an area of practice or knowledge is encompassed by the field, whether it is one to which the term may correctly be applied. These common characteristics are the critera for "obtaining agreement among the scholars and practitioners of the field on those problems that fall within the scope of instructional technology and distinguishing them from those that rightfully belong to other fields; . . . even new problems generated by a changing society" (Seels & Richey, 1994b, p. 117).

For the field of instructional technology, a starting point would be the definition accepted by the Association for Educational Communications and Technology (AECT), the body under whose auspices IT programs are reviewed in the certification of academic programs by the National Council for Accreditation of Teacher Education (NCATE).

Definition of the Field

In 1994 the AECT published the fourth officially endorsed definition of the field since 1963, stating that:

> Instructional technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning. (Seels & Richey, 1994b, p. 9)

Consensus on this definition followed a five year process which included surveys, discussion groups and continuous peer review (Seels & Richey, 1994a). The process involved a broad base of professionals in the field and, as AECT notes in the preface,

> whether or not we agree with the statements presented here, they will provide a benchmark and a point of dialogue for further development of a profession which seeks to provide conditions for effective learning. (Seels & Richey, 1994b, p. xvii)

The 1994 definition of the field is based on the assumptions that:

> Instructional technology has evolved from a movement to a field and profession . . . concerned with a knowledge base. (Seels & Richey, 1994b, p. 2)
>
> Practice in this field is characterized by efficient, economical pursuit of ends. Another hallmark that differentiates the professional from the lay person is the ability to achieve effective, productive ends in a way that is most direct, adroit, and cost-beneficial. There are many activities conducted by professional instructional technologists that are also conducted by others, such as developing computer courseware, selecting materials to use with learner, or making video recordings. The difference, it is assumed, is that the professional will be able to conduct these activities with a more efficient use of human and material resources. (pp. 2-3)

To summarize, it is not *what* IT practitioners do that charactizes the field, but rather, *how* they do it. Specifically, they provide conditions for learning that achieve effective, productive ends in a way that is 'most direct, adroit, and cost-beneficial'. Alternatively stated, they implement cost-effective instruction that results in improved performance or understanding. The knowledge and skills to accomplish this would then have to be central among the competencies addressed in an IT program. This focus may underlie a shift toward performance technology in some IT programs, a shift not generally embraced by educators. This is one more indicator that, despite publication of a new definition, there is not yet fundamental agreement on what instructional technology is. The performance technology field involves

> the application of what is known about human and organizational behavior to enhance accomplishments, economically and effectively, in ways that are valued within the work setting (Stolovitch & Keeps, 1992, p. 4); [and]
>
> has emerged from the coalescing of principles derived from the carefully documented practice of thoughtful behavioral psychologists, instructional technologists, training designers, organizational developers, and various human resource specialists. (p. 3)

Instructional technologists writing in the performance field include such prominent IT faculty as Clark (University of Southern California), Jonassen (Pennsylvania State University) and Kaufman (Florida State University).

Semantics or Essence

Seels and Richey (1994b) note that most professionals in the field use the terms educational technology and instructional technology interchangeably. They consider them "synonymous" (p. 5) labels for the field called audiovisual communications in 1963, educational technology in 1972 and 1977, and instructional technology in 1994. Consistent with their view of the terms being equivalent, they characterize the change of name as most obvious but least important (1994, p.122). However, that was not the view of the AECT in 1977 when it defined instructional technology to be a sub-set of educational technology.

> Instructional technology is a complex, integrated process involving people, procedures, ideas, devices and organization for analyzing problems and devising, implementing, evaluating and managing solutions to those problems, in situations in which learning is purposive and controlled (AECT, 1977, p.3);

while education technology covered "those problems involved in all aspects of human learning" (p. 1). Their rationale is tenable if the term technology used in the 1977 definition was a synonym for technologies; but it is more likely that the 1977 definition was an effort to integrate the two distinct definitions of instructional technology identified by the Commission on Instructional Technology (1970):

- media born of the communications revolution which can be used for instructional purposes alongside of the teacher, textbook and blackboard (p. 21); [and]

- a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication and employing a combination of human and non-human resources to bring about more effective instruction. (p. 21)

The Commission, however, noted that widespread acceptance and application of this second definition belonged to the future but might be the key to use of technologies in learning. Beckwith (1988) sees educational technology as "a powerful and worthy dream — a dream yet to be fulfilled" (p. 18) that must move beyond that systematic process. Seels and Richey (1994b) present the two perspectives as equivalent domains of one field of study concerned with a common knowledge base, while the author's review of current IT programs suggests a continuing dichotomy between a focus on technologies or use of media and a focus on learning or ISD.

The semantic confusion arising from use of the term 'technology' in the label is further compounded by the fact that technology is itself a field of study and, in common parlance, is also used interchangeably with computers as a tool. In the wider sphere, where instructional technology graduates are closely associated with applied-learning technologies, it is computer based multimedia technologies that seem to dominate perceptions of the field. The result is that IT graduates, who may use the computer only as a tool, are deemed to be technical computer experts. They are assumed to have such competencies, as for example, the North Carolina Instructional Technology Specialists who, through advanced study and preparation, "develop extensive knowledge and skill in the area of computer technology (hardware, courseware, programming techniques, sources of information)" (North Carolina Dept. of Public Instruction, 1992, p. 15).

Reviewing Seels' subsequent book, *Instructional Design Fundamentals: a reconsideration*, Hedburg (1996) concludes that "while it creates a few fires it doesn't also supply enough fire-fighting equipment even to hint at how they might be extinguished" (p. 237). It "leaves room for further work on the critical issues which are forcing us to re-examine what is instructional design in a world with changing technologies, cognitive theory and economic necessities" (p. 238). Clearly, the fourth definition of the field of instructional technology also leaves room for further work. It has not identified with any precision the parameters of the competencies that a future oriented IT program should address. Perhaps the literature related to practitioner roles that are within the range of possibilities identified by the various definitions may suggest criteria for prioritization of future oriented competencies.

Practitioner Roles

Among the criteria applied in developing the 1994 definition of instructional technology was the dictum that, in addition to demonstrating the uniqueness of the field, the definition should also be embraced by persons in the field with a range of experience, interests, job responsibilities, and national affiliations (Seels & Richey, 1994a, p. 10). This diversity of job responsibilities is characteristic of the field and is reflected in the breadth of organizational roles in which graduates are employed. In this study, literature on the most prominent generic roles was reviewed to confirm current competency requirements and to identify future oriented competencies.

Instructional design and development

Seels and Richey (1994b) point out that "the domain of design represents the largest theoretical contribution of instructional technology to the larger field of education" (p. 11). In the development process the theory of instructional design is applied to the production of curricula and media, with media having captured the public imagination.

> The powers of digital technology both to teach nontraditional students and to document how they learn are being explored in a world the academic liberal arts have ignored, the world of applied-learning technologies developed for business, government, and the military. The developers of these interactive laserdisc "texts" and computer-managed instructional programs, because they do not share our commitment to the codex book, and because they must document the success of their efforts, have approached digital pedagogy without crippling preconceptions. They are redefining what a textbook is, among other things, and completely renegotiating the traditional ratio of alphabetic to iconographic information upon which it has been

> based. Their *logos* has already become bi-stable. (Lanham, 1993, p. 106)

The instructional designer plays a central role in curriculum and multimedia development. In fact he/she is:

> the central writer and designer. He or she coordinates concepts and ideas. In conjunction with his or her responsibility for scripting and story-boarding, the instructional designer documents the visual expectations of the graphic designer and must be sensitive to the concerns of both the graphic designer and the programmer. The instructional designer must also consider the needs of potential users and be prepared to provide the essential teaching points, techniques, and structure for the product. (Mugg, 1996, p. 11)

In addition to this multi-faceted role, the instructional designer may also be the editor as well as graphic and system designer in designing and developing curricula or media to be marketed for wide use. In short, the instructional designer is part of a team of professionals which may include content experts, graphic designers/animators and system designers/programmers; instructional, art, publishing and system editors providing quality control; and sound effects experts, video producers, scriptwriters and photographers.

In the description of the life-cycle of the multimedia project she completed for Lexus, Irish (1995) identifies this interplay of competencies. The project was developed for delivery of training to new sales staff at Lexus dealerships. In addition to conveying product information, the multimedia training was to coach new staff on techniques for closing a sale. This interactive multimedia project was so successful that it won New Media's Invision 1995 Gold Award for training. The production team involved was not unlike that of a full feature movie that includes computer simulations. Development started in July 1992, following a full year of needs analysis. By fall 1993 a $70,000 prototype was ready for demonstration to an audience of 503 in small group meetings. Then design documents were developed that included strategy and detailed workings of each component of the system and performance objectives.

> IEC marshaled a small army of people to design the beta system: project managers, creative directors, script writers, programmers, video producers, instructional designers, experts in testing and evaluation, graphic artists, music composers, photographers, video crews, computer technicians and accounts. (Irish, 1995, p. 47)

In addition to this vast effort, company staff time was allocated for approvals, feedback and creation of the script.

> Using our performance objectives as the starting point, we began the painstaking process of creating a script. Miscellaneous Lexus sales-training personnel, IEC developers, and subject matter experts, dealership marketing, and sales, locked themselves in a room for several days and hammered out a basic script.
>
> This was no easy task. Consider the nature of simulations: In effect, we were creating a movie with many possible story lines and endings. Each decision point had to be flowcharted, then scripted. (Irish, 1995, p. 48)

Five months were required to shoot video for the simulations and program for the beta system. The beta test, running for two months, included a 24 hour a day toll free help line. Refinements were made based on the test feedback, and by May 1995, nation wide installation began. The Lexus project is illustrative of a large scale multimedia training design project and the diverse and highly specialized competencies involved.

Multimedia training projects on this scale are often developed for particular segments of the global training market rather than for individual clients, as for example PowerMaster Interactive (Williams Companies Inc., 1997). The 78 module CD-ROM product is designed for training power delivery personnel on safety-related practices. It is priced at $62,000, or $995 per module, and has a global market in the range of 20,000 potential customers who can "incorporate their own text, graphics, and site-specific information to tailor training to their individual needs (p. 1 of 2). The developer, Williams Learning Network,

- is an international provider of full-service training solutions, including off-the-shelf and customized operations, maintenance and safety training in video-, computer- and interactive CD-ROM-based formats; and
- provides training and consulting services, such as needs analysis, program design, material development and procedure writing. (Williams Companies Inc., 1997, p. 1 of 2)

The Williams Companies Inc. (http://www.twc.com) "consists of the nation's largest-volume system of interstate natural gas pipelines, business units offering a complete array of traditional and leading-edge energy solutions, and single-source providers of national business communications systems and international satellite and fiber-optic video services" (p. 2 of 2). The micro-marketing of instructional technologies by such companies can be expected to impact dramatically the instructional technology field.

While most instructors, trainers and human resources professionals may be involved in outsourcing such products, they will have more ongoing responsibilities for instructional design and development of curricula that they may also deliver. One of the parameters they will address in the design will be cost effective delivery alternatives. In looking at these instructional roles, use of the ISD process will be addressed first; followed by use of instructional technologies.

Instruction and ISD process

IT professionals involved in instruction, training and human resource roles will continue to be called upon to deliver instruction and will, therefore, be expected to have the necessary instructional competencies; however these are not the focus of IT programs. They will also design and develop curricula, perhaps following the ISD process taught in IT programs. As it is applied in multimedia development projects such as those noted above, ISD documentation describes the project output and, used in conjunction with a PERT chart that outlines allocation of manpower resources over a specified timeline, is part of the project management process. Similarly, in the corporate training environment, the ISD documentation is the descriptive basis for a business-like process whereby resources are allocated toward the achievement of specified training outcomes. In that setting, where the ISD process is well established, one of the cost variables is delivery, e.g. in-person or technology based; in-house or out-sourced. Teachers however, do not perceive that they can consider delivery options in designing instruction. Evaluation of cost-effectiveness is not an approach with which they are generally comfortable; nor is the ISD process.

Reiser (1994) expressed the commonly held sentiment that "those of us who believe in the power of the systems approach to instructional design are often frustrated by the fact that the approach is rarely used in one environment in which it is sorely needed, namely the public schools" (p. 11). Indeed, "ID interventions for the classroom are perceived by teachers as low in credibility" (Earle, 1994, p. 7). As to need, Kennedy (1994) reported on the comprehensive results of four studies of teacher ID knowledge and competency carried out between 1989 and 1992. Participants were teacher-librarians and primary, elementary, and secondary teachers in the Newfoundland school system. They had little or no academic or inservice exposure to instructional development but, as a group, were highly qualified and had extensive teaching experience. These four studies demonstrated that participant "knowledge of and competency in instructional development was minimal" (Kennedy 1994, p. 23). Kennedy points out that

> teachers have gleaned knowledge and competencies in certain areas that can be incorporated in an instructional development framework, but their understanding of learning theory as an underlying framework is abysmal, and their ability to see instruction from a systems perspective is, in most cases, non-existent. (p. 23)

These findings, which were based on actual testing of participant ID knowledge and competency, support the position that there may be a need for instructional design training among teachers.

> It is interesting to note that respondents in all four studies rated their competencies as adequate. When confronted with follow-up questions eliciting specific knowledge of the competency area, however, it was apparent that the majority of respondents lacked even rudimentary knowledge to implement an instructional development approach. Respondents consistently self-rated their knowledge and competency considerably higher than that which actually existed. (Kennedy, 1994, p. 20)

Of equal importance for the marketing of an IT program, is the confirmation that teachers, based on self-assessment of their competency, do not perceive any need for such training.

> Despite the general lack of theoretic knowledge of instructional development on the part of the majority of respondents in all groups, more than 50% of respondents felt they could use an instructional development approach if they chose to do so. They assessed their level of competency as adequate. This result is not surprising, when it is considered that the majority of respondents see little or no relationship between the underlying theories and the application of an instructional development model. (Kennedy, 1994, p. 20)

In contrast, Branch (1994) reports that teachers, although they consider the ISD process unrealistic at the classroom level, generally engage in instructional design practices. This is based on a survey, with a response rate of 17%, of 42 junior high and 35 senior high teachers from a small urban school district. As to whether, despite their sentiments on the ISD process, teachers do engage in instructional design practices, the validity of the survey instrument appears open to question. Branch (1994) recognized that, in order to construct a valid survey to measure teacher planning activities, translation of instructional design jargon into *teacher language* was necessary. According to the translation table developed for the study, the designer practice of 'conducting an instructional analysis' is equivalent in teaching practice to 'determining goals based on the curriculum' and 'breaking down curriculum goals into learning tasks' (p. 30). This translation is not supported by Kennedy's (1994) findings.

> Secondary teachers had no knowledge of or competency in needs assessment, indicating that these skills were not required in a system where the curriculum is set and subject to public examination; [and]
>
> while all secondary teachers claimed to make extensive use of objectives, their source of objectives was a combination of creating their own and referring to those provided in curriculum guides. Only one-quarter were able to develop a specific objective on request, and while claiming knowledge of levels and hierarchies of objectives, only one-quarter proved to have sufficient knowledge to be competent in this area. (p. 20-21)

This lack of competency is of particular significance since "design problems tend to be organized hierarchically" (Murphy, 1990, p. 280) whereas teachers, starting with pre-specified objectives, tend to focus on content and activities in their planning. Reiser (1994) notes that the teacher planning process relies heavily on mental planning. His research affirms the impression that

> given sufficient training, some teachers will employ a systems approach process to help them plan their instruction. Although their written plans will be sketchy, the instruction these teachers deliver will reflect the close relationship between objectives, instruction, and assessment that is central to systems approach thinking. (p. 15)

Even though the systems approach appears to be compatible with teacher planning processes, Reiser (1994) does not feel the approach will be adopted by teachers without support from studies "that examine whether instruction that is designed and delivered by teachers who use a systems-approach process results in greater student achievement than instruction designed and delivered by teachers who employ some other means of instructional planning" (p. 16).

Darwazeh (1995) carried out one such study following 18 hours of instructional design training. The study investigated whether the training had a significant effect on in-service teachers planning routines and whether the relationship between teachers' planning routine and their students' academic achievement differed significantly before and after training. "The most interesting finding of this study was the significant correlation ($r=.51$, $p<.02$) between teachers who received training on IDC and their students' academic achievement" (p. 102). Further studies on the impact of instructional design training for teachers on subsequent student achievement will be required to confirm Darwazeh's findings.

Studies are also needed that consider the impact on student achievement of curricula developed by trained instructional designers, but delivered using alternative delivery options. It should also be noted that such studies are premised on ISD objectivist models that "are used to design and develop efficient and effective instructional solutions to human performance problems" (Dick, 1996, p. 62). It is these models with which teachers have been uncomfortable and, while it is the position of the present study that these models incorporate key constructivist elements, it may be that educators will, instead, follow constructivist models where the instructional outcome is intended to be evaluated against a creative standard rather than a performance standard. For educators, constructivism seems to address the "critical need to simply motivate and engage students" (p. 62). But it is performance in the global economy that has been the put forward as the rationale for significant public expenditures on both instructional technologies and the communications infrastructure thus raising an expectation of higher performance.

Instruction and instructional technologies

Berling (1985) noted that "people knowledgeable in the field of technology, whether they work in education or not, would probably agree that the use of technology in the profession of teaching and learning has not reached its true potential" (p. 75). Despite rapid technological change and increasing ease of use, barriers still exist. Spotts and Bowman (1993) in examining such barriers, identified incentives to using instructional technology among faculty at the University of Michigan. They concluded that the major incentive was the perception that technology contributed to improved student learning, interest and achievement. However, faculty also indicated reservations as they believed that it still remains to be demonstrated that the technology based methods offer clear advantages over traditional methods. These findings clearly suggest that it is necessary to demonstrate the technology's potential in education, and most certainly to 'walk the talk' in instructional technology programs.

Major barriers to increased faculty use of instructional technologies continue to be lack of: time (to learn and use), available equipment, training, and financial support. These barriers fall into two categories. The first, whether in the corporate environment, the classroom, or among university faculty, starts with basic computer literacy and the training instructors need to achieve this. The second category is infrastructure support which includes the availability of equipment and software that is up-to-date, and support staff to maintain both. Schwarz (1996) survey of Alberta teachers confirmed these barriers, but added a lack of administrative support.

As for computer literacy training, instructors feel that to achieve the potential advantages which instructional technologies offer, they need to be able to use technology effectively and confidently. They need to have reached a threshold level of self-efficacy before they will use technologies in the classroom. At Purdue University, Faseyitan, Libii and Hirschbuhl (1996) developed a program to raise faculty computer self efficacy levels.

