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A Conceptual Analysis of Educational Technology: The Professional versus the Student Model 1968 - 1989

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A Thesis

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ABSTRACT

Following in the tradition of its scholars to define and describe educational technology in terms that would clarify meaning among all its members, this thesis used three sources of information. The first source refers to the professionals in the literature, the second to decision-makers (faculty) of curricula (the Concordia Graduate Calendar, 1968-89), and the third to students in the field of Educational Technology.

A historical/case study research design was set up to carry out this conceptual analysis of Educational Technology, including a survey of the literature defining and describing educational technology, a survey of the changes in the curricula at Concordia, and a survey of 408 students attached to the Concordia Program (an estimated 60% of the whole population).

Major findings show an agreement in changes from being a field concerned with improvement of teaching practices through the use of media, to a field mainly concerned with learning processes and their effects on the teaching process. Moreover, educational technology appears to have been seen consistently, over the years, as a field concerned with educational problem-solving and learning theories through the use of a systems approach.

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A thesis for a Master's degree is only one step in a long process. In this case this process lasted for four years, and therefore recognitions are due to a lot of people.

In chronological order, I would like to thank Dr. P.D. Mitchell who accepted me into the Diploma of Computer Assisted Learning, Dr. D. Beckwith and Dr. G.M. Boyd who encouraged me to seek admission to the Master's of Art programme, and to my dear friend Claudette Dupras who helped me overcome the worst language hurdles. Further, I extend my deepest thanks to my thesis supervisor, Dr. R.M. Bernard for his perseverance and moral support and for teaching me the techniques, methods, processes, and tools neçessary to finish this thesis. Special thanks are also extended to my thesis commmittee members, Dr. S. Shaw and Dr. R. Schmid, for their interest in, and comments, on this project.

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Chapter 1

Rational

> "The systems environment is the set of all entities, a change in whose attributes affects the system, and also those entities whose attributes are changed by the behaviour of the system."
>
> McMillan, C & Gonzales, R.F. (1969)

This study stems from an ongoing discussion among academics about what is educational technology (e.g., Lumsdaine, 1964; Saettler, 1968; Engler, 1969; Tickton, 1970; Davies, 1971; Silber, 1977; Mitchell, 1977; Hawkridge, 1981; Ely, 1983 & - 89; Heinich, 1968, 1984, 1990; Eraut, 1989), its advances and declines (Mitchell, 1986, 1989), its traps (Bernard, 1986; Beckwith, 1988), the relationships between theory and practice (A.E.C.T. Task Force; Ely, 1983; Hortin, 1988; Winn, 1989) and what practitioners in the field do (Mitchell, 1975; Rosset & Gaborsky, 1987; Spitzer, 1987; Eraut, 1989). Common to these professional attempts to clarify the conceptual structure of the field appears to be the orientation that educational technology is based on the application of a systems approach to educational problems intended to change educational practices. Most of these efforts to define educational technology aim at clarifying the conceptual framework of the field to guide research and practice. However, these views are constructed from expert or professional material, meaning that experts have mostly been synthesizing what other professionals say and then philosophizing, i.e., looking critically at the field of educational technology.

In this study educational technology is observed as a man-made, complex, open and adaptive system (Braham, 1973), where the components are both its professionals and its students, two groups which interact and influence the field. The construct "educational technology" is created using three parts that cannot be studied apart, but must be seen as a whole: an educational part, a technological part and a philosophical part.

Education is considered as the subsystem responsible for "self- and social optimization, participation, and adaptivity of the learner system" (Braham, 1973). Braham (1973) further explains education as including both learning and teaching, however with a unified goal, namely to facilitate learning for all at all ages. This view is further supported by Leedham (1975) who stresses the concept of life-long education which extend beyond institutions, thus being made available to all. Technology is thought of as the subsystem that facilitates the goals of education, "by its tools, processes, products and procedures" (Steering Group of

Educational Technology, 1975). The third part, the guidance or theoretical framework component refers to systems thinking, which is identified as the linking mechanism that guides the activities of the two other subsystems.

This conceptualization of educational technology appears congruent with the classification scheme used by Plomp and Pals (1989), where three main categories of educational technology are discerned. There is ET1 which centres around the physical media assisting the teaching and/or learning procedure. This concept has also been classified as a hardware concept by Davies (1971) and as the product concept by Romiszowski (1981). ET2 stands for processes, techniques and methods used for developing, designing and evaluating instruction. This concept is characterized by stepwise procedures (e.g., first needs assessment, then definitions of objectives, selection of methods, development of resources, testing, evaluating and implementing the design model, Kaufman, 1983). Other names for this concept are the software concept (Davies, 1971) or the process concept (Romiszowski, 1981). ET3 is represented by a philosophical, holistic approach or the systems approach, characterized by a problem-solving methodology, where the problem is analyzed in its own context and where as many facets as possible, relevant to the solution, are taken into account. This classification scheme is used as the underlying structure to clarify relationships between the professional model and the student model.