> The authors chose to focus on computer self efficacy for three reasons. First, studies have consistently shown that self-efficacy correlates highly with the use of complex technologies (Hill, Smith, and Mann, 1987; Landino and Owens, 1988). Secondly, Faseyitan and Hirschbuhl (1992) surveyed faculty in universities and concluded that computer self-efficacy is significantly related to the adoption of computers for instruction. (p. 215)

The same computer literacy need is present in K-12 school systems, an area of significant projected job growth. The competencies identified in North Carolina, although they have been developed in response to local government policy and legislation, are generally representative. Two competency levels were identified that illustrate K-12 requirements for all teachers. The major need is for teachers with the requisite knowledge and skills to utilize computers and other media for information, instruction and management needs. Whereas information needs relate both to professional development and course content, instructional needs are directed primarily by the requirement to integrate computing content and use with subject content in student instruction.

> With the inclusion of computer skills for students in the Standard Course of Study and with the approval by the State Board of Education in May 1991 of computer proficiency as a graduation requirement beginning with the Class of 2000, all teachers and personnel working with students in the instructional program need the skills and knowledge contained in the Level I Computer Competencies to help students succeed academically. (North Carolina Dept. of Public Instruction, 1992, p. 2)

In North Carolina the Level I computer competencies which all educators should be able to demonstrate are:

1. an appropriate understanding of the basic concepts of hardware and software in relation to the use of the computer
2. knowledge of the capabilities and limitations of computers and programs
3. the ability to discuss the effects of computers on society
4. the ability to use the computer in instructional programs. (p. 4)

A demonstrated understanding of Internet Web pages will, no doubt, be added to this list in the next revision. It is important to note that at this level educators are also expected to have the ability to evaluate, select and use computer courseware to meet specified instructional objectives. Building on these, the second level of competency that all content area teachers must demonstrate requires:

1. an understanding of basic concepts of computer hardware in relation to their subject area
2. a knowledge of Computer Assisted Instruction (CAI), Computer Managed Instruction (CMI), and authoring programs
3. an understanding of the use of peripheral devices, other general items and those specific to the content area. (p. 5-6)

In addition, content area teachers at this level are expected to be able to demonstrate understanding and use of content specific instructional technologies in the design of lesson and unit plans which incorporate content specific activities including the use of peripherals. An example would be the use of midi interfaces in music classes.

The expectation in North Carolina, as elsewhere, is that these Level I and Level II competencies are, or soon will be, included in undergraduate teacher preparation programs. Indeed, as instruction for these competencies moves into the K-12 curriculum, some are already pre-requisites for admission to post-secondary institutions. In an IT program, computer literacy to this level must be a pre-requisite for all applicants, not a component of the graduate program. Although these competencies will thus exceed the parameters of this study, they are noted because they are presently being addressed in many graduate IT programs. This has evolved from the fact that, as computers were incorporated into the school setting, IT programs were the logical choice to provide courses for practitioners in what was characterized as a new IT specialization. Teachers who took a few of these graduate courses received a specialist certificate and qualified for 'computer specialist' pay. Such specialist designation for salary purposes has resulted in an unfortunate trivialization that confuses basic computer literacy with computer efficacy, thereby further diminishing the valuation of legitimate instructional technologies expertise. Computer literacy will soon be a minimum necessary to maintain certification; and practitioners without it will be expected to deal with the deficiency as part of their self directed professional development. Computer efficacy requires significant practice beyond literacy and precedes expertise.

During the transition period many institutions, the University of Alberta among them, are structuring institution wide training programs for instructors. These programs not only address computer literacy to give faculty the sense of compatibility and control that will enable them to move on, first to efficacy, and then to innovative computer use, but also use instructional technologies to motivate change and innovation in teaching methods.

> To cultivate the use of computers in the classroom among faculty , therefore, it is critically important to strengthen their computer self-efficacy. A high self-efficacy about computers will enhance the following attributes among faculty: 1) a feeling of compatibility of computers with their teaching; 2) a sense of control of the classroom situation when using computers; and 3) an intrinsic interest in developing innovative uses of computers (Faseyitan, Libii, & Hirschbuhl, 1996, p. 215).

Educators in particular recognize that since the tendency is to teach the way we were taught, it is imperative that future teachers be introduced to classroom innovations that go beyond lectures. Princeton has developed a program to introduce graduate students, who have been evaluated on the basis of potential for future excellence in teaching and scholarship in their fields, to the resources, methods, and tools for research and teaching made possible by computing and networked technologies. Some of the goals and objectives of that program were to:

- develop a cadre of young scholars who, having worked and learned together, will carry their new knowledge to many other institutions as they begin their careers. The project will thus help to shape the new professoriate and the nature of teaching and learning in the next century (Princeton University, 1996a, p. 1of 2); [and]

- enrich relationships among senior faculty and graduate students, by providing opportunities for mutual mentoring around issues of new research and teaching strategies. Students can themselves become mentors to senior faculty as they share their knowledge of new methods, and will benefit from the critique and insight of seasoned professors. (Princeton University, 1996b, p. 1)

A one-week instructional seminar was followed with bi-weekly colloquia through the summer and then monthly colloquia through the academic year. The latter emphasizing teaching applications of the tools and methods, also involved senior faculty as mentors and as fellow participants. Technology mentoring is also being used very effectively in the K-12 setting where Holzberg (1997), with examples of successful staff development strategies from schools across the country, illustrates how "adults [teachers] learn about technology from third-graders while helping these students develop their communication and leadership skills" (p. 36). In some schools it is students, under the direction of a teacher, who set up and maintain the school networks. But more often the emphasis at this level is on World Wide Web home-pages, presentation software and e-mail. These applications offer the significant advantage of a very low learning curve. Satisfying results can be achieved on the basis of a relatively small learning investment. This is in stark contrast to the steep learning curve of many of the specialized instructional technologies, such as CAI and CMI, that are the traditional purview of IT programs.

Shaw (1992) reporting on the use of computer-aided instruction by working professionals found that:

- it must be related to their work and, preferably, must be done on the job;
- they must be able to locate the desired subject matter easily and without interruption from the computer, and with as few keystrokes as possible;
- there should be many ways to use and access the instruction because of the wide range of user modes in the adult population;
- computer control should mainly involve managing the vast amounts of information that may be reached through the computer;
- otherwise, the instruction should be controlled by the user. (p. 57)

Her findings contrast CAI use in instructional programs where the objectives are subject matter mastery with use targeted at adult professionals whose focus is performance. They offer insights useful both for practice and for CAI utilization in IT programs.

In this context, Gentry and Csete (1995) observed that "educators are slow to recognize the need to develop a curriculum that will prepare the workforce for the new demands they will face" (p. 25). One of the most important skills they identified was independent learning, a perception supported by all of the competency studies reviewed in this study. For IT professionals in particular, this is an essential skill that must be actively modeled. Learning to use presentation software, web pages or other instructional technologies to effect instructor centered delivery is not sufficient. New skills must be expertly applied to fulfill the promise of providing conditions for learning that achieve effective, productive ends in a way that is 'most direct, adroit, and cost-beneficial'. IT faculty must to continuously apply independent learning to enhance effectiveness of a program that is cost effectively delivered utilizing an appropriate mix of face-to-face, independent and technology based delivery.

One of the requirements to deliver this program, whether in the classroom or the workplace, then is infrastructure support including availability of up-to-date equipment and software, staff to maintain them, and, in some cases, to provide assistance in using or learning to use them.

Instructional systems technology support

North Carolina has identified three categories of technology competency to meet K-12 system needs. The category related to classroom teachers was described above. The second category was for computing and technology teachers. Although this category is outside the scope of this study, it should be noted that the school's computing teacher was often the sole support for teachers when there was insufficient hardware and computer use to justify hiring computer systems professionals. Indeed, the instructional systems technology support role grew out of the increased need for hardware and software support beyond what a lead user or the computer teacher could provide on an informal basis. In addition, the sophistication of LAN and WAN installations, and the capital investment required, made the former *modus operendi* unrealistic. This third category, outlined from the North Carolina's perspective, is one that includes components that would seem to be the purview of IT programs. It

> is appropriate for those persons who, through advanced study and preparation, wish to develop extensive knowledge and skill in the area of computer technology (hardware, courseware, programming techniques, sources of information) and its application to the K-12 curriculum. The Instructional Technology Specialist--Computers . . . serves as a member of a management team and has responsibilities that include computer skills curriculum planning and implementation; staff development; hardware and courseware evaluation, selection, and integration; production and utilization of resources; and management of personnel and facilities. (North Carolina Dept. of Public Instruction, 1992, p. 15)

However, the growth in school networks now means that instead of teaching and looking after school technology demands, these specialists more often divide their time between school, district and state responsibilities which may include WAN network administration or webmaster roles. The University of Southern California addresses this role in a new IT program to train specialists to guide schools in technology planning, implementation and utilization. Kearsley and Lynch (1994, p.9) have categorized these technology support competencies by level, as listed in Table 1. For the purposes of this study, these have been subcategorized as computer (C) or IT competencies, a distinction that is clearer at the district and state levels.

Table 1 *Examples of Technology Leadership Skills*

Level	**Computer or IT**	**Skill**
State	C	• negotiate discounts for district hardware and software purchases • support regional technology centers • conduct evaluations of technology in schools • maintain a state-wide educational computer network
	IT	• set standards for teacher training in technology
District	C	• coordinate hardware/software purchasing and maintenance • coordinate district-wide administrative computer use
	IT	• plan and conduct teacher and staff inservice training • identify specific objectives for technology use in schools
School	C	• provide personal support to teachers/staff • recommend/evaluate software or hardware • troubleshoot software/hardware problems • introduce new software or hardware
	IT	• identify educational problems for which particular technologies may provide solutions

The computer designated skills are those that require a high level of technical computer knowledge. These are competencies for which programs and certification are available through computing science programs and institutes of technology, such as NAIT and SAIT in Alberta. The University of North Texas and Nova Southeastern University offer IT programs that address the competency needs for positions that combine computing teacher and technology support responsibilities and would be taken by teachers lacking a formal computing science or technologist background. Such programs are targeted only to the K-12 job market. They may also reflect the competitive job market for computer professionals that has led to schools expect Education faculties to deliver teacher training programs that address these competencies. The support role also involves an administrative component that increases from the school to state level.

IT skills, as identified in Table 1, are those related to staff development, curriculum planning and media selection. They focus on instructional design skills and leadership by example rather than on administration. In response to the 1992 guidelines, one North Carolina district created Technology Resource Teacher (TRT) positions in each school that did not already have a designated technology resource person. The TRT role was to prepare teachers and students for the state computer competency exams that were required after implementation of the guidelines and to assist teachers with the integration of technologies into the classroom. Often when computer systems experts attempt to train teachers, or other novices, the results of their efforts are seen as not useful, or even relevant. Those hired for the TRT positions were classroom teachers who had passed the state computer literacy test and had an interest in both technology and teaching. Eighty-three percent had a background in teaching math; 16.7% in science. The majority of their time, almost 75%, was spent providing technical support. None of the TRT's hired had "any training or college courses in instructional design and technology" (Moallem, Mory & Rizzo, 1996, p. 520). With such a background, it is understandable that the TRTs "provided workshops based on their own understanding of the teachers' needs, informally monitored the process, and used more of the collegial relationships with teachers to help them integrate technology" (p. 526). The instruction had neither specific objectives or planned action for implementation and evaluation. Moallem, Mory and Rizzo (1996) concluded that

> if public schools would like to use the time and money efficiently, they need to use professionals who have not only the characteristics of the TRTs but also skills in instructional design. (p. 526)

Unfortunately it cannot be assumed that the availability of colleagues with a classroom background, technology skills and instructional design skills is a resource that all public schools will understand and appreciate. Garbosky (1994) reported on a follow-up study with 10 teachers trained in educational technology. Although in 1987 the majority felt that "their skills in instructional design and technology were not being tapped by their schools or districts" (p. 43), this state of affairs has since improved. This improvement was primarily due to their own initiative and unwillingness to compromise.

> Most often interviewees sought or created the need for positions which would specifically make use of their skills. Yet, even then, their success in using their skills appeared dependent upon the administrator's understanding and valuing those skills. (p. 47)

In addition,

> whereas contributions in computer and video technologies and applications in districts and classrooms comprised the bulk of respondents' activities earlier, now the majority of these educators are relying on their design skills. (p. 46)

It should be noted that, even when IT graduates did not perceive that their skills were valued by others, these IT graduates used the skills on a daily basis in the classroom and felt that, as instructors, their design and technology training had given them:

- insight into designing instruction (for students and adults);
- the self-confidence to take risks and try new things; and
- understanding of and practice in the appropriate use of technologies to enhance teaching and learning. (p. 43)

As outlined above, technology support positions may combine instructor, and technology skills with either leadership skills or instructional design skills. Building on either of these combinations, Thatch and Murphy (1995) determined that distance education positions require a combination of instructor, technology, design and leadership skills.

Distance education delivery

Building on the mass delivery technology of the entertainment and communication industries, in-class and distance delivery options are now available which were previously judged not to be cost effective within the education arena. Competition among post-secondary institutions to attract students beyond their traditional geographic markets increases the interest in the opportunities afforded by technologies that deliver instruction outside the traditional classroom. In corporations, where classroom instruction often entails travel and housing costs, effective distance delivery of training can offer significant cost benefits. This is particularly the case for large corporations that already have in place, as part of their business operation, the telecommunications infrastructure to deliver such training.

Whetzel, Felker and Williams (1996) carried out a field study to assess the effectiveness of satellite training compared to classroom training. The study involved eight United States Postal Service (USPS) training courses. Six were delivered only by satellite; two used both satellite and classroom delivery. Assessment of participant reactions to the satellite training medium were positive in terms of the technology, on-site support and course content. Participants in all six courses delivered only by satellite showed significant learning gains. The results of the post training job skills test of participants in the two dual-delivery courses suggest that job procedures can be taught to large groups of adults "in different geographic locations as effectively via satellite as using classroom instruction" (p. 17). Where it has been determined that a course can be delivered as effectively in terms of learning outcomes by various media, "in a world of competing resources, the issue for researchers and practitioners is to choose the most efficient and cost effective medium" (p. 6).

From the perspective of IT program development, utilization of new technologies for instructional purposes, while offering new delivery options, requires new skills and knowledge on the part of instructors. One of the new competencies that Thach and Murphy (1995) identified was instructional design for interactive technologies. This is consistent with stated requirements in the new Interactive Distance Learning program at Florida State University where students, in addition to all the ISD core courses, take courses in interactive distance learning and interactive communication. While Thatch and Murphy have tied interactivity to technologies, Burke (1997) does not and focuses instead on feedback as the key element in learning. He illustrates how societies and people learn through diligent and effective feedback in the same way that, at a physiological level, process dynamics result in a homeostatic state. Feedback, while not excluding interactive instructional technologies such as CAI, as well as artificial intelligence (AI) and simulations, is far more inclusive an approach to learning and interactivity. The tendency to relate interactivity to technologies rather than learning again raises the learning vs. technologies dichotomy.

Ely's (1997) observations identifying the apparent dichotomy between design and development and the technologies in the literature are consistent with the observations of this study.

> There is an undercurrent in the literature that appears to equate educational technology with information technology. As the use of computers, networks and telecommunications increases dramatically, new advocates are created and replace, to some extent, professionals who have been prepared to serve the field from a broader perspective — that is, from the design and development point of view. Most educational technologists insist that their work emphasizes the design and development of instruction for the improvement of learning, and *not* the application of hardware and software. However, *the trends seem to reflect a hardware emphasis.* (p. 20)

He goes on to note that "this potential conflict is not evident in the current analysis of trends, but it is an important undercurrent that may emerge in the future" (p. 20).

In looking at practitioner roles, this section has focused on the attributes, and competencies that IT graduates need to fill effectively positions that are evolving with relative rapidity. Common to all roles is a need to prepare graduates who can provide leadership in establishing the added value of the IT field to learning through demonstrable performance improvement. Ely (1997) suggests that part of the long-range approach and a conflict "solution would be for professional educational technologists to become more adept with the newer technologies, and for the latter-day practitioners to gain new skills in design, development, and evaluation" (p. 20) to which a renewed focus on learning might be added.

Labour employment projections will be reviewed next to provide an indication of the extent of job opportunities that may exist or emerge for graduates in the various job sectors.

Market Demand for Graduates

Employment market data were taken from published American data because comparable Canadian information is not publicly available. However, it is reasonable to anticipate that the Canadian market for IT graduates will, in response to similar influences, grow similarly.

The U.S. employment projections for 1992 to 2005 (U.S. Bureau of Labor Statistics, 1994), do not include specific data for instructional technology graduates. A partial explanation for this may lie firstly in the fact that the field accounts for such a small portion of the total workforce, and secondly in that IT graduates may be employed as specialists in a wide variety of fields. Since almost all IT programs are in Education faculties, the proportion of media design graduates to education graduates does give some indication of the workforce impact of the field. The data reveal that of the total number of education graduates 96,028 in 1992/93 and 98,938 in 1993/94 received masters degrees (U.S. National Center for Education Statistics, 1996, Table 247); 7,030 graduates in 1992/93 and 6,908 in 1993/94 received doctorates (Table 248). Of those 1993/94 graduates, only 957 at the masters level and 60 at the doctoral level, or less than 1%, graduated in educational/instructional media design (Table 244). Technology/industrial arts education specialists accounted for another 493 masters and 30 doctoral degrees for a combined impact of somewhat over 1%. In 1993/94 the field in the United States with the largest number of graduates at both the master's and doctoral levels was education (p. 169).

In Canada in 1993, of the 3,616 M. Ed. degrees awarded, 338 were awarded in Alberta (Statistics Canada, 1996, Table 39); and of the 361 doctoral degrees, 92 were awarded in Alberta (Table 41). If one were to apply the U.S. ratio of IT graduates to education graduates, one could anticipate 36 masters and perhaps three doctoral IT graduates in Canada. In 1995 the instructional technology program at Université Laval awarded 19 masters and one doctoral degrees (Peterson's, 1997, p. 908); and the Educational Technology program at Concordia University awarded 23 masters and two doctoral degrees (Peterson's, 1997, p. 895). These numbers do not suggest a pressing need for a new IT Canadian program, but the fact that the number of education graduates is increasing does suggest that an IT program in western Canada could be supported. The proportion of doctoral graduates in Alberta indicates that there is a pool of potential candidates for an IT doctoral program.

In terms of demand growth, according to the U.S. Bureau of Labor Statistics (1994), three industries "are expected to provide nearly half of the total growth in wage and salary jobs from 1992 to 2005 - retail trade, health services, and educational services" (p. 74).

Education system

In the US, among the thirty occupations projected to have the fastest growth under a moderate growth economy are: computer engineers and scientists, systems analysts, and special education, preschool and kindergarten teachers. Two of the twenty occupations expected to provide the largest number of wage and salary jobs are elementary and secondary school teachers. This is due, in part, to projected enrollment increases of 14% for the K-12 age group. Given the similarity of the U.S. and Canadian economy and demographics, the situation in Canada may be assumed to be similar. However, given the strong demand for teachers, individuals holding a teaching certificate will have to be convinced that a further IT qualification will be of benefit to them. As already indicated, this will not be an easy task. However,

> the very changes that are concentrating people's attention on education are obliging everyone to be more outward-looking, and to judge their ways of doing things by the yardstick of the best in the world. ("Education and the wealth," 1997, p. 15)
>
> Academics are starting to ask why countries as culturally different as Japan or Switzerland do so well [in comparative education tests]. The evidence suggests that teaching methods are the key. (p. 15)

The measurement and comparison are occurring in a political climate where "given the pressure to trim budgets there is no prospect that governments will chuck money at schools without checking to see whether standards are improving" ("World Education," 1997, p. 22). Legitimacy of public demands in this area have just been strongly reinforced as a result of the Third International Maths and Science Study (TIMSS) which compared 13 year olds in 41 countries and documented that:

- low-spending countries such as South Korea and the Czech Republic are at the top of the TIMSS league table. High-spenders such as America and Denmark do much worse (p. 23); and
- American children have three times as much money spent on their schooling as South Koreans, who nevertheless beat them hands down in tests. (p. 21)

As a result, one may anticipate that in the future K-12 teachers with competencies in evaluating and improving instructional performance and cost-effectiveness will be more highly valued, as adult instructors with these competencies already are. Looking beyond K-12 positions, strong growth in the adult education and training markets will benefit IT graduates.

Workforce training and lifelong learning

IT programs attract many students with either experience or interest in adult education or training. According to the U.S. Bureau of Labor Statistics (1996a):

> Employment of adult education teachers is expected to grow faster than the average for all occupations through the year 2005 as the demand for adult education programs continues to rise. The 35-44 year old population — the largest users of adult education — is expected to grow, contributing to increasing enrollment. Participation in continuing education grows as the educational attainment of the population increases. More people are realizing that life-long learning is important to success in their careers. To keep abreast of changes in their fields and advances in technology, an increasing number of adults are taking courses for career advancement, personal enrichment, and to upgrade their skills, spurring demand for adult education teachers. (p. 3 of 5)

Although most adult education teachers work in a classroom setting, some may act as consultants to a business and teach classes at the job site. "Businesses are finding it essential to provide training to their workers to remain productive and globally competitive" (U.S. Bureau of Labor Statistics, 1996a, p. 3 of 5). Adult educators also have a long tradition of self-employment and corporate training opportunities are now showing a strong trend in this direction as "businesses increasingly contract out personnel functions or hire personnel specialists on a contractual basis to meet the increasing cost and complexity of training and development programs" (U.S. Bureau of Labor Statistics, 1996b, p. 6 of 8). American industries and business are also hiring in-house training specialists. Gentry and Csete (1995) observed that "the demand for qualified educational technologists in these training programs exceeds the number of candidates applying to and graduating from academic programs in educational technology" (p. 27). Such training specialists plan and direct a wide range of activities including:

- orientation sessions and on-the-job training for new employees;
- sessions on interpersonal skills and dealing effectively with employees for supervisors; and
- individualized training plans to strengthen employees' existing skills or teach new ones.

> Training specialists in some companies set up programs to develop executive potential among employees in lower-level positions. In government-supported training programs, training specialists function as case managers. They first assess the training needs of clients, then guide them through the most appropriate training method.
>
> They also periodically evaluate training effectiveness. Depending on the size, goals and nature of the organization, trainers may differ considerably in their responsibilities and in the methods they use. Training methods include on-the-job training; schools in which shop conditions are duplicated for trainees prior to putting them on the shop floor; apprenticeship training; classroom training; programmed instruction, which may involve interactive videos, videodiscs, and other computer -aided instructional technologies; simulators; conferences; and workshops. (U.S. Bureau of Labor Statistics, 1996b, p. 3 of 8)

In addition to classroom and business settings, adult educators are hired by organizations to teach classes and design programs. Professional organizations often sponsor continuing education credit (CEC) courses for members. Non-governmental organizations (NGOs) sponsor programs targeted to individuals who may be socially and economically disadvantaged. Government numbers do not reflect the market demand for adult educators within this sector — the third and fastest growing sector of the economy.

Media development

Many IT graduates are employed as instructional design specialists in the development of multimedia educational products. They are instrumental in the development of the sophisticated computer based tutorials that software developers such as Microsoft® and Adobe® utilize in marketing their products. The quality of these tutorials sets a standard which students will then expect all computer-based classroom instruction to meet. The fact that the computer industry accounts for 50% of the current growth in the U.S. economy suggests strong employment possibilities for IT graduates in this area, particularly those who also have creative and artistic capability. As in all design occupations, a good portfolio with examples of a person's best work, rather than educational credentials, is often the deciding factor in obtaining a job. In 1994 demand for media development specialists was such that employers were hiring promising students out of the Arizona State University IT program before they had graduated. These informal indicators continue to reflect strong demand, particularly for students with a solid portfolio of work.

Labour market projections were reviewed for cross-validating data. While there was insufficient detail to identify new job opportunities, significant growth is projected in key areas in which graduates have traditionally been employed. Research and reviews of the field were also examined so that influences that could change competency expectations and role opportunities in the 21st century might be anticipated.

Research Issues, Trends and Shifts

In reviewing media and technology research, Ely and Minor (1994) concluded that much of it is fragmented in nature.

> Doctoral students and faculty at many universities pursue their own research interests and report their findings from time to time. Most of this research is idiosyncratic; that is, the inquiries often seem to be isolated from other research (p. 24).

Among the early exceptions noted were the Yale and Pennsylvania State universities film and television studies that "built on one another and provided rich results for their sponsors and professionals in the emerging field" (Ely & Minor, 1994, p. 24). Results of wider value have more recently been provided by programmatic research, such as that undertaken by the Vanderbuilt Cognition and

Technology Group and the TERC Group. "Both of these programs are deeply involved in the application of technology to teaching and learning, but it is not the technology itself that is important; it is the design of the learning materials that make the results of these research programs useful beyond the walls of each organization" (p. 24). Similarly the research results of Dwyer (1978; Moore & Dwyer, 1994), spanning over thirty years, on the impact of visual literacy and visual cues on learning and achievement provide a resource of wider value.

Looking more broadly at media and technology research, Ely (1992; 1997) utilized the content analysis technique to identify, from the literature, trends in the field. Content sources included five leading professional journals; papers given at annual conventions of three professional associations; dissertations from five universities highly respected for the level of their doctoral productivity; and the educational technology documents that have been entered into the ERIC database over the year. In 1992 Ely, Foley, Freeman and Scheel identified three trends having particular relevance to IT curriculum development. These are noted below.

1. The creation of technology-based teaching/learning products is based largely upon instructional design and development principles. The term *constructivism* appears with increasing frequency. (p. 8)

2. Evaluation has taken on greater importance as the concept of performance technology has been further developed. Performance technology is appearing more frequently in the literature to refer to instructional design and delivery that works. It is being used more in the business-industry-government settings than in school and college environments. (p. 9)

3. Distance education is evident at almost every educational level in almost every sector. Over 1,500 schools are participating in some form of distance education. Technologies used: satellite (56%); audiographics (15%); microwave (17%); coaxial cable (21%); computer-based (13%) and fiber optics (11%). There is probably no other single trend that encompasses the theory and practice of educational technology better than distance education. (p. 11)

In analyzing the trends from 1988 through 1995 Ely (1997) offers a longer range perspective. He perceives a new era in education on the basis that "in the past there has never been an expressed priority related to educational technology" (p. 12) but today it is one of the six top school issues. He cautions that, while the data are clear that computers, networks, CD-ROMs and television are increasingly available to students in the schools, at home and in other community settings, data are not available to confirm their creative and appropriate use for learning. "However, optimism prevails, and schools continue to purchase hardware and software as symbols of progress and change" (p. 21).

One of the results expected from these expenditures is structural change in education as instructional delivery options evolve that are not teacher centered. The development of school based educational technology plans is one suggested vehicle for such change. "This plan becomes the framework for strategic planning in which educational technology plays a central role" (p. 18). An essential premise of these plans is "teacher education and staff development programs that will help teachers and other educators become more proficient with today's technology" (p. 21). Much of this staff development discussion focuses on computer based technologies, particularly the Internet, while overlooking the fact that television, in combination with VCRs, is an effective instructional technology that is widely available in schools and does not require any staff training.

Trends in instructional technologies and in education generally tend to reflect or evolve in response to developments and changes initiated in the wider societal context. Two recent Delphi studies suggest how the response to technological developments might impact education in Alberta. Barker (1994/1995) used a Delphi survey methodology to identify changes likely to occur in the Canadian education system. Respondents, 9 in the first phase and 25 in the second, represented a wide range of Canadian stakeholder groups. Barker also identifies the wider context in which the identified changes are forecast to evolve. These include:

- increased links to the media. According to Toffler (1990), the media system of the future will encompass six principles: interactivity, mobility, convertibility, connectivity, ubiquity, and globalization. Toffler says that to ignore the relationships between the educational system of the future and the media system of the future is to cheat learners who will be formed by both. (p. 106)

- concentration and concern for literacy, both basic literacy worldwide and functional literacy in developed countries. Throughout the world, education remains a major goal for development as well as a means for meeting goals for health, higher labour productivity, stronger economic growth, and social integration. The increasing levels of technological "savvy" demanded by modern life often are more than people are prepared to meet, even in the most modern societies. (p. 106)

- Drucker (1992, p.5) would construct a curriculum approach `to equip students with the elementary skills that would make them

> effective as members of an organization: the ability to present ideas orally and in writing; the ability to work with people; the ability to shape and direct one's own work, contribution and career'. (p. 107)

It is of significance that Barker anticipates that somewhere around the year 2000, teachers will have acquired advanced technological skills during teacher training and will have opportunities to maintain enhanced skills (p. 197). After the year 2000, Barker (1994/1995) expects that

> evaluation of each student will incorporate portfolio assessment of his/her work and student assessment will include results beyond those which can be measured with paper and pen. The catalysts for this change will have been changed provincial government priorities and programs, pressure from teachers and administrators, and other factors (p. 191).

The survey included four items related to instructional technology that were not confirmed by respondents in round one of her survey and, therefore, were eliminated from later survey rounds. The elimination of these four items suggests that the possibilities held out for technology to replace books, classrooms, and teachers are not anticipated to be operational in the coming decade. Respondents did not consider it likely that in education:

1. the increased use of portable microtechnologies, e.g. entire dictionaries on videodiscs, and access to electronic data bases has eliminated the traditional library;
2. individual student learning programs are generated and managed by computers for all students;
3. virtual reality technology, used as simulators, reduces the number of professional teachers needed;
4. time is irrelevant as microtechnology has individualized all programs. (Barker, 1994/1995, p. 361)

Also looking at future trends in Alberta, Mullen (1993/1994) used a Delphi survey methodology to identify educational changes predicted by 82 Alberta public school superintendents. The first ranked response to the survey item regarding teaching strategies was that the "emphasis will be to teach students how to access and use information" (p. 94). Every round two respondent predicted an increase in the use of technology. Each suggested that technology will:

- play a greater role in the delivery of instruction. It will have an increased role in the classroom. Children will be computer literate at an early age . . . and there will be more courses in technology, with computers used in every subject. (p. 95)

- take over many of the traditional teacher roles (managing of data, rehearsing information, etc.), [and] classes' or tutorials will be able to be conducted anywhere in the world with two way interactive technology. (p. 89)

Respondents were equally unanimous in their prediction that "the cost of staying technologically competitive would have an underestimated impact on education" (p. 98). Budgeting for educational technologies is an important administrative issue, and one of the critical competencies that IT program graduates must be prepared to address.

Instructional Technology Programs

In the decade 1985 to 1994 the average number of instructional technology doctoral programs reported in the Educational Media and Technology Yearbook annual survey of US programs was 62 per year with a high of 67 in 1988. Ely, Foley, Freeman, & Scheel (1992) noted that:

- professional education of educational technologists has stabilized in size and scope; and

- programs tend to include similar content, are primarily offered at the graduate level, and prepare students for similar positions. (p. 22)

However, this stabilization appears to have changed as the last three years (1994, 1995 and 1996) reported a downward trend with 51, 46 and 35 doctoral programs being reported. Concomitant with this downward trend, is an overall decline in the number of faculty and students. The literature may offer possible explanations for this. One possibility is the diffusion into undergraduate programs of components that, when they were new, were included in IT graduate programs. In addition many technology and media issues are now being addressed in curriculum subject courses rather than in technology courses. Another is the fact that the critical need for programs to train existing as well as new teachers when hardware first became prevalent in the schools, has, to a large extent, peaked. With a significant number of teachers having taken the Computers in the Classroom courses, the Ontario government decided it could "no longer subsidize the cost of teacher professional development" (Owston, 1995, p. 19). Funding support for the program was then withdrawn, resulting in a further reduction in demand for the course. While adjustments such as these are likely to continue, market demand for program graduates remains strong.

Major Institutions in the Marketplace

Based on doctoral program data reported in the annual survey published in the *Educational Media and Technology Yearbook*, the institutions granting the most instructional technology doctorates were:

- between 1987/88 and 1992/93: Florida State University, Nova University, University of Illinois, Purdue University, University of Texas and Wayne State University.
- between 1990/91 and 1992/93: Florida State University, University of Illinois, Purdue University, University of Texas and Wayne State University.

The institutions with the largest number of doctoral students registered in 1993/94 were: Pennsylvania State University, Wayne State University, University of Minnesota, University of Iowa and Syracuse University. The higher number of doctoral students at the universities of Texas, Minnesota and Wayne State, however, appear to reflect a combined total of technology and curriculum students, rather than a count of only instructional technology students.

Among institutions with instructional technology doctoral programs, the five universities generally accepted as having the highest level of doctoral productivity are Arizona State University, Florida State University, Indiana University, Syracuse University and University of Southern California. An objective of this study was to identify a global benchmark. In the IT field, it is these major US programs that have set the global standard. For example, at Indiana

> the Spring 1979 issue of Chalkboard reported that graduates of the IST program held positions in 48 states. Additionally, alumni were involved in instructional systems technology in 83 countries including seven provinces in Canada, 19 countries in South America, 24 countries in Asia and the Far East, 21 countries in Africa, and six countries in Europe as well as Australia, England, and Iceland. (http://education.indiana.edu/ist/students/history/postlars.html)

The program at Syracuse University, which began in 1948, has graduated students from more than 50 nations and currently has "cooperative agreements with several international institutions and government agencies for faculty exchanges, collaborative curriculum development, and joint research projects" (http://web.syr.edu/~jmehra/HTML/progover.html). The Learning Systems Institute at Florida State University has a worldwide reputation

> for improving the performance of state, national, and international educational systems. [Its] Center for International Studies working collaboratively with developing nations, through dissemination and networking activities, CIS makes the tools and lessons of its work available to other countries and agencies working to improve their educational systems. (http://www.fsu.edu/~lsi/index.html)

Lead Institutions

The *Educational Media and Technology Yearbook* profiles innovative or `cutting edge' academic programs. In 1994 the profile was on a pioneer in the field.

> Indiana University has served as the model for more graduate programs in the field of media and technology than any other program anywhere in the world. It was one of the earliest graduate programs and has graduated more people with advanced degrees in the field than any other program in North America. The revamped Indiana University program is 'one of the premier new programs in the United States' with a 'completely new approach to delivering the curriculum'. (1994, *EMTY*, v. 20, p. 24)

In 1990 a needs assessment study was carried out by faculty of the Indiana University program and Arthur Andersen, Inc. The results (Pershing, 1994, p. 31) suggested that competency based instruction, with hands-on exposure to technologies, particularly those emerging, in a learning environment structured to foster concurrently the work-place process skills such as team projects, presentations and proposal writing should guide curriculum development for instructional technology programs. The results further suggested that coaching in communication skills must be a component of the curriculum.

This close association with business and the high quality internship opportunities thus provided continues and is an advantage to students in the Indiana program.

> In January 1985 Pett became the IST department chair. An emphasis on training and development resulted in many internship opportunities for IST students in locations such as Arthur Andersen, the Machinist's Union, the Smithsonian, and the IU Medical Education Resources Program. (http://education.indiana.edu/ist/students/history/postlars.html)

The program philosophy and approach is reflected in the philosophy statement of the current R521 course:

- all learning in this course takes place within the context of real-world situations that you are likely to find yourselves in when you leave the academic environment;

- begin with a project that requires developing instruction for a 30-minute lesson on one of the simplest kinds of learning, using simple media and a simple form of evaluation. . . . will provide a foundation of understanding and competence for progressively more complex projects;

- one of the things that is important for an instructional designer to learn is how to be resourceful — how to find information that will be helpful to you in your work — long after you have left IST. This is the "lifelong learner" notion;

- most of the organizations where you will work are in processes of dramatic change. The expectation for our field is that we "add value" to the change process. (http://education.indiana.edu/~istcore/r521/r521.html#philosophy)

Florida State University also has significant internship and research opportunities through the Learning Systems Institute associated with IT program faculty such as Walter Dick.

> Six LSI centers assist educational systems to improve their efficiency and effectiveness, conduct basic and applied research on key aspects of human performance, and provide training and technical assistance to organizations and institutions. (http://www.fsu.edu/~lsi/)
>
> Product and process descriptions of prior work completed by CET can be found by visiting the SchoolYear 2000 Home Page. The Florida Schoolyear 2000 Initiative is designing and developing a new system of schooling for Florida. It is a large-scale, systemic, and comprehensive effort to increase the productivity of public school students in Florida through developing, testing, and implementing a technology-supported system of schooling. (http://www.cet.fsu.edu/SY2000/HomeInfo/InfoPacket/Overview.html)

Summary

This chapter summarizes the literature related to the professional roles of instructional technology graduates and the skill and process competencies currently required for those roles as well as those anticipated by future trends. The next chapter outlines the methodology to be followed in conducting this study.

Chapter Three Methodology

This chapter describes the methodology followed in this study: (1) research focus and design, (2) criteria for selection of programs, and (3) data collection and analysis.

Research Focus and Design

This study sought to identify the key components of a graduate level IT curriculum that would provide graduates with the subject knowledge, technical competencies, and attitudes necessary to provide leadership in the 21st century, in the design, development and evaluation of instruction and training utilizing appropriate development and delivery technologies.

Technology is an integral tool of instruction and learning in the information age. The potential for technology based delivery of learning materials as directed by curriculum, work, or curiosity - to students, citizens, consumers, novice or expert - is expanding daily. Indeed, given the rate at which the volume of information is growing, it is difficult to stay current in any given field without utilizing some form of information technology. Our future position in the global information society will be improved, at least in part, by the availability of experts in Alberta who can contribute to the effective design, development and evaluation of instruction appropriately utilizing various technologies. For these reasons, the identification of core competencies of an instructional technology program was chosen as a research focus.