This study refers to a particular organizational system, the Educational Technology Master of Arts programme at Concordia University considered from the inception of the program in 1968 until December 1989. The main purpose of this study was to describe and clarify relationships among its historical emergence and evolution, philosophy, founders and students.

Two sub-studies were carried out. Study one attempted to answer questions concerning whether there is a set of core concepts of Educational Technology seen through the eyes of entering students and whether and how their conceptualization of educational technology has changed over the years. The main objective of the second study was to examine the content of students' theses by period and to investigate what changes might have occurred over the years.

The goal of this thesis was thus to compare and contrast the Concordia University M.A. students views with the professionals in the field, in order to describe their differences and similarities concerning core concepts of educational technology, and how the field might have changed over the years. Further, the objective was to investigate students' reasons for entering and how the students demographics have changed since the inception of the program. A secondary purpose was to derive a methodology that would facilitate treatment of large data-bases, consisting of both directly observable and latent variables (constructs).

Chapter 2 provides a discussion of methodological issues in conceptual analyses. Relevant definitions and a historical overview of the provenance and subsequent evolution of educational technology are summarized in a conceptual map. Since this thesis, to a large part, relies on multivariate statistics, a brief overview of underlying theories for interpretation and assumptions is provided. This chapter also includes a specific problem statement and a set of detailed research questions for each study.

Chapter 3 describes the overall design as well as the sub designs for study one and two, the operational definitions of variables, the participants, materials, procedures and statistical analyses that were used.

Chapter 4 includes the results from the cross-tabulations, factor analyses and discriminant function analyses for both study one and two, a synthesis of the professional literature and the Concordia University Calendar.

Chapter 5 discusses findings and proposes a conceptual map of Educational Technology constructed from both the professional and the student model. Finally, a discussion of further development of methodological issues and possible applications within the field of educational technology are addressed.

Chapter 2

Literature Review

> "It is only the attempt to write down your ideas, that enables them to develop".
>
> Ludwig Wittgenstein (in Drury, 1982).

Conceptual analyses: Methodological Issues

In carrying out this specific conceptual analysis, it became evident that methodology was a problem. Thus, the following discussion is an attempt to clarify the methodological framework that underlies this thesis.

Conceptual analyses can be described as a method of defining a concept in a manner that the concept can be unambiguously used in at least specific contexts and hopefully also in related contexts, that is "... improving our understanding ... by clarification of the conceptual apparatus" (Scheffler, 1966, p.4). The fundamental idea behind carrying out a conceptual analysis is to facilitate and optimize communication and to clarify thought, in other words to clearly define a construct or concept. Specific methods are manifold (Wilson, 1963; Frankena, 1965; Ackoff, 1969; Mitchell, 1977). However, a general model or a meta-model for carrying out these analyses is difficult to find (personal communication, Mitchell, 1990). According to Peters (1963) one of the worst pitfalls, when analyzing a concept, is to look *only* to its lexical meaning. Even though lexical meaning gives some information, looking for how a concept is used by its users (members of the user group), both in its empirical and theoretical sense, better clarifies meaning.

According to Wilson (1963), the first and most important step is to formulate a conceptual question that will isolate the impending problem from the target concept. Hence, to define a concept it is useful to describe or relate situations where the contextual meaning is clear, so called model or paradigm cases. Wilson further states that from that point on, different approaches can be equally beneficial, e.g., to describe situations that are non-examples, borderline cases, imaginary cases and related cases.

Frankena (1965) explains conceptual analysis basically as two lines of reasoning. The first one deals with the theoretical and philosophical aspects of the target concept and the second with empirical or scientific and practical line of reasoning. Conclusions are shown in a map-type diagram, where the relationships among sub-concepts and the target concept are represented. He suggests that a list of criteria of contextual usage is created in order to formulate the main focus of the target concept.

Closely related to these strategies for defining a concept is a technique called historical analysis, that aims to critically examine how a concept emerges and how it changes over time (Kerlinger, 1973). Historical analyses use primary and secondary sources, where primary sources are original documents, such as records, minutes etc., and secondary sources are one or two steps removed from an original document, such as a newspaper account is of a meeting. It is considered as a major historiographical error to use secondary sources whenever primary sources are available. It appears that historical analyses are especially valuable in educational contexts, because "... it is necessary to know and understand educational accomplishments and trends of the past in order to gain perspective on present and future directions" (Kerlinger, 1973, p. 702).

Bagozzi and Fornell (1984) in their argument for the value of multivariate statistics in defining the meaning of concepts, show "that it (multivariate methods) serves as a foundation for scientific explanation" (p.24). They defend this by contending that a theory consists of a system of concepts built upon accepted hypotheses that relates the independent, intervening and dependent variables.

All these techniques appear heuristic in nature, the search for an unknown goal, where the questions continue until a *suitable* [to the context], and *meaningful* [to most members of that context] alternative