While there has been some research on instructional technology programs and relevant competencies, the focus of this study is on the competencies that such programs must address in order to prepare graduates for 21st century roles. It is anticipated that the results of this study will provide operational insights that may be applied in the further development of the instructional technology program of the University of Alberta and, depending on the generalizability of the results, in the development of such programs by other institutions.

As this curriculum planning question attempts to anticipate the future, utilization of a Delphi survey to solicit the perceptions and opinions of a panel of instructional technology experts was considered as a methodology. However, the decision was made not to utilize this methodology following the preliminary analysis of existing IT competency and program data. That review suggested that quantitative analysis of such survey results would not provide a basis from which to answer adequately the study question. To draw any meaningful conclusions, this study had to look beyond the large number of usual contextual factors that affect curriculum considerations. It was necessary to look to the data for an understanding of how the core IT curriculum develops in response to differing definitions of the field. Thus, the methodology selected was a qualitative analysis which has the important benefit of providing the basis for a descriptive-comparative analysis.

This approach was chosen as it is through reflection and understanding of the information uncovered during the course of an interpretive research process that suggestions for curriculum improvement can be made. Such possibilities are revealed through a descriptive data process that:

- demands that the world be approached with the assumption that nothing is trivial, that everything has the potential of being a clue which might unlock a more comprehensive understanding of what is being studied (Bogdan and Biklen, 1992, p. 30-31);
- is concerned with the process and how do people negotiate meaning? How do certain terms and labels come to be applied? and How do certain notions come to be taken as part of what we know as 'common sense'? (p. 31); [and]
- analyzes data inductively and theory emerges from the bottom up rather than top down. (p. 31)

Selection of IT Programs

The objective of this research process was to contribute to the development of a curriculum for a quality, future-oriented instructional technology program. It was therefore, critical that the analysis be based on programs, or program elements, that are recognized as leaders in quality or innovation.

Criteria for selection were, in part, based on EMTY quantitative data. Firstly, those institutions with the highest number of students enrolled or the most doctoral graduates in recent years were identified. Secondly, those institutions that have an instructional technology program with a strong reputation for quality or innovation in either research, program or graduates were identified through the literature, WWW presence, or departmental faculty. Analysis was then restricted to those programs that met the following criteria:

1. have a doctoral program from which candidates have graduated in the last three years;
2. have at least 3 full time equivalent faculty members; and
3. have NCATE or other appropriate accreditation; or offer workplace or research internships.

Other institutions were included only insofar as they offered an innovative implementation alternative that might be appropriate in a particular local context.

Data Collection Methods

The major data collection took place between June and December, 1996. Data were collected in several ways and from a variety of sources.

Firstly, data from *EMTY* and Peterson's *Graduate programs in the humanities, arts & social sciences* were compiled to develop a quantitative profile of North American IT doctoral programs and, more specifically, to identify those programs with the largest number of students and doctoral graduates in recent years.

Secondly, descriptive data for selected programs were gathered primarily from the Internet home pages of the programs. Data collected included entry and exit competency requirements, program objectives, course descriptions and any other program requirements or strategic initiatives that appear to offer future competitive advantage. As part of this phase an instructional technology web site was developed which included links to various programs as well as related background information. The process served as a 'virtual field study' allowing immersion in the field. Information was also collected on employment projections and job requirements for instructional technology graduates. The program data are included in Appendix E.

Data Analysis Procedures

Analysis of the data began with a review of the quantitative data for 19 programs to identify those programs that appeared to have the widest current influence in terms of graduates and to identify general trends or patterns that apply across programs. The analysis of the descriptive data for the selected programs was then carried out in order to generate a profile of a typical program, to identify characteristics common to leading programs and to identify innovative initiatives. A final analysis, generalizing the themes/factors identified, resulted in a curriculum recommendation. The researcher attempted to identify a conceptual framework for reporting data that would focus on the action implications of the results.

Ethical Considerations and Timeline

The study involved no human participants and therefore, was not subject to any conditions under the University of Alberta *Ethics Review Policies and Procedures.*

Information collection and summarization commenced in June and continued through December, 1996. While some analysis was carried out during this time, the formal analysis began in January, 1997. Given the dynamic nature of the program data, it was necessary to update of all program data in March, 1997. The summary and final analysis were carried out in April, with the final report presented in August, 1997.

Summary

The methodology followed in this study identified the competencies in terms of skills, knowledge and attitudes that graduates of an instructional technology program should have in order to be competitive in the global market of the 21st century; and, described various program requirements that might contribute to the provision of these. Data on various additional variables related to institutional marketing of such a program were also collected to see if they might usefully be analyzed in relation to student preference. The summary of the data and results of the analysis are presented in the following chapters.

Chapter Four Competency and Program Data

In 1989 Adams noted that "tomorrow we will be able to simultaneously access text, images, and sound over the same line. By the twenty-first century electronic knowledge highways will converge at the individual and at the world" (p. 194). In fact, that convergence of global text, sound and image at the individual level has already arrived via the Internet. From an education perspective, even more significant than the technological changes *per se* is the rate of change in the technologies and the speed with which new digital technologies are being adopted globally by individuals as well as by organizations. For all these reasons, the definition of IT practitioner competencies appears to be — to an even greater degree than in the past — a moving target.

In this study existing data on IT role competencies and IT programs will be utilized to develop a masters level program profile. This chapter presents those competency and program data; the next chapter presents conclusions and recommendations based on these data.

Role Competencies

Instructional technology programs typically focus on knowledge and skills for such career roles as: instructor/trainer, instructional designer, educational media developer, educational computing specialist or distance educator. Over the past decade extensive national surveys have been carried out to identify practitioner competencies related to a number of these roles. In the U.S. and the U.K. the identified practitioner competencies have also been prioritized to identify core competencies for training purposes, and performance criteria, for certification purposes. In the U.K. the certification process is now in the implementation phase. This study utilizes the competency data derived from these studies, in conjunction with data from more recent future-oriented studies related to the targeted roles. The data in this chapter begin with workplace competencies, a component essential but not unique, to IT roles or curricula.

Workplace Competencies

The ten basic skills for the America 2000 workplace have been identified as: reading, writing, computing, speaking, listening, problem solving, managing oneself, knowing how to learn, working as part of a team and leading others (Carnevale, Gainer & Meltzer, 1988). These skills will also be demanded of instructional technology graduates as they are necessary in order to acquire the information to keep current and to apply field specific skills and knowledge in the workplace.

In studies specific to the IT field, Trimby (1982) found in a survey of ASTD trainers to identify essential entry level competencies, "the highest ranked competencies dealt with interpersonal communication type skills" (p. 5). Palmer (1987), in a survey of Illinois training professionals, found that the five competencies, from a list of 34, ranked as extremely useful by more than 50% of respondents were "oral communication skills, written communication skills, group facilitation skills, platform presentation skills, and needs assessment techniques" (p. 6). Heideman (1991) elaborates that effective use of oral presentations in interpersonal communications is "demonstrated by effective performers who were forceful, accurate and well prepared when they adopted roles as communicators. By demonstrating mastery of presentation skills, these individuals demonstrated an astute awareness of the impact of their presentations on subordinates and on the organization" (p. 114).

Gagné (1987) noted that underlying the application of technical training or instructional design skills are facilitating competencies that are likely generic characteristics of effective performance and constitute a minimum for IT practitioners, irrespective of the specific application qualifications required. Communication is one of these. Another is a value best dealt with in the selection process: "one needs to choose people who believe in empirical evidence as a source of truth and a preferred basis for action" (p. 27).

Heideman (1991) refers to this quality as perceptual objectivity and determined that it is necessary for effective performance both now and in the future. It is:

> characterized by the ability of an individual to view an event from more than one perspective, not limited by subjective judgments. (Boyatzis, 1982). The ability to remove oneself from any emotional involvement concerning issues, enables effective performers to make decisions based on sound consideration of all situational realities. Possession of this competency is manifested in an individual's weighing of differences between alternatives, and selecting a course of action after this analysis. (p. 125)

The importance of these generic workplace skills to the effective performance by IT graduates was again confirmed in the 1990 needs assessment study carried out by Indiana University and Arthur Andersen, Inc. (Pershing, 1994). The results confirm that coaching in communication skills is an essential component of an IT curriculum.

British Training and Development Competencies

In 1996 competency data on training and development roles were published by the U.K. Employment Occupational Standards Council (EOSC). These are the most current national data available for major IT roles. The British data are the core of the EOSC produced "standards and qualifications which are accepted nationally by all parties having an interest in training and development" (p. 5). These interested parties included businesses, employer organizations, professional bodies, trade associations, unions, education and training providers. The standards identify five main areas and fourteen subsections of functional competency as listed in Table 2. It is also worthy to note that this is the only data set that has been developed into a fully integrated modular curriculum and accepted as the basis for certification.

Table 2 *Training and Development Competencies - Britain*

Competency Area	Specific Competencies
A. Identify training and development needs	1. Identify organisational training and development requirements 2. Identify learning requirements of individuals
B. Plan and design training and development	1. Design training and development strategies for organizations 2. Design training and development programmes 3. Design and produce learning materials
C. Deliver training and development	1. Manage the implementation of training and development 2. Facilitate learning with individuals and groups
D. Review progress and assess achievement	1. Monitor and review progress 2. Assess individual achievement 3. Assess individual achievement of competence
E. Continuously improve the effectiveness of training and development	1. Evaluate the effectiveness of training and development within an organization 2. Evaluate the effectiveness of training and development programmes 3. Improve own training and development practice 4. Contribute to advances in training and development

(UK EOSC, 1996, p. 8)

The British standards were developed in the context of the EOSC definition that the purpose of training and development is to "develop human potential to assist organizations and individuals to achieve their objectives" (UK EOSC, 1996, p. 7).

The standards profiled the training and development competencies for three roles that relate to IT programs. The first role, labeled as Training and Development Level 3, identifies the competencies associated with the professional role for those "who deliver training and development programmes and those who carry the responsibility for their design and evaluation" (p. 15). Within the job market these roles might be labeled as teacher, instructor or trainer. The core competencies identified for this entry level role are:

- Evaluate and develop own practice;
- Identify individual learning needs;
- Design training and development sessions;
- Prepare and develop resources to support learning;
- Create a climate conducive to learning;
- Facilitate learning in groups through presentations and activities; [and]
- Evaluate training and development sessions.

The second role, termed Training and Development Level 4 - Learning Development, addresses a professional role for those whose responsibilities "are involved in the delivery of learning programmes to individuals and groups; . . . more concerned with the facilitation of a broader range of learning opportunities with individuals and groups" (p. 16). The core competencies identified for this more advanced role are:

- Evaluate and develop own practice;
- Identify individuals' learning aims, needs and styles;
- Design learning programmes to meet learner's requirements;
- Agree learning programmes with learners;
- Create a climate conducive to learning;
- Monitor and review progress with learners; [and]
- Evaluate training and development programmes.

The third role, also Training and Development Level 4, focuses on development of human resources rather than on learning. It encompasses those

> who have management responsibility for training and development and are involved in identifying organisational training and development needs and planning the implementation of training and development objectives. They will also be responsible for the improvement of a range of training and development programmes . . . more concerned with co-ordination of learning opportunities in line with organisational

> requirements than the direct delivery of training to individuals and groups. (p. 15)

The core competencies identified for the human resources role are:

- Evaluate and develop own practice;
- Identify organisational training and development needs;
- Devise a plan for implementing an organisation's training and development objectives;
- Co-ordinate the provision of learning opportunities with other contributors to the learning programme;
- Evaluate training and development programmes;
- Improve training and development programmes; [and]
- Manage relationships with colleagues and customers.

In addition to the core competencies identified for each role, optional competencies are also specified. These competency data have been fully integrated into student curriculum plans and practitioner performance standards. For these purposes, 38 content units are outlined in detail including performance criteria, range statements and assessment criteria, as, for example, Unit A21 (see Appendix A) which addresses the competency: "Identify individuals' learning aims, needs and styles" (UK EOSC, 1996, pp. 38-42).

The British data are very current and have been refined and integrated to meet employer needs and expectations, although primarily in the business sector. The competencies focus on performance — what is done. The performance criteria look at how it is done with an emphasis on identification and implementation of optimal choices from a variety of options. Although there is little mention of instructional media or technologies, the performance criteria require that practitioners operate in an up-to-date and cost-effective manner. To determine if the British data might be applicable in the Canadian context, they can be compared to that of an older but comparable Canadian study.

Canadian Training and Design Competencies

In 1986 the Ontario Ministry of Education published the report of a project carried out by Davie, Suessmuth and Thomas of OISE for a "review of the literature and field validation of the competencies of industrial and organizational trainers and educators" (p. 1). One of the objectives of their study was

> to prepare and submit a final report which will include inventories of competencies which are to be identified, and displayed in a manner

which could be used for the development of guidelines for training material for various occupations within the cluster. (p. 2)

This undertaking proved to be more involved than project funding would allow, although the report, as stated by the principal investigators, "provided a good beginning" (p. iv). It is worth noting that, for comparison purposes, there are terminology differences, some culturally based, and others reflecting changes in practice that have arisen in the intervening decade.

In the Canadian study a list of 54 competencies was compiled from the literature, and validated with three groups: the Ontario Society for Training and Development (OSTD), an associations group (AG), and adult educators from the Ontario Association for Continuing Education (OACE). This validation resulted in a list of 71 competency statements from which participants were asked to identify the 10 core competencies required for various training roles. The roles assigned by the groups were Instructor (I), Designer (D), Manager (M) and Consultant (C). The associations group also included an Administrator role (A).

The only competency validated by the three survey groups as being core for all roles was the need to keep informed through professional development. Respondents in turn proposed the competency — assessing self development needs, values, and beliefs — for future validation. In contrast, these two aspects are already operationalized in the comparable British competency — evaluate and develop own practice. The three groups saw effective written communication, another basic competency, as core for both instructors and designers. Interestingly, adult educators did not see effective oral communication as a core to instruction.

The role of Instructor was the only one that generated any significant number of commonly recognized and unique competencies, with those seen as core by at least two groups noted in Table 3.

Table 3 *Instructor Competencies - Canada*

	Response Group		
Competency	**OSTD**	**AG**	**OACE**
Motivating trainees (Creating a learning atmosphere)	√	√	√
Conducting classroom training	√	√	√
Selecting and using audio-visual equipment	√	√	
Assisting transfer of learning to practical situations	√	√	
Preparing instructional materials (printed/of all types)		√	√
Assessing learning attainment	√	√	√
Assessing performance of trainees	√	√	

There was less agreement on the skills/competencies needed by instructional designers. Table 4 shows those generating the highest agreement. Based on survey responses, the report proposed four instructional design competencies for future validation: implementing adult learning process skills, preparing curricula/course designs, developing instructional strategies and designing computer-assisted instruction.

Table 4 *Designer Competencies - Canada*

	Response Group		
Competency / Skill	**OSTD**	**ERG**	**ACE**
Developing and conducting training needs surveys			√
Carrying out job or skills analysis		√	
Analysing learner characteristics and skills		√	√
Preparing clear statements of goals	√		√
Specifying training goals		√	√
Selecting and developing audio-visual materials and devices	√	√	
Consulting with subject matter experts	√	√	√
Constructing questionnaires and surveys	√	√	
Designing testing instruments	√	√	

The management competencies that were identified as core focused on developing budgets and funding proposals, and included justifying cost effectiveness.

Comparing these Canadian data with those derived from more extensive U.S. studies enables cross validation of the Canadian data from a North American perspective.

American Instructor and Instructional Design Competencies

McLagan and Bedrick (1983) summarized the results of the massive American Society for Training and Development study by describing roles and products of human resources specialists. Building on this study, the following instructor competencies were confirmed as core by the International Board of Standards for Training, Performance and Instruction (IBSTPI, 1988):

1. Analyze course materials and learner information
2. Assure preparation of the instructional site
3. Establish and maintain instructor credibility
4. Manage the learning environment
5. Demonstrate effective communication skills
6. Demonstrate effective presentation skills
7. Demonstrate effective questioning skills and techniques

8. Respond appropriately to learners' needs for clarification or feedback
9. Provide positive reinforcement and motivational incentives
10. Use instructional methods effectively
11. Use media effectively
12. Evaluate learner performance
13. Evaluate the instruction
14. Report evaluation information.

There is a high degree of commonality among the core instructor competencies identified in the U.S. (McLagan & Bedrick, 1983), Canada (Davie, Suessmuth & Thomas, 1986) and Britain (U.K. EOSC, 1996). While not the focus of an IT program, these competencies are integral to IT theory and practice. Instructional designers too must understand and apply the theories of effective communication, presentation, questioning, feedback skill and instructional strategies. In addition, since IT graduates, even those in business settings, are often expected to deliver instructional sessions, these instructional competencies must be demonstrated and enhanced — in depth and breadth — by the learning activities of an IT program.

The IBSTIPI 1986 competency standards for Instructional Designers identified 16 core instructional design competencies (p. 3). These have been grouped in Table 5, as closely as possible, under the IT field domains (Seels & Richey, 1994b).

Table 5 *Instructional Design Competencies - U.S.*

Domain	**Competency**
Evaluation	• Determine projects that are appropriate for using instructional design methodologies • Conduct needs assessments
Design	• Assess the relevant characteristics of learner/trainees • Perform task/content/job analyses • Analyze the characteristics (resources, constraints, values, etc.) of the organization's environment • Write statements of performance objectives • Sequence the performance objectives • Specify the instructional strategies • Design the instructional materials • Design the instructional management system
Management	• Plan and monitor instructional design projects
Evaluation	• Develop the performance measurements • Evaluate the instructional/training
Generic	• Communicate effectively in visual, oral, and written forms • Interact effectively with other people • Promote the use of instructional design.

As Seels & Richey (1994b) noted, "the domain of design represents the largest theoretical contribution of instructional technology to the larger field of education. The domain of development is also mature and represents the largest contribution to practice" (p.11). On this basis, the theory and knowledge related to the instructional design competencies, listed in Table 5, that focus on design practice, or 'what' instructional designers do, would be core to an IT curriculum.

Several recent studies have reviewed IT competencies in the context of program content. Morlan and Lu (1993), of San Jose University, carried out a survey in Northern California to identify the competencies needed by instructional trainers and designers. One of the study objectives was to identify strengths and weaknesses of current university programs. The authors concluded that "most university programs include many of the 'basics' needed by instructional designers, but have 'gaps' which could be filled by including courses in areas dealing with human relationships and overseeing projects or programs" (p. 9). The competencies identified as important, in decreasing order, by over 85% of respondents were:

- knowledge, understanding and applications of instructional design models and principles;
- learning needs assessment and evaluation; understanding, skills and applications;
- project management from inception to completion;
- design, production and utilization of self-paced learning materials;
- instructor-led-training, including skills necessary for giving effective presentations;
- design, production and utilization of independent learning modules;
- learning theories, including adult learning and cognition; and
- use of computers in word processing, data bases, and spread sheets. (p. 4)

These data are consistent with those already presented. It would, however, have been of interest to see the impact on respondent ranking if design, production and utilization had not been addressed as a single competency in the survey questions as the curricula of the programs reviewed in the current study appear to reflect a substantive difference in the competencies required to design and develop learning materials and modules, as opposed to utilizing them.

When the University of South Alabama extended its Instructional Design and Development (ID & D) program to the doctoral level, Dempsey and Rasmussen (1993) developed a survey of 62 ID & D competencies to assess entry competencies of students and program effectiveness. Students entering the program were asked to identify the ten most important skills they wished to develop. Faculty also identified the top ten competencies for doctoral students to develop. While most faculty agreed that learning theory and effective communication in writing were important, there was no clear consensus in other areas. Students, however, identified the following competencies as the seven most important:

- plan instructional development projects;
- conduct needs assessments;
- design and plan for large scale instructional systems;
- develop evaluation instruments;
- systematically design and develop CBI;
- conduct formative evaluation and use the data for program revision; and
- discuss and apply research and learning theory. (p. 4)

It is of interest to note that the Alabama students identified a number of the same competencies as the California practitioners such congruence suggesting that these competencies could be important from a program marketing perspective. Also from a marketing perspective, Seels and Glasgow (1991) surveyed 260 practitioners in the Pennsylvania area to identify competency requirements for instructional design positions. The survey included nine key ID competencies. To determine the criticality of each competency, respondents were asked to indicate, only for those in which they were presently involved or which they performed (a) the difficulty of the task, (b) if they had to perform the task immediately on starting their present position, (c) if there were people in the organization they could call on for help to do the task, and (d) what happened if they performed the task improperly. Among the findings those of particular interest in the development of an IT program are that, among the 63 respondents,

- one third of those employed in ID tasks have no one to help them with these tasks; and
- the task of developing media is the least critical task and is the task done the least. (p. 5)

Seels and Glasgow (1991) also note that, while the questionaire did not measure performance quality of the design, there is a perception that more instructional design is being done in schools than is generally assumed and that much of such design is performed by people not prepared in the field. These findings, along with those of Kennedy (1994), suggest that a similar situation exists both in Canada and the U.S.

Looking at technologies, Furst-Bowe (1996) surveyed members of the National Society for Performance and Instruction to identify the competencies trainers need to utilize instructional technologies. Technologies currently used by at least 50% of participants include: multimedia systems, computer-based training, tutorials and simulations; presentation software and projection systems; electronic performance support systems and local area networks. More importantly, respondents indicated that in the future they plan to use more complex technologies, such as hypertext systems, expert systems, intelligent tutoring and virtual reality. They expect that distance education will utilize more advanced and interactive systems. Equally important, for the purposes of this study, are findings that the primary sources of competency development in instructional technology for trainers were vendor-sponsored training and self-study methods. "Universities and technical colleges appear to play a minimal role in providing trainers with knowledge and skills in computer-based training, multimedia systems, EPSS, distance learning systems or computer presentation systems" (Furst-Bowe, 1996, p. 236).

Projected Instructional Technology Competencies

Heideman (1991), using Boyatzis' model for effective performance of managers, compiled 28 IT job responsibilities that he considered a behavioral anchor for managerial competency, along with four he considered to be transitional. Respondents, all from Southern California, were first asked to rate each of the 32 job responsibilities as to the likelihood that they are presently required for effective performance by instructional technology practitioners; and secondly, to rate the likelihood of their requirement in the year 2000. Findings "suggest that the use of man/machine interfaces is emerging as a possible requirement for effective performance in the future, even though at present it is not considered so" (p. 134).

Heideman's assumption that development of knowledge-based publishing was a transitional responsibility was not supported by the perceptions of respondents. Although present ratings were low, future ratings suggest an increased requirement.

> This job responsibility involved the design of alternatives to print materials, primarily through the use of computer and video disk technology. Included in this job responsibility were development and management activities of animation, live motion, computer graphics and accompanying voice or music. (p. 148)

In contrast both groups of respondents indicated that programming computer software is a "job responsibility was neither presently required for effective performance, nor very likely to be in the future" (p. 147).

The job responsibilities ranked as most likely to be required for effective performance in the year 2000 have been grouped in Table 6 under six domain headings: Assess; Design, Deliver, Develop, Manage and Evaluate. Two groups of respondents, Education/Academia and Business/Industry, ranked the job responsibilities. The results of their competency rankings are grouped separately. Those responsibilities followed by an H in the 'Both' column have a combined education/business ranking that suggests a high likelihood of importance to future performance. Team teaching was the only non-transitional job responsibility assessed as not likely to be required in the future.

Table 6 *Projected Instructional Technologist Competencies in 2000 - US*

Job Responsibility	**Education / Academic**	**Business / Industry**	**High In Both**
Assess:			
Assess Learner Characteristics		5	
Perform Needs Assessment and Interpret Data		12.5	
Design:			
Bilingual/bicultural skills	5	12.5	H
Analysis of learning environment		12.5	H
Specify instructional strategies	3	7.5	
Design instructional materials and resources	8	7.5	
Consultation skills		7.5	
Deliver:			
Interpersonal communication skills - oral presentations	1	1.5	H
Use graphic and audio visual skills	3.5	1.5	
Develop / Produce:			
Develop knowledge-based publishing	10.5		H
Develop and use satellite and distance training	3.5	10	H
Develop and use man/machine interfaces (interactive)	7	12.5	H
Develop and use expert systems (gather, store, db)	3.5		H
Manage:			
Manage human resources		3	H
Interviewing skills in organization development		4	H
Community relations expertise	9		
Plan efficient and cost effective facilities	10.5		
Evaluate & Improve:			
Project trends and visualize possible futures	3.5		
Evaluate training [program]		7.5	

It should be noted that Heideman uses the term bilingual/bicultural skills to refer to perceptual objectivity, namely the ability to view an event from more than one perspective and not limited by subjective judgments.

He identifies four areas of specialized knowledge that are important to instructional technology practitioners, both now and in the future. They are the skills to develop and use expert systems, develop and use interactive man/machine interfaces, develop and use satellite and distance training, and develop and use expert data systems. Equally important for IT curriculum development, is Heideman's (1991) observation that

> specialized knowledge was found to relate to concepts and facts that a practitioner used in his job role. For the instructional technology practitioner, specialized knowledge appears to be related to high technology innovations. (p. 131)

In this section IT competency data from a number of surveys, covering Canada, Britain and the U.S., were reviewed to identify current and expected role competencies. The next section considers IT program data to see how these various role competencies may have been translated into course competencies and program requirements. It should be noted that, while international program data collection and comparisons were beyond the scope of the current study, one of its objectives was to develop recommendations based on a global perspective. This objective can be met utilizing U.S. program data as the marketplace has already established that the leading US programs, e.g. Indiana and Florida State, are also the global benchmarks.

Program Data

Available IT program data for selected programs were reviewed to identify (a) core and specialization competencies as stated or as reflected in their course descriptions, (b) program entry and exit requirements, and (c) program structure and delivery options. The first objective was to identify how the previously identified role competencies might be bundled within graduate courses and to identify specializations that could be built on these core competencies. The second objective was to identify benchmark characteristics of quality or innovative programs. The current study benefited from the recent restructuring of a number of leading IT programs which have been changed to reflect, at least in part, the judgment of program faculty as to the future direction of the field. How those programs now structure courses, competencies, and entry and graduation requirements may offer insights that can be applied in other programs.

Program Focus and Specializations

The programs reviewed in this study, and their designations, are listed in Table 7. Among the programs that have a focus that falls within the parameters of the 1994

AECT definition of instructional technology, a definition that is very inclusive, the programs reviewed were further limited according to the criteria noted in Chapter 3.

Table 7 *Instructional Technology Program Designations*

Institution	Program
U of Arizona (Tucson)	Learning and Instructional Technology
Northwestern U	Learning and Instructional Technology
Florida S U	Instructional Systems
U of Indiana, Bloomington	Instructional Systems Technology
Pennsylvania S U	Instructional Systems
Syracuse U	Instructional Design, Development and Evaluation
U of Iowa	Instructional Design and Technology
California S U, Monterey Bay	Instructional Technology
San Jose S U	Instructional Technology
U Southern California	Instructional Technology
Wayne S U	Instructional Technology
U of Texas	Instructional Technology
Utah S U	Instructional Technology
U of Northern Colorado	Educational Technology
San Diego S U	Educational Technology
Nova Southeastern U	Education and Technology
Arizona S U (Tempe)	Educational Media and Computers
Purdue U	Educational Computing and Instructional Development
U of North Texas	Computer Education and Cognitive Systems

A majority of the programs reviewed use the broad program label of either Instructional Technology or Educational Technology. These programs are fundamentally very similar and tend to serve primarily K-12 teachers and administrators. The other general designation of Instructional Systems/Design, based on the program descriptions, appears to be used to convey a focus on the design, development and evaluation domains as outlined in the 1994 AECT definition of IT. However, no significant program generalizations could be identified on the basis of program designation.

Program Situation

All of the programs reviewed are situated either within an education faculty or a school with one exception; the Northwestern University Ph. D. program is affiliated with a university-wide research center. Such placement is consistent with the educational media origins of the programs and with accepted competency profiles for trainers and designers. Table 8 lists the institutional situation within the faculty of the IT programs reviewed in this study. A number of the programs award M.A. or M.Sc. degrees, in addition to M.Ed. degrees, in which case the education degree generally has a stronger applied focus; the M.A. and M.Sc., a stronger research focus intended to provide the foundation for doctoral studies.

Table 8 *Instructional Technology Program Situation*

Institution	Division / Dept.
U of Indiana, Bloomington	Instructional Systems Technology
Pennsylvania S U	Instructional Systems
Syracuse U	Instructional Design, Development and Evaluation
Florida S U	Educational Research
Northwestern U	Institute for the Learning Sciences
U of Arizona (Tucson)	Psychology in Education
Arizona S U (Tempe)	Division of Psychology
U of Iowa	Educational Psychology
U of Northern Colorado	Division of Educational Psychology, Statistics, and Technology
San Diego S U	Educational Technology
Utah S U	Instructional Technology
California S U, Monterey Bay	Media Learning Complex
U of North Texas	Technology and Cognition
Nova Southeastern U	Programs in Education and Technology and Computer Technology in Education
Purdue U	Curriculum & Instruction
U Southern California	Curriculum and Teaching
U of Texas	Curriculum & Instruction
San Jose S U	Educational Leadership and Development
Wayne S U	Administrative and Organizational Studies

The departmental situation of those programs reviewed in this study includes instructional systems technology, technology and cognition, curriculum and teaching, educational psychology, administration or leadership and adult education. And program situation does appear to have related program characteristics reflecting the fact that instruction and instructional technologies would impact all these departments but with a different focus — learning or teaching, curriculum resources or program design, K-12 classroom or adult training, media or change.

This is illustrated in the 1996 summer institute of Nova Southeastern University where one of the themes was changing educational systems. Faires (1996) noted that "technology will play a major role in educational planning, regardless of the country or the reform effort" (p. 4 of 6) and questions addressed at the institute included:

- Are schools models of education for the future or are they anachronistic relics in an information age?
- International information infrastructure, digitized collections in libraries and museums, expanding knowledge bases, and interactive multimedia systems are sophisticated technological advances present in the world today. Are school leaders being prepared to integrate these systems into their educational packages?
- Distance education, satellite and cable schoolrooms at home, and new formats for continuing education are not future ideas, but present day quality practices. Will present day leaders have the skills to manage these enterprises?
- Will school leaders have the capacity to learn the new, and to some, yet-unknown skills necessary to lead and manage the schools of today that exist in a world already experiencing tomorrow? (Faires, 1996, p. 4-5 of 6).

The issues behind these questions, in this case framed from an organizational change perspective, are being addressed by all those involved in learning, training, instruction and IT. The IT programs situated in psychology or instructional systems divisions are characterized by a learning and/or program design focus. Whereas those IT programs situated in curriculum or technology divisions are characterized by a teaching resources focus in which, as with the leadership divisions, primary emphasis is placed on the K-12 learning organization. It is here that the dichotomy between teaching resources and learning tools noted in Chapter 2, can be seen in the IT programs. It is here also that an operational problem with the AECT (1996) accreditation guidelines for educational communications and information technologies (ECIT) programs manifests itself.

The guidelines specify that the program should be "initiated, developed, and implemented by faculty members whose own preparation is in this field of specialization" (Caffarella et al., 1996, p. 16), with the involvement of related specialists in education. As indicated above an operational problem with this accreditation guideline is the identification of 'this field'. The academic training of senior IT faculty in established programs is often not IT, as would be expected given the relatively short history of the field. For example, educational psychology is the predominant background at Florida State. Whether the faculty are IT graduates does not appear to be a benchmark of quality programs. Furthermore, it cannot be assumed that even those faculty whose field of preparation is IT, share a common orientation since their own training program could have had, for example, either an instructional psychology or curriculum orientation.

Indeed, a strong case can be made in support of the need for IT faculty with diverse background specializations. Such diversity would better address the wide range of employment opportunities open to graduates, as noted in IT program descriptions. A number of programs identify their own target markets as program specializations. Specializations offered at the masters level, in those programs reviewed, are indicated in Table 9.

Table 9 *Instructional Technology Program Specializations*

Institution	Focus / Specializations
San Diego S U	1. Instructional Technology 2. Training Systems Design and Administration 3. Instructional Software Design 4. Workforce Education and Lifelong Learning (new '96)
San Jose S U	1. Instructional Design and Development 2. Media Design and Development 3. Computers and Interactive Technologies 4. Media Services Management 5. Telecommunications and Distance Learning 6. Teaching and Technology
U Southern California	- to train specialists who will guide schools in technology planning, implementation, and utilization (new fall '96)
U of Northern Colorado	1. Educational Technology 2. Educational Media
Florida S U	- Interactive Distance Learning (new fall '96)
U of Indiana, Bloomington (students take 2 of the 3)	1. instructional analysis, design, and development 2. instructional development and production 3. implementation and management
U of Iowa	1. Cognition and Instruction 2. Training and Human Resources Development 3. Computer Applications 4. Classroom Instruction (MA only) 5. Media Design and Production (MA only)
Syracuse U	1. Management and Human Resources Development 2. Education and Research 3. Distance Learning and Interactive Technologies 4. Design and Development 5. Continuing Education (new summer '97)
Pennsylvania S U	1. Educational Systems Design 2. Corporate Training 3. Emerging Technologies
U of Texas	1. instructional systems design 2. learning and instructional theories 3. instructional materials development

Whether a specific program is offered will reflect current faculty strengths and market demand. The specialist designation is used to refer to a stream in the masters program, as, for example, at Indiana and Pennsylvania; to a specialization based on post-masters courses at Florida; or to specialist certificates marketed on the basis of 9-15 hours of course work following a bachelor's degree at San Jose. The inherent danger in the latter marketing strategy is that it can contribute to a trivialization of the specialist designation and a characterization of practitioners as "equipment jockeys" (Beckwith, 1988, p. 9). These negative factors may in turn influence the very marketability of the program in terms of attracting students, faculty and collaborative opportunities.

Specializations that reflect faculty research and development strengths result in the kind of projects and collaborations exemplified by SchoolYear 2000 at Florida State (http://www.cet.fsu.edu/sy2000/). These collaborations are frequently a source of the research and internship opportunities for graduate students and that appear to be one of the benchmarks of a quality program. Closely allied with these, another benchmark of quality programs appears to be a strong program core which requires that students take a higher proportion of mandatory courses at the master's level.

Core Courses

The core courses offered by an IT program can be assumed to address the knowledge and skills that, in the view of the faculty, are required of all instructional technology practitioners. In reviewing the data on core courses, the dichotomy in the field can again be seen. If any generalization can be drawn, it might be that quality programs build on a strong design core. Further, programs directed primarily at teachers emphasize the presentation aspects of communication competencies and the resource aspects of media skills.

All of the competency data reviewed for this study confirmed that a demonstrated communication skill set is a requisite for effective performance. IT practitioners are expected to communicate effectively using graphic, visual, oral and written forms, whether making presentations or leading instruction. In the workplace, they are expected to interact effectively with others, demonstrate the ability to establish and maintain credibility, manage relationships with colleagues and customers, and listen and consult effectively. These competencies are generally addressed, as in the Indiana program, through learning tasks and evaluation criteria, not as a course; and, through demonstration by program faculty. Students and faculty in the program similarly demonstrate the instructor competencies involved in facilitating learning with individuals and groups by means of presentations and activities wherein they are expected to create a climate conducive to learning and prepare the instructional site, including the set-up of instructional technologies.

In terms of specific core courses, there is usually one, as noted in Table 10, that provides an introduction to the field. Such a course would normally include terminology, history, current issues in the field as well as placing the field in the wider contexts of education and human resources.

Table 10 *Introduction to the Field Core Courses*

Institution	Course Name
FSU	Introduction to Instructional Systems (3)
FSU	Trends and Issues in Instructional Design (3)
FSU	Seminar in Instructional Design (1)
Indiana	Instructional Technology Foundations (2)
Indiana	Instructional Design and Development I (1)
Utah	Foundations of Instructional Technology
Syracuse	Introduction to Educational Technology
Colorado	Introduction to Performance Technology (3)
Penn State	Performance Technology (CT) or Psychology of Learning Course (one of, 3 credits) (ESD & ET)

The other core courses have been grouped, as closely as possible based on limited descriptive information, under the design, development, management and evaluation domains outlined in the 1994 AECT definition of IT. Required courses in the design domain are listed in Table 11. They fall into two categories: models and principles of (a) learning, instruction and design theory and (b) process.

Table 11 *Design Domain Core Courses*

Institution	Theory Course Name
FSU	Theories of Learning and Cognition in Instruction (3)
Iowa	Psychological Bases of Instructional Design (3 s.h.)
Colorado	Theories and Principles of Learning (3)
Syracuse	Principles of Instruction and Learning
Penn State	Psychology of Learning Course (one of, 3 credits) (ESD & ET) or Performance Technology (CT)
Utah	Instructional Technology Communications Theory

Institution	Applied/Process Course Name
FSU	Introduction to Systematic Instructional Design (3)
Iowa	Introduction to Instructional Design (3 s.h.)
Syracuse	Instructional Design: Theory and Practice
Indiana	Instructional Design and Development II (3)
Iowa	Advanced Instructional Design (3 s.h.)
Colorado	Instructional Materials Design - 3
Penn State	Instructional Design Models, Strategies, and Tactics (CT) or Designing Constructivist Learning Environments (ESD)
Utah	Analysis and Design for Classroom Instruction

The theory courses focus on learning while encompassing instruction and media based communication. Through these courses students develop a wider understanding on which to base analysis of the design input data and to select the most appropriate interaction strategies. Effective design requires an understanding of questioning, feedback and motivation techniques — all of which are identified core instructor competencies, as well as a repertoire of instructional methods.

The process course introduces the ISD instructional design models and principles. The targeted competency area is the planning and design of training and instruction for sessions, programs to meet learners' requirements, and system or organizational programs. Within the major design competency a number of subcompetencies have been identified as core for practitioners:

- specify appropriate performance objectives;
- sequence the performance objectives;
- specify the instructional strategies and formats;
- specify appropriate learning tasks, activities; and
- evaluate and utilize available learning resources/materials.

In addition to the design of curricula, the courses address the design of instructional resources and materials. The identified core competencies expected of students are to design and prepare resources or materials to support instructor-led training and to design self paced learning materials and independent learning modules. At a more advanced level the expected competencies are to design and plan for large scale instructional systems and systematically to design and develop CBI.

The IT program core usually includes at least one development course as indicated in Table 12. It is generally in this course that students are introduced to project management and participate in ISD teams.

Table 12 *Development Domain Core Courses*

Domain: Development	**Course Name**
Indiana	Instructional Development and Production Process (3)
Penn State	Systematic Instructional Development
Colorado	Instructional Development - 3
Syracuse	Principles of Instructional Development
Syracuse	Instructional Product Development
FSU	Development of Computer Courseware (3)
Utah	Instructional Development in Education
Utah	Principles and Practices of Distance Ed.

The broad competency addressed is development of training and instruction to meet the design specifications. It includes the preparation and development of resources to support learning and training, including self-paced learning materials and independent learning modules. Students are expected to utilize current technologies in the development process. But, at the master's level, development of courseware and multimedia may be optional. Development courses that focus on various specialized knowledge areas of the field, such as computer assisted instruction (CAI) and interactive multimedia, are more often taken at the post master's level. Examples of some of these specialized competencies identified by Heideman (1991), and expected to be of increasing importance in the future, are to:

- develop knowledge-based publishing;
- develop and use satellite and distance training;
- develop and use man/machine interfaces (interactive); and
- develop and use expert systems (gather, store, data mining).

Geographic Information Systems (GIS), another specialized knowledge area of potential importance, is addressed in the new IT program at CSU Monterey Bay.

It is worth noting the the leading programs include few core courses that focus on the utilization and management domains. Utah, an exception, has a number of required technologies utilization courses. This is consistent with the program focus on the exploration, development and dissemination of the technologies of instruction and information. However, since the Utah masters program requires completion of 57 credit hours in contrast to 30-36 hours in most other programs, these courses are in addition to, not instead of, the core courses of other programs.

Core management domain courses offered address implementation strategies and skills, including planning. The focus is on developing an understanding of the issues that affect successful program implementation and the impact of these issues on design and development and of the monitoring skills and strategies that improve learning and transfer of new skills. More advanced management competencies identified in the surveys reviewed include: (a) planning and monitoring instructional design projects from inception to completion and (b) managing human resources.

Consistent with the AECT definition, courses on needs assessment have been included in Table 13 with the core courses in the evaluation domain. This domain also includes measurement courses. Formative and summative evaluation competencies, though part of this domain, are generally addressed within design and development courses.

Table 13 *Evaluation Domain Core Courses*

Domain	Evaluate	Course Name
FSU		Performance System Analysis or Managing Instructional Development (3)
Iowa		Needs and Task Analysis (3 s.h.)
Penn State		Learning Systems Analysis
Utah		Analysis and Design for Classroom Instruction
Indiana		Evaluation and Change in the ID Process (3)
Iowa		Introduction to Educational Measurement (3 s.h.)
Penn State		Principles of Measurement
Syracuse		Techniques in Educational Evaluation
Colorado		Evaluation: Models and Design or EPRE 602 Elements of Statistics

Needs analysis is a pre-design/development function carried out for the purpose of identifying training and instruction needs and constraints at the individual, group and organizational levels. The identified core competencies are:

- analyzing performance problems to determine the need for instruction, and
- identifying and analyzing the necessary design inputs (perform needs assessment and interpret data) including:
    - learning tasks (perform task/content/job analysis),
    - individuals' learning aims, needs and styles (learner characteristics),
    - learning environment,
    - course materials, and
    - organizational environment (resources, constraints, values, etc.).

Practitioners are expected to engage in an iterative process which continuously improves the effectiveness of their training and instruction. This includes the evaluation and improvement of their own practice through professional development. The identified core competencies are to:

- assess individual achievement (learning attainment);
- assess individual achievement of competence (performance);
- evaluate the effectiveness of training and instruction sessions and programs;
- evaluate the effectiveness of training and development within an organization; and
- report evaluation information.

At a more advanced level practitioners are expected to contribute to advances in training and development, design and develop training needs surveys or questionnaires, and design and develop testing or evaluation instruments and performance measures.

This section has identified the core practitioner competencies in relation to core program courses. The next section considers what selected programs have determined as a reasonable aggregation of core competencies to expect after completion of the core courses.

Program Objectives and Core Competencies

Students in the University of Indiana program, at the conclusion of the core courses, are expected to be able to demonstrate understanding of the instructional systems development process:

- by discussing the rationale for using a systematic approach;
- by paraphrasing the major elements commonly included in instructional development models and comparing/contrasting their emphases;
- by discussing the rationale and procedures for formative evaluation and revision; [and]
- by discussing approaches to successful implementation of the design solution. (http://education.indiana.edu/~istcore/r521/r521.html)

In addition, the Indiana students are expected to be able to demonstrate competence in doing instructional systems development, specifically by:

- analyzing performance problems to determine the need for instruction;
- analyzing the necessary inputs (characteristics of learners, learning environments and learning tasks) for making good instructional design decisions;
- specifying appropriate objectives and measures for given learning tasks and learners;
- selecting appropriate instructional strategies and formats;
- designing and developing course outlines and small lessons;
- creating effective media and message design;
- producing quality instruction for a variety of media;
- conducting formative and summative evaluations of instruction;
- planning for effective implementation and organizational change;
- using group-process skills to work productively in an ISD team;
- using computers effectively in the ISD process; [and]
- showing sensitivity to ethical issues and concerns. (http://education.indiana.edu/~istcore/r521/r521.html)

The program recognizes communication as a critical competency and students are provided ample practice opportunities and coaching support. Remedial courses outside the program are available if required. A majority of the Indiana graduates find employment in the business or training sector.

In contrast to Indiana the University of Pennsylvania program objectives focus on graduate employment in the education sector. It is expected that M. Ed. graduates will be able to:

- discuss learning processes and implications for the development of effective instruction;
- develop effective instructional materials for a variety of learning tasks, student characteristics, and learning environments;
- conduct comprehensive needs assessments identifying important learner, environmental, and task characteristics; [and]
- evaluate the effectiveness of educational materials. (http://www.ed.psu.edu/~insys/how/masters/howms.html)

M. Sc. graduates will also be able to pose and answer important learning-related questions requiring basic research and statistical competence.

In North Carolina, the Dept. of Public Instruction (1992) has outlined general guidelines for instructional technology specialist programs which should "be characterized by flexibility, individualization, and personalization to allow for differences in the capability, experiences, and educational background of candidates" (p. 19). In addition, the program should:

1. provide a general understanding of the [background] of computer technology as it relates to teaching and learning theory and practice and to the K-12 content areas;

2. provide for the development of competencies in planning, organizing, implementing, interpreting, and evaluating a computer skills instructional program at school systems levels;

3. develop knowledge and provide experience designed to promote the acquisition of several different kinds of leadership styles and understanding of when each style should be used;

4. provide an understanding of the purpose, organization, and administration of school systems with special emphasis on the role of the computer specialist in developing and directing activities related to computer technology; and

5. develop an individual awareness of the need for continued learning on the job and for intelligent consumption of research and current information. (p. 19-20)

The programs oriented to the K-12 practitioners appear to focus on a narrower range of objectives. They reflect a strong focus on technologies and instructional materials that is also reflected in program pre-requisites that are sometimes extensive.

Pre-requisites

Competencies required to complete program activities but not taught within the program are specified as program pre-requisites. For a number of IT programs, computer competency to a specified level is now a pre-requisite. The levels required for students overall, meets basic computer literacy requirements and is not very demanding. It should be noted that changes in these requirement over the course of this study reflect a steady escalation in what constitutes basic computer literacy, particularly in the school systems.

At the University of Southern California prospective students who are assessed as lacking the necessary competency in technology tools are required to take the *Use of Instructional Technology in the Curriculum* course to acquire:

- basic knowledge of a computer and its potential and capabilities to support teaching and learning;
- basic competency in the use of the navigation tools, classroom management applications, information indices and multimedia applications; [and]
- the basic skill to integrate technology tools in support of instructional practice. (http://www.usc.edu/dept/itp/lapredef.html)

Students entering the University of Indiana Instructional Systems Technology Program are expected to have or acquire during the first semester:

> basic computer competence (Level 1) on both Macintosh and DOS/Windows computer systems in the following areas: operating systems, word processing, graphics, a general theoretical understanding of how computers work, and electronic mail. (http://www.education.indiana.edu/~istcore/r521/r521.html)

Students applying to the San Diego State graduate program must have the skills appropriate to classroom teachers and covered in the course *Technologies for Teaching Skills* (http://edweb.sdsu.edu/Courses/EDTEC470/ET470syllfall95.html). These include producing an educational video, designing and developing an instructional multimedia program and evaluating examples of educational software.

At San Jose students entering the program must have "basic competency in media selection, production and utilization as required for advanced work in instructional technology" (http://www.sjsu.edu/depts/it/ma1.html). In addition, two courses are prerequisites to the Master's Program: *Using Instructional Media* and *Instructional Technology: Professional Aspects.* The former is a survey course designed to enable students to develop familiarity with various instructional materials and to design educational media materials (http://wwwsjsu.edu.depts.it/edit186/syll.html). The latter is designed to provide students with background information on the field and develop their individual programs (http://www.sjsu.edu/depts/it/edit188.html).

In this summary data related to core competencies and courses have been presented. In the following chapter a proposed program core based on those data is presented.

Chapter Five Conclusions, Recommendations

In this section findings presented in the previous chapters are summarized and discussed. The first part of this summary and discussion, which derives from the research sub-questions, addresses core IT program competency inputs and outputs. The second part presents observations, interpretive comments and recommendations related to key IT program structural elements, specifically specializations and delivery.

The conclusion of this study is that the key to achieving a quality, future oriented IT program lies in a strong ISD core which accommodates diverse and highly specialized options, within a structure that can implement changes in delivery and options in a cost-effective and timely fashion.

This conclusion leads to two recommendations:

- a strong program core that focuses on ISD — an iterative process of design, development, implementation and evaluation of instruction and training for development or performance improvement; and
- a program structure that fosters fullest diversity in the options, including highly specialized instructional technologies, in combination with the expertise of the program core; and demonstrates responsive and cost effective delivery.

In addition, recognizing that teachers represent a significant program market, it may be critical to reconcile the current perception wherein K-12 teachers generally do not consider the ISD process to be relevant to classroom practice.

Program Situation and Focus

Academic responsibility for IT programs has traditionally been situated in Education faculties. As teaching about instruction is not seen as the purview of any other academic faculty, it is likely, that over the next five years, IT programs will continue to be primarily the responsibility of Education faculties. Instructional technologies, however, are clearly not the sole purview of Education faculties. For example, at the University of Alberta, where the Fine Arts Faculty, building on its design courses, is now offering courses on computer graphics and web site design.

For an instructional technology program to be initiated within an Education faculty and establish itself as a quality program, there must be faculty who view themselves as practitioners of a distinct field — not, for example, curriculum specialists seeking to integrate technologies or technology content into classroom instruction. They must have a clear and shared view of what differentiates the field and what is the focus of its research issues. It is this shared view among faculty, as opposed to common background training, that is important to a quality future oriented program. The result of such a shared view of a distinct field could be the establishment of a separate unit as is the case at Indiana where such a unit is called Instructional Systems Development. The designation Instructional Systems Design and Development (ISDD) would be recommended by the author as, based on the data examined in this study, it most accurately conveys the focus of the field and the core expertise of its practitioners. Use of the IT and ET labels can result in confusion as they are also widely used to designate programs that focus on the use of instructional technologies by instructors.

The term instructional psychology (Mayer, 1996) has also been proposed as a designation of the field based on the assumption that

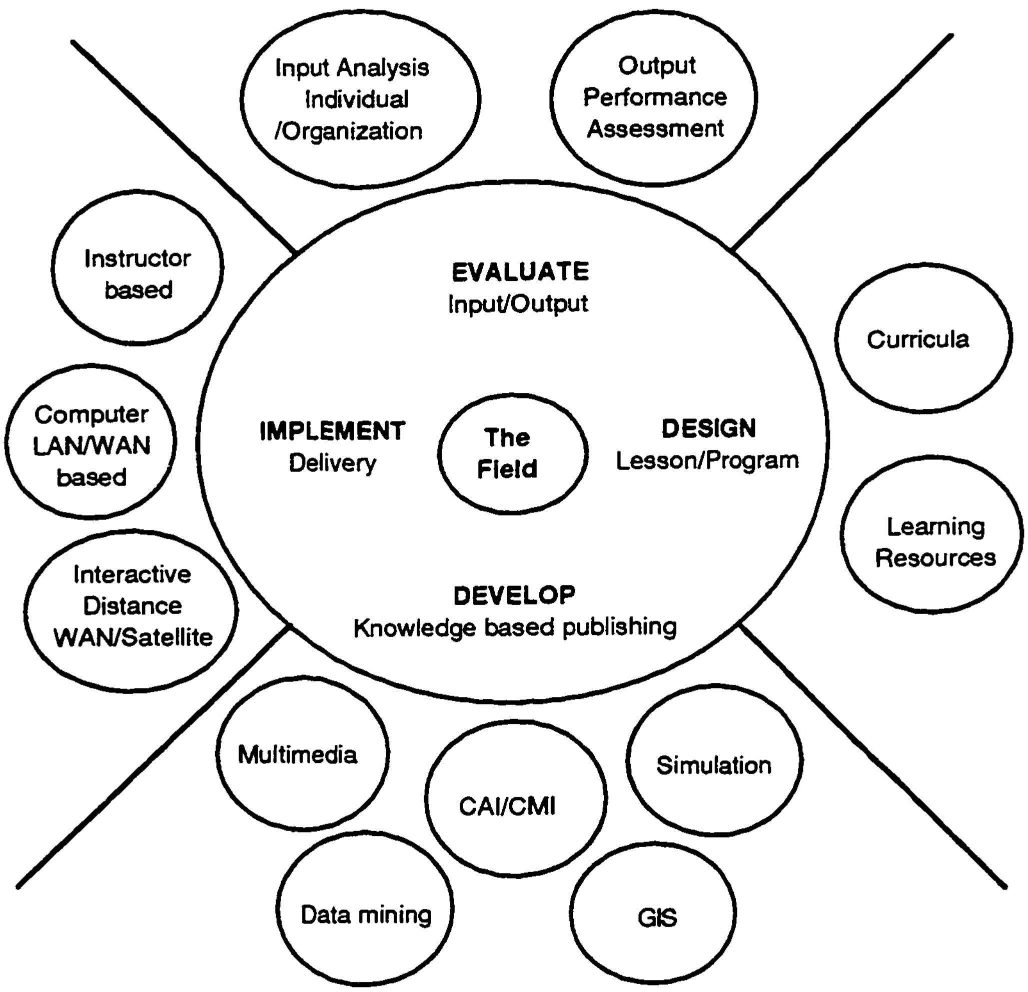
> the relation between the fields of psychology and instruction has progressed from a one-way street in which psychology was applied to instruction, to a dead-end street in which psychology and instruction did not communicate, to a two-way street in which the two fields mutually benefit one another. (p. 32)

However, the findings of this study regarding the core program competencies suggest that instructional psychology is but a component of the interdisciplinary knowledge base of the field and as such does not comprise the entire field.

Program Core

In the previous chapter, it was established that the core courses of selected quality programs broadly encompass those competencies that have been identified, in numerous surveys, as most frequently required by practitioners. The author has integrated elements from the programs reviewed into a generic program core, as represented in Figure 1, with an added emphasis on two aspects that have been identified in the literature as critical — cost-effectiveness and a demonstrated practice of continuous professional improvement. The proposed generic program core begins with an overview of the field as a whole and the four domains include five modules presented as an elaboration of the field domains already used to categorize role competencies and program data. For each module, content detail (knowledge base), objectives (competencies), and approach have been outlined. Figure 1 outlines the program core and its relationship to potential specializations.

Figure 1 *Generic ISDD program core and specializations*



The Field

An essential component of the program is a course on 'the field' that serves to provide a unifying context for the domain specific modules. It would provide those elements that Seels and Richey (1994b) attribute to formal training, namely:

- a foundation in the literature and the principles and practices of a field;
- a sense of history; and
- a common set of definitions. (p. 119)

The term proposed to identify the field is Instructional Systems Design and Development (ISDD). The course, ISDD-1, would introduce the theory, practice and trends of the field and related cognate fields. Such an introduction should establish a foundation for communication and collegial interaction between group members, first as students and later as practitioner colleagues.

ISDD-1	**The Field**
Content Description	The unit provides a comprehensive overview of the field including definitions, history, relation to cognate fields, current trends and issues.
Objectives	Upon completion of the module students will be able to: • describe the major theoretic base of the field and how it relates to and draws from theories of related cognate fields; • describe how the ISD process relates to reflective teaching and performance technology; and • discuss trends in theories, research and technologies as they relate to instructional practice and options.
Approach	The module involves a combination of independent study and seminars, utilizing presentations followed by open discussion, and involving faculty, students and outside participants. The following competencies are addressed through this approach: • oral communication including platform presentations and effective interaction through discussion and explanation; and • intellegent consumption of research and current information.

A seminar course where faculty and graduate students review and discuss current research as well as application developments raises awareness among students of the need to continue on the job learning, even among expert practitioners. Faculty involved should, as appropriate to the topics, represent a variety of departments and faculties. The course could also be one component in addressing the AECT accreditation guideline specifying that "faculty and administration are expected to systematically review new developments in the field" (Caffarella et al., 1996, p. 22).

Design Domain

The design domain involves two content areas. The first module, ISDD-2, encompasses instructional design theory including theories of learning and communication insofar as they impact planning, delivery and evaluation of instruction. The module involves a combination of independent study and seminars, utilizing presentations followed by open discussion.

ISDD-2	Theory of Instructional Design and Development
Content	The unit provides a comprehensive overview of instructional theory including learning and communication as they relate to instruction, training and performance improvement. It would also cover evaluation of instructional products such as CAI for meeting identified instructional needs independently.
Objectives	Upon completion of the module students will be able to: • identify a range of instructional strategies appropriate to various learning objectives, learner characteristics, and settings; • identify appropriate instructional materials to explain or present content; provide practice appropriate to the skill being learned; • evaluate instructional materials for accuracy of content; against visual and learning design criteria; and for congruency with specified learning objectives, learner characteristics, instructional strategies; and • evaluate instructional modules for accuracy of content; against visual and learning design criteria; and for congruency with specified learning objectives and learner characteristics.
Approach	In the module students will: • select, analyze and evaluate print, computer based and Internet instructional resources to address identified instructional needs; • select, analyze and evaluate print, computer based and Internet instructional resources to effect identified instructional strategies including self directed learning; and • learn to use a software application new to them using vendor documentation and tutorials, help-screens, and any other instructional aids.

Many IT students are also experienced instructors and may have a predisposition to presentation delivery style, or other instructional strategies. In order to overcome such predilection and to broaden their repertoire of design options, the module requires students to evaluate instructional resources that would be utilized by learners under the guidance of an instructor, as well as those utilized independently. This emphasis is reinforced by having students independently learn a software application, where they also view the design options from a learner perspective. Independent learning skills, identified as critical in the workplace (Gentry & Csete, 1995), are also essential to lifelong professional development.

The second module, ISDD-3, introduces the ISD process and provides students with an opportunity to apply the theory in an instructional planning context.

ISDD-3	ISD Process
Content	The unit covers the design of programs which meet identified learning needs for individuals and groups. It explores in depth the components of the ISD process with emphasis on design issues and the selection of options for meeting learner requirements. Students practice the design, in individual or group projects, of effective and appealing instruction based on principles from instructional theory.
Objectives	Upon completion of the module students will be able to: • explain the value and application of systems thinking (ISD) in the planning and design of instructional programs and resources; • explain the importance of evaluation of effectiveness, including cost effectiveness, of instructional sessions, programs and resources; • explain how the instructional design process is applied in classroom instruction, adult learning settings and business training to improve learning outcomes; • explain how the instructional design process is applied in classroom instruction, adult learning settings and business training to improve performance through increased transfer of learning; and • demonstrate a working knowledge of instructional design.
Approach	In the module students will practice applying the principles associated with steps in the ISD process. Working individually or in teams, students will develop an instructional plan in storyboard format for a group presentation and a CAI or self directed learning module to meet specified learning objectives, learner characteristics and setting resources and constraints. The plan will outline: • content selection and sequencing; • learning objective selection and sequencing; • instructional strategy selection and design; • feedback/message and interaction design; and • learning assessment strategy and design.

This module is designed to convey both the relevance and the pragmatic application of the ISD process to classroom instruction. The module approach assumes that this can be assisted by introducing the storyboard technique as a tool for documenting the design or plan; and demonstrating how this documentation then provides the basis for iterative lesson improvement through selective revision.

Development Domain

The development domain encompasses the development of both media and curricula. In the module as outlined in ISDD-4, students will work in teams to develop a multimedia product from a storyboard, or otherwise specified, design. By separating the design and production activities the module minimizes a potential problem that can result when a student learns instructional design in combination with CAI or multimedia development. In such situations "the design gets lost in the effort to simply get something up and running on the computer" (Dick, 1996, p. 59). Team composition would be reviewed prior to the start of each project to ensure a balance of specialized competencies adequate to complete the project. In addition, team responsibilities would be reviewed to ensure that all students have an opportunity to apply basic production skills.

ISDD-4	Development
Content	The unit introduces students to technologies used for instruction and training and to the entire multimedia production process. The module emphasizes basic skills in instructional media production, quality assurance and group process.

Objectives	Upon completion of the module students will be able to:
	• discuss and compare the capabilities and limitations of various instructional technologies;
	• discuss the steps in the production process;
	• discuss project management methodologies and tools;
	• apply basic skills in instructional media production (CAI and multimedia software) and presentation technologies (e.g. World-Wide Web) including:
	    • graphic and interface design;
	    • use of text and still images, writing and editing;
	    • planning for formative and summative evaluations;
	    • rapid prototyping;
	    • management process (teamwork, roles and reporting); and
	    • project/production management (quality assurance, usability testing, product revision and tracking of time and budget).

Approach	Given a design plan for a simple interactive product, students develop a multimedia prototype for delivery of effective and appealing instruction based on principles from instructional design theory (ISDD-2).

Cohen (1993) notes that effective program management, critical to meeting time and budget constraints, requires "skills in project planning, project tracking, project mapping and process management (p. 54). In this module students will be introduced to the concepts and tools for time and cost management of projects so that they can apply these at the micro and macro levels.

Implementation Domain

The implementation domain as outlined in ISDD-5 addresses instructional system implementation, including context and impact analysis, and diffusion of innovations. This is in contrast to the categorization in the 4th definition of the field in which these elements are found in the management and utilization domains respectively (Seels & Richey, 1994b, pp. 43, 49, 70-71). The term implementation has been used to emphasize the entrepreneurial rather than bureaucratic perspective of the module. The focus is on implementation through management of process, systems and change, rather than management of people. It should be noted that fewer generally agreed upon competencies have been validated in surveys as being basic to such a domain. The Indiana program does offer a course on change entitled *Evaluation and Change in the ID Process.*

ISDD-5	Implementation and Change
Content	The unit provides a comprehensive overview of systemic change in education and business enterprises; innovation and adoption practices; implementation analysis and strategies; productivity; cost-effectiveness; and preparation of training or technology implementation plans.
Objectives	Upon completion of the module students will be able to: • discuss utilization of personal professional development plans to overcome individual resistance and barriers to change; • discuss utilization of technology plans to overcome systemic resistance and barriers to change; • discuss the utilization of cost-effectiveness analysis as a basis for selection among instructional delivery alternatives • identify human issues associated with the introduction and use of instructional technologies; and • demonstrate development of a professional development plan.
Approach	The module emphasizes change theory and principles as they relate to adoption and use of instructional products and transfer of learning at micro and macro levels. Students will: • prepare a personal professional development plan and identify at least one instructional technology need and an implementation plan to address it; • work in teams to prepare an implementation plan for either a special needs student or for a staff training session in a school or business setting

Noble (1996) cautions against the over zealous adoption of new technologies for fear of "losing ground or falling behind" (p. 23). In this module cost-effectiveness analysis is introduced as a basis for selection among delivery alternatives and to stress the need for a decision process to assess changes, such as new technologies, and to balance their costs against proven effectiveness.

Evaluation Domain

The evaluation domain includes two content categories: design input analysis, output assessment and reporting. Consistent with this ISDD-6, the evaulation module, includes initial problem analysis where a determination is made as to whether the problem or project is one best addressed by instruction and appropriate for instructional design methodologies. Front end analysis techniques include needs assessment, identification of learner characteristics, environmental analysis and cost-benefit analysis. ISDD-6 also covers evaluation, which includes measurement of learning and assessment of the instruction. Although the fourth definition of the field includes formative and summative evaluation of instructional products within the evaluation domain, in practice these are typically part of the design and development processes. It is for this reason that, in this study, they have been addressed in the Development module, ISDD-4.

ISDD-6	Analysis and Evaluation
Content	The course provides a comprehensive overview of data collection and analysis techniques, instructional analysis, measurement and evaluation. Topics covered will include: reporting skills; design of assessment situations; simple data summary, analysis and decision techniques including cost-effectiveness and cost-benefit.
Objectives	Upon completion of the course students will be able to: • discuss utilization of instructional analysis for planning; • discuss utilization of implementation analysis for planning; • discuss utilization of evaluation results to monitor and improve learner performance, instructor performance and intervention effectiveness; • develop effective evaluation forms for instructional sessions; and • analyze various data types using a variety of methodologies.
Approach	The course emphasizes knowledge of a range of analysis techniques and criteria for application. Students will: • develop an instructional analysis plan for either a special needs student or an employee; and • identify appropriate strategies to diagnose or measure accomplishment; • design evaluation forms for specified training sessions; and • prepare analyses of specified data.

Birnbrauer (1996) outlines how data on learner reaction to a course can be used to provide valuable design input for course improvement when evaluation forms have been well designed and are session specific. In this module the design and use of such forms to gather appropriate data for ongoing performance improvement in the planning and delivery of learning sessions and programs will be introduced.

Capping Requirements

While not typical of IT programs, students in the University of Indiana program are required to prepare a portfolio of work for evaluation before they can graduate. Such a portfolio would meet the AECT accreditation guideline that specifies demonstration of

> the competencies of the area in which the student has specialized; . . . evidenced by a multimedia product, a video product, an audio product, a visual product (film, videotape, slide/tape presentation), or a program of instruction (individualized instruction, competency based course development). (Caffarella et al., 1996, p. 22)

Where methods, such as televised micro-teaching, mediated test procedures, and computer-simulated gaming and technology, have been employed in the evaluation of graduates, these could be included in the portfolio.

An IT practitioner's presentation of a portfolio of work is a particularly appropriate method to demonstrate design and development capabilities and competencies. A portfolio could also be used on an ongoing basis to highlight acquired skills. This use, in conjunction with a professional development plan, would not only demonstrate development planning, but also achievement of results. And professional development was consistently identified as an essential practitioner competency in the data examined in this study. It is for these reasons that this study recommends that programs require preparation of a portfolio of work for evaluation prior to graduation.

The AECT accreditation guidelines consider research to be an essential component of the graduate curriculum and mandate that students are to "become skillful, critical consumers of research data in educational communications and information technologies and related cognate fields" (Caffarella et al., 1996, p. 18). At the masters level this requirement is addressed by a research course and a thesis or project requirement. Students in advanced graduate programs would "design and conduct research in the field" (Caffarella et al., 1996, p. 18). These are standard program requirements.

Development of the core courses outlined in this study and determination of capping requirements have followed the ISD approach described as top down by Allen (1992). This approach assures that all students who graduate will have a knowledge and skill foundation that is validated and sufficient. In addition to this recommended foundation, the program will include optional courses. This study recommends that determination of such optional courses follow a bottom up approach. Such a combined approach would recognize that many students in IT programs are experienced professionals and take into consideration that some may be proficient in particular areas of IT specialization.

Specialization

> The field of educational communications and information technologies is comprised of a wide variety of specializations. Therefore, programs of preparation should enable the student to develop a broad base of competencies within the total field while, at the same time, pursuing a particular specialty of his or her choice. (Caffarella et al., 1996, p. 18)

The IT field does indeed encompass a wide variety of specializations, based on what Heideman (1991) referred to as specialized knowledge, and this is almost certain to expand in the next five years. These areas of specialized expertise, such as those identified in Figure 1, include multimedia, CAI/CMI, and interactive distance education among others. For an IT program at the masters level, the recommendation of this study is that:

- the core courses encompass the broad base of competencies within the total field that all students will require as IT practitioners; and
- students choose the optional courses that best fit their own background and goals.

Thus, in the optional courses, a student may choose courses from each of the four domains or from one domain in pursuit of an IT field specialty of his or her choice. In pursuit of that specialty, the student should not be solely limited to courses within the program. Such flexibility is particularly important given the fact that IT programs normally have a small number of full time faculty to support the range and depth of specializations appropriate to the field. There is precedence for such flexibility as for instance at Indiana University and Pennsylvania State University which require that students take four courses outside ISD, but within the University. Moreover, this study expands on this need for flexibility in that it recommends that the choice of specialization not be institutionally limited. Even though one may anticipate some operational adjustments regarding such transfer courses, experience has confirmed the viability of such flexibility. For instance, the University of Alberta (U of A) and the Northern Alberta Institute of Technology (NAIT) appear to have resolved any operational difficulties as students in some U of A engineering programs take some of their program courses at NAIT. Additionally, the Nova Southeastern University Ed. D. program in 1996 (http://www.hoe.se/bon/summinst/summ96.html) included a Summer Institute arranged in collaboration with Uppsala University College of School Leadership. One of the themes addressed during the course of that summer institute was consideration, from a global perspective, of changing educational systems, including the impact of technology. Without such structural flexibility ISDD programs unnecessarily limit their ability to maintain program quality and at the same time keep up with the range of legitimate practitioner and research specializations as, for example, data mining, graphic information systems (GIS), artificial intelligence and virtual reality.

In addition, the applied nature of the field and the dynamic evolution of tools integral to the field in comparison to other education specializations, suggests that a different relationship may be appropriate between full time and adjunct faculty in this area. The AECT accreditation guidelines note that

> the field of educational communications and information technologies is dynamic, therefore requiring constant faculty renewal which in turn will provide students with appropriate access to the most recent developments relating to this area. (Caffarella et al., 1996, p. 19)

The focus is on faculty development in terms of support for short term participation in professional meetings and workshops as well as of support for longer term participation in research and other professional growth activities. While it is necessary that each faculty member be engaged in active and continuous renewal, there must also be provision for renewal of the program faculty. This is an issue not addressed by the accreditation guidelines, although the guidelines do note that

> the field of educational communications and information technologies consists of a number of specialized areas. Part-time faculty, recruited from adjacent geographic areas, frequently teach in these specialized areas. When balanced carefully against a regular full-time faculty this is a reasonable solution to staffing challenges facing many programs. (Caffarella et al., 1996, p. 19)

The stipulations are added that whereas such part-time faculty should meet the same academic requirements as full-time faculty they should not teach a major portion of the courses offered in the program. Alternatively, assuming that full time faculty are responsible for the core courses, it would seem that, essential to a dynamic and competitive program, is a strong commitment to a combination of adjunct and contract faculty. In an applied field, such utilization of practitioners is also an important demonstration of faculty who deliver in the 'real' world. Such a combination of staffing and institutional cooperation would extend the range of optional course offerings. And, quite aside from other tangible benefits, such a cooperative approach would permit maximum flexibility and cost effectiveness in responding to the multiple external demands, opportunities and emerging technologies while, at the same time, maintaining a strong program core.

The determination of optimum intra and inter institutional collaborations will depend, in part, on the specializations of full time faculty and how these match the specialization interests of students and of employers of graduates. Surveys of employers and entering and graduating students could be utilized for market assessment and program evaluation.

Although the identity of the profession has been tied to cost-effectiveness in the fourth definition of the field, the knowledge and skills required for cost analysis and decision making are conspicuously absent in the program data reviewed for this study. With respect to the programs themselves, cost data that will provide the basis for analysis and decision making are critical in the current environment of dynamic change. Yet the future survival of IT programs may well depend on their ability to develop both instructionally sound and commercially viable programs.

Program Delivery

Program delivery alternatives were not examined in this study, although during the course of the study it became clear that such alternatives will be an important factor in program restructuring. Drucker (Lenzner & Johnson, 1997) has identified one cost-effective delivery approach. To put his insights in perspective, it must be noted that

> a half-century back Drucker recognized the significance of the government guarantee of a college education for veterans of World War II: a vast expansion of higher education and a more literate population. Sounds obvious now, but at the time nobody realized how far-reaching would be the consequences of the GI Bill of Rights. (p. 10 of 14)

In a 1997 interview for Forbes, Drucker identified another change with far-reaching consequences. He points out that higher education is in crisis with expenditures on this essential commodity having risen out of control without any concomitant visible improvement in quality. He suggests that the system is becoming untenable and resolution of the failure will be addressed, at least in part, by new instructional technologies, noting that

> already we are beginning to deliver more lectures and classes off campus via satellite or two-way video at a fraction of the cost. The college won't survive as a residential institution. Today's buildings are hopelessly unsuited and totally unneeded. (Lenzner & Johnson, 1997, p. 9-10 of 14)

Distance education, the emerging catalyst to inter-institutional competition for students, increases the requirement to develop programs that are both instructionally sound and commercially viable.

Conclusion

The objective of this study was to identify evolving changes in IT practitioner competency requirements and consequent changes in IT curricula. The literature review identified four categories of IT practitioners with differing competency priorities and requirements. These are: instructional designers and developers and practitioners responsible for implementation and support of on-site and distance delivery of instruction and training programs.

Data collected during the study, and interpreted within the models in the literature, identified four domains basic to IT performance, namely design, development, implementation and evaluation. The implementation domain includes diffusion of innovations and project and process management, which the fourth definition of the field (Seels & Richey, 1994b), with five domains, includes in the utilization and management domains respectively.

Educators and educational systems are being deluged by technology marketing hype with a focus on means that often loses sight of the end. This is most particularly exemplified by the plethora of software programs each of which focus on a miniscule portion of the spectrum of knowledge expected of functioning individuals. This marketing hype surrounding software, which relates to process rather than content, tends to become implicit in our judgments and results in a tendency to interpret the focus of an instructional technology curriculum as technologies of instruction. Indeed, the current study began with an implicit assumption that emerging technologies would have the most significant impact on the core competencies to be addressed in a future-oriented IT curriculum. As the study progressed, however, it became clear that detailed enumeration of technological competencies was not the key to addressing the study question. Education is a combination of process and content and, if one looks to IT education as merely being the sum of these little process components, the end result is something that falls short of prevailing educational expectations.

A comparison of the competencies identified in various practitioner surveys as most important with the competencies addressed in the core courses of selected IT programs confirms the view that the broad components of the field continue to be stable in the nineties and consistent with those noted by Kennedy in 1982. It is the competencies related to what practitioners do that form the stable foundation of the field. Building on this knowledge foundation, practitioners continuously adapt how they work in response to new and evolving tools. Recognition of this fact shifted the focus from one of assessing technology competencies to reviewing ISD competencies in the program core; and examining how, to meet quality and future-oriented objectives, the structure and delivery of an IT program with a design-development-evaluation focus might respond to multiple and dynamic demands in a cost-effective manner.

This study confirms that a program can be developed where all students take a common set of core courses providing a grounding in each of the four domains within an ISD framework. The program would enable graduates to become IT practitioners. The programs at Indiana and Florida State would appear to fit into this category. However, this opportunity must be tempered by the recognition that the market for IT practitioners is relatively small and the data stemming from this study suggest that the market for a program requiring mastery of all the identified core competencies is limited. A number of IT programs, however, while offering as options the courses that would encompass the core competencies required by an IT practitioner, maintain a smaller program core that targets a wider market. The Pennsylvania State program includes a similar core but offers application streams tailored specifically to business and the K-12 environments. In programs such as these the student may find that courses designed to appeal to the broader market are not rigorous enough to provide the foundation necessary for IT practice. There is a continual and dynamic trade-off between program breadth and depth; success is more art than science.

A major component of that wider market is instructors who do not aspire to be IT professionals but choose to acquire selected IT competencies adjunctive to professional or technical qualifications. It is only by addressing this aspect of the market that most IT programs can maintain market viability. Data stemming from this study suggest that doing so would require a compressed core together with tailored streams, utilizing as instructors, active practitioners from the field. Such instructors can deliver applied education that bridges content and process.

Further Research

A major limitation of this study was that all the data were documentary and secondary. The program data, in addition, reflect a limited time period. To validate the practitioner roles, field domains and core competencies identified in this study, site visits and interviews followed by a Delphi survey to project future roles and competencies more specifically would now seem to be appropriate. Alternatively, a market survey, in the context of the validated roles and competencies, might be undertaken.

This study study indicates that the perceptions of K-12 teachers regarding ISDD competencies requires further investigation if there is to be reconciliation of purported and perceived value of ISDD competencies in the classroom. This could be investigated in the context of micro marketing such as what community colleges (Bragg & Jacobs, 1991) do with 'cohort groups', and the design of virtual curricula (Leitzel & Vogler, 1995) to respond specifically and quickly to such micro marketing opportunities.

Further work needs to be undertaken to identify those competencies more appropriately developed on the job or through internships rather than through instruction as well as those skills more appropriately developed through independent learning rather than through training or group instruction.

In addition, further work could be undertaken in the area of globalization of the training market and the impact of cultural differences on instructional resources, strategies and ISDD competencies on training in developing countries.

This study suggests that teachers do not normally utilize independent learning as a preferred learning strategy, particularly with regard to instructional technologies. Further work needs to be undertaken to identify the independent learning skills that teachers have, as well as those required in this area. The question also appears worthy of closer examination in relation to workplace training since "universities and technical colleges appear to play a minimal role in providing trainers with knowledge and skills in computer-based training, multimedia systems, EPSS, distance learning systems or computer presentation systems" (Furst-Bowe, 1996, p. 236).

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Glossary of terms

AECT: Association for Educational Communications and Technology.

CAI: computer assisted instruction.

CEC: continuing education course.

Curriculum: an 'academic plan' or a "blueprint for action, including purposes, activities, and ways of measuring success. A plan implies both intentions and rational choices among alternatives to achieve the intentions" (Stark and Lattuca, 1997, p. 9-10).

EMTY: Educational Media and Technology Yearbook.

EOSC: Employment Occupational Standards Council.

IBSTPI: International Board of Standards for Training, Performance, and Instruction.

Instructional design process: the process of design of curricula, lessons and resource materials; includes needs analysis through to specification of evaluation and implementation parameters; encompasses design issues such as identification of instructional problems, classification of learning tasks, selection of instructional strategies and tactics; and design of effective and appealing instruction based on principles from visual design, human communication and learning theory; may include production of prototypes.

Instructional development process: the process of development of curricula, lessons and resource materials; includes developing and validating instructional products, lessons, procedures and systems of learning. It is directed at development of effective human and media based instruction that contributes to the achievement of learning objectives that have been specified in the design process.

Instructional systems development (ISD): a systematic way of designing, carrying out, and evaluating the total instruction process to cost-effectively bring about specific learning objectives; encompasses all of the design, development and evaluation activities from analysis (task, learner and organizational), through design and development of a solution, visual design and media production, formative evaluation and revision, implementation and summative evaluation (resources, student learning and instruction delivery); may include project management.

ISD: Instructional systems development.

ISDD: Instructional systems design and development.

ISO: International Organization for Standardization.

IT: instructional technology.

Instructional technology (IT): "the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning" (Seels & Richey, 1994b, p. 9).

NCATE: National Council for Accreditation of Teacher Education.

NGO: non government organization.

SEI: Software Engineering Institute

3SE: Software Services Support and Education Centre Ltd.

TRT: Technology Resource Teacher

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Appendix A: British Training Competencies, Unit A21

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Appendix A: British Training Competencies, Unit A21

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Appendix B: IBSTPI Checklist for Evalutaing Training

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Appendix C: Competencies North Carolina IT Specialist

North Carolina Instructional Technology Specialist -- Computers

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Appendix C: Competencies North Carolina IT Specialist

North Carolina Instructional Technology Specialist -- Computers

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Appendix D: AECT Guidelines (Appendix B)

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Appendix E: Survey of Instructional Technology programs

For current information see URLs

http://www.ualberta.ca/~prempel/itfield.html

http://www.ualberta.ca/~prempel/itfield5.html

For URLs at the time of the study see HTML code below.

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Included here are selected IT program links.
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For a comprehensive listing see the pages designed and maintained by Dr. Gerald
R. Viers, California State Polytechnic University, Pomona, of <A HREF =
"http://www.sci.csupomona.edu/seis/ist.html">Graduate Programs in Instructional
Technology</A>. That site has been approved for inclusion in the Clearinghouse for
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[<A HREF = "http://www.ualberta.ca/~prempel/itfield.html">IT Field </A>]
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[<A HREF = "http://seamonkey.ed.asu.edu/~gail/programs/lntphd.htm"> Ph.D.
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aogbb@asuvm.inre.asu.edu</A><P>
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 harrison@ucsvax.sdsu.edu</A>
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Web Quest</A>
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Center</A>
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Technology</A><br>
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work completed in the Instructional Technology Program counts toward the
cooperative doctoral degree with the University of Southern California.
<LI>Contact: Dr. James Cabeceiras, <A HREF =
"mailto:jcabece@cello.gina.calstate.edu">
jcabece@cello.gina.calstate.edu.
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performance at work, <br>
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program in Instructional Technology is being offered [fall of 1996] in the School of
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<LI>Research in Technology and Learning
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"mailto:kontos@alpha.acast.nova.edu"> kontos@alpha.acast.nova.edu</A>

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<br>Certificates: School Media Specialist
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Course descriptions
<br>Foundations; Instructional Analysis, Design, and Development; Instructional
Development and Production; Implementation and Management
<LI>Contact: Dr. Thomas Schwen, <A HREF = "mailto:schwen@indiana.edu">
schwen@indiana.edu</A>
<P> <DT><B>University of Illinois, Urbana-Champaign</B>
<DD><A HREF = "http://www.grad.uiuc.edu/grad_program/EDUCATION.html">
Education </A> graduate programs
<P><A HREF = "http://www.ed.uiuc.edu/">Learning Resource Server</A>The LRS
provides you with a "knowledge space" that links you to some of the most exciting
uses
of technologies for learning on the Internet. Using the LRS, you will be able to see
real projects of
teachers and students, access the work of researchers who are articulating new
visions of what
learning can be, and learn how to create new knowledge yourself. Includes link to
<A HREF = "http://lrs.ed.uiuc.edu/TTA/">Teaching Teleapprenticeship Project </A>.
</DL> <HR>
<A NAME="indi"><LI><B> Indiana </B><P>
<DL><DT><B>Indiana University, Bloomington</B>
<DD><A HREF = "http://education.indiana.edu/isthome.html"> Instructional Systems
Technology </A>
<br>Programs:
[<A HREF =
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"http://education.indiana.edu/ist/programs/masters/masters.html">M.S.Ed.</A>]
 [<A HREF =
"http://education.indiana.edu/ist/programs/edd/docedd.html">Ed.D.</A>]
 [<A HREF =
"http://education.indiana.edu/ist/programs/phd/docphd.html">Ph.D.</A>] <br>
Course descriptions
<br>Foundations; Instructional Analysis, Design, and Development;  Instructional
Development and Production; Implementation and Management
<LI>Contact: Dr. Thomas Schwen, <A HREF = "mailto:schwen@indiana.edu">
schwen@indiana.edu</A>
<P>
<DT><B>Purdue University</B>
<DD><A HREF = "http://www.soe.purdue.edu/home/"> Instructional Systems
Technology </A> </DL> <HR>
<A NAME="iowa"><LI><B> Iowa </B><P>
<DL><DT><B>University of Iowa</B>
<DD><A HREF =
"http://www.uiowa.edu/~coe2/divisions/pandq/idt/index.htm">Instructional Design
and Technology </A>
<br>Programs:
 [<A HREF =
"http://www.uiowa.edu/~coe2/divisions/pandq/idt/program.htm#MA">M.A.</A>]
 [<A HREF =
"http://www.uiowa.edu/~coe2/divisions/pandq/idt/program.htm#EdS">Ed.S.</A>]
 [<A HREF =
"http://www.uiowa.edu/~coe2/divisions/pandq/idt/program.htm#PhD">Ph.D.</A>]
<br> <LI>Contact Dr. Stephen Alessi,
 <A HREF = "mailto:steve-alessi@uiowa.edu "> steve-alessi@uiowa.edu </A>
</DL> <HR>
<A NAME="mich"><LI> <B>Michigan </B>
<P><DL>
<DT><B>Wayne State University</B>
<DD><A HREF = "http://WWW.COE.Wayne.Edu/AOS/AOS.html">Instructional
Technology </A> link under construction
<br>(M.Ed.), (Ed.Sp.),  (Ed.D.), (Ph.D.)
<LI>Contact: Contact: Dr. Rita C. Richey,
<A HREF = "mailto:  rrichey@cms.cc.wayne.edu "> rrichey@cms.cc.wayne.edu
</A>
</DL>
<HR>
<LI> <B>Minnesota </B>
<P><DL>
<DT><B>University of Minnesota</B>
<DD><A HREF = "http://134.84.183.21/ist/">Instructional Systems and Technology
</A>
<br>(M.A.), (M.Ed.), (Ph.D.)
<LI>Contact: Simon Hooper, simon@maroon.tc.umn.edu
<A HREF = "mailto:simon@maroon.tc.umn.edu ">simon@maroon.tc.umn.edu </A>
</DL>
<A NAME="newy"><HR><LI> <B>New York</B><P>
<DL><DT><B>Columbia University, Teacher's College</B>
<DD><A HREF = "http://www.ilt.columbia.edu/">Multimedia Courseware
Development Initiative</A>
<br>(M.Ed.), (M.A.), (Ed.D.)
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<br>Certificates: Library Media Specialist
<LI>Contact: Dr. Howard Budin, <A HREF = "mailto:hb50@columbia.edu">
hb50@columbia.edu</A>
<P>
<LI><A HREF = "http://www.ilt.columbia.edu/projects/index.html">Live Text </A>
resources on ILTweb are being developed by the Institute for Learning Technologies,
Columbia University, to provide K-12 related resources to educators, students and
others; and to support the Insitute's K-12 school based projects, including the
Advanced Media in Education Project. Specific initiatives include the Living
Schoolbook Project, a New York State funded collaboration.
<P>
<LI>Get <A HREF =
"http://www.cc.columbia.edu/cu/chemistry/Edison.html">Multimedia Chemistry
Education Movies</A>developed through the Edison Project at Columbia University.
<P>
<DT><B>Syracuse University </B>
<DD><A HREF = "http://web.syr.edu/~jmehra/">Instructional Design, Development
and Evaluation </A>
<br><A HREF =
"http://web.syr.edu/~jmehra/HTML/degreesmain.html">Programs</A>: (M.S.),
(Ed.D.) [Ph.D.] and [C.A.S.] Advanced Graduate Studies certificate.
<LI>Contact: Dr. Donald P. Ely, <A HREF = "mailto:dely@ericir.syr.edu">
dely@ericir.syr.edu</A>
</DL>
<HR>
<A NAME="penn"><LI><B> Pennsylvania </B><P>
<DL><DT><B>Pennsylvania State</B>
<DD><A HREF = "http://ets.cac.psu.edu/catalog/">Faculty Technology
Projects</A><br>
Penn State faculty proposals submitted to the Faculty Technology Initiative. This
program promotes the development of projects demonstrating the instructional
effectiveness of interactive teaching and learning technologies.
<DD><A HREF = "http://www.ed.psu.edu/dept/ae-insys-
wfed/insys/insys.htm">Instructional Systems </A>
<br>Programs:
 [<A HREF = "http://www.ed.psu.edu/dept/ae-insys-
wfed/insys/Degree_Programs/Masters_Programs/describem.htm">M. Ed., M.S.</A>]
with 3 areas of emphasis: Educational Systems Design, Corporate Training and
Emerging Technologies] [Certification: <A HREF = "http://www.ed.psu.edu/dept/ae-
insys-wfed/insys/Degree_Programs/Certification_Programs/supervise.htm">IT
Supervisor</A> / <A HREF = "http://www.ed.psu.edu/dept/ae-insys-
wfed/insys/Degree_Programs/Certification_Programs/special.htm">IT
Specialist</A>]
 [<A HREF = "http://www.ed.psu.edu/dept/ae-insys-
wfed/insys/Degree_Programs/Doctoral_Programs/described.htm">D.Ed., Ph.D.</A>]
<br>
<LI>Contact: Dr. David Jonassen, <A HREF =
"mailto:JONASSEN@PSU.EDU">JONASSEN@PSU.EDU</A>
</DL> <HR>
<A NAME="texa"><LI><B> Texas </B><P>
<DL><DT><B>University of Texas</B>
<DD><A HREF = "http://www.edb.utexas.edu/coe/depts/ci/it/">Instructional
Technology </A>
<br><A HREF =
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"http://www.edb.utexas.edu/coe/depts/ci/it/multimedia/multimedia.html">Interactive
Multimedia Research / Multimedia Class projects </A>
</DL>
<A NAME="utah"><HR><LI><B>Utah</B>
<P>
<DL><DT>Utah State University
<DD><A HREF = "http://www.ed.usu.edu/coe/it/index.html">Instructional
Technology</A>
<br>(M.Ed.), (M.S.), (Ed.Sp.), (Ed.D.), (Ph.D.) <br>
with masters degree in Instructional Design and Development (ID), Library-Media
and <A HREF = "http://www.ed.usu.edu/coe/it/edtech/">Educational Technology</A>
(via EdNet & ComNet)
<LI>Contact: Dr. Don Smellie, <A HREF = "mailto:dsmellie@cc.usu.edu">
dsmellie@cc.usu.edu</A>
</DL> </UL> <HR> <P>
<A NAME="cana"><CENTER><B>Selected Graduate Programs in Instructional
Technology <br> in Canada</B></CENTER>
<P><DL><B>University of Alberta</B>
<DD><A HREF =
"http://www.ualberta.ca/educ/psych/psych.html#Instruct">Instructional
Technology</A>
<DD><A HREF =
"http://gpu.srv.ualberta.ca/~gduguay/gumby/insttech.html">Program, courses,
etc.</A> <br>(M.Ed.)
<LI>Contact: Dr. Michael Szabo, <A HREF = "mailto:mike.szabo@ualberta.ca">
mike.szabo@ualberta.ca</A>
<P>See one of our course offerings - <A HREF =
"http://www.quasar.ualberta.ca/nethowto/">The Internet</A>: communicating,
accessing and providing information and resulting <A HREF =
"http://www.quasar.ualberta.ca/nethowto/resource/">student Projects & Porfolio
Samples </A>
<P>Look at the work of Brent Poohkay, one of our graduates - <A HREF =
"(http://www.law.ualberta.ca/brent.html>Brent's page</A> or the <A HREF =
"http://www.law.ualberta.ca/">Law Centre page</A>
<P><DT><B>University of Manitoba</B>
<DD>Master of Education (M.Ed.) <br> <A HREF =
"http://www.umanitoba.ca/educ/htmldocs/educ.html">
 Education Faculty</A> -  Educational Technology <A HREF =
"gopher://gopher.cc.umanitoba.ca:70/11/faculties/Faculty of Education/Educational
Technology Program">Program and courses</A>
</DL><HR><P>
<A NAME="aust"><CENTER><B>Selected Graduate Programs in Instructional
Technology<br> in Australia</B></CENTER>
<P><DL>
<DT><B>Edith Cowan University, Perth, Western Australia</B>
<DD><A HREF = "http://www.cowan.edu.au/education/comped/main.html">
Multimedia Learning Technologies</A>
<br>Graduate Certificate in Interactive Multimedia Technologies
<br>Graduate Diploma of Arts (Interactive Multimedia Technologies)
<br>M. Ed. (Educational Computing), M. Ed. (Interactive Multimedia), (Ph.D.)
<LI>Contact: Professor Geoff Ring, <A HREF = "mailto:g.ring@cowan.edu.au">
g.ring@cowan.edu.au</A> <P>
<DT><B>Royal Melbourne Institute of Technology, Melbourne, Australia</B>
<DD><A HREF = "http://minyos.xx.rmit.edu.au/~rpylw/enquiry.html"> Department of
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Visual Communication</A>
(M.A.), (Ph.D.)
Animation and Interactive Multimedia, Media Arts, Illustrative Photography, Art Direction and Advertising
(M.Sc.), (Ph.D.)
Scientific Photography
<LI>Contact: Mr. Ian Haig, <A HREF = "mailto:I.HAIG@RMIT.EDU.AU">
I.HAIG@RMIT.EDU.AU </A><P>
<DT><B><A HREF = "http://www.uow.edu.au/"> University of Wollongong,</A>Wollongong,
Australia</B> </B>
<DD>Interactive Multimedia

(M.Ed.), (Ed.D.), (Ph.D.)
<LI>Contact: Dr. John Hedberg, <A HREF =
"John_Hedberg@uow.edu.au"> John_Hedberg@uow.edu.au</A>
</DL><P><HR><P>
For further information on many of these programs, please consult <B>
Degree Curricula in Educational Communications and Technology</B>,
Fifth Edition, Edited by Jenny K. Johnson, (1995) <A HREF =
"gopher://sunbird.usd.edu:72/1"> Association for Educational Communications and Technology. </A> <P>
To explore Interactive Technologies in Education see <A HREF =
"http://www.iat.unc.edu/">Institute for Academic Technology</A> at the University of North Carolina, Chapel Hill.<HR>
<A NAME="mult">
<CENTER><H4>Selected Multimedia Programs</H4></CENTER>
<UL><LI><B>Califormia </B><P>
<DL><DT><B>California State University, Haywood</B>
<DD>Proposed <A HREF = "http://www.mcs.csuhayward.edu/mmm/">Master of Arts in Multimedia</A>

</DL><HR>
<LI> <B>Canada </B>
<P><DL>
<DT><B>Vancouver Film School</B>
<DD><A HREF = "http://www.multimedia.edu/mmpgof.htm">Multimedia Campus</A>
<DD><A HREF = "http://www.multimedia.edu/mmpgof.htm#curriculum">Curriculum </A>
<LI>Contact: Catherine ? , <A HREF = "mailto:catherine@griffin.multimedia.edu">
catherine@griffin.multimedia.edu</A>
</DL>
<HR><P>Or, go to:
[<A HREF = "http://www.ualberta.ca/~prempel/itfield3.html">IT Competencies </A>]
[<A HREF = "http://www.ualberta.ca/~prempel/itfield4.html">IT Core Courses</A>]
[<A HREF = "http://www.ualberta.ca/~prempel/itfield.html">IT Field </A>]
[<A HREF = "http://www.ualberta.ca/~prempel/itfield2.html">IT Roles and Job Trends</A>] <HR><P>
Last updated on 4 August 1996
<ADDRESS>
P. Rempel<A HREF="mailto:prempel@gpu.srv.ualberta.ca">
prempel@gpu.srv.ualberta.ca</A>
</ADDRESS>
</HTML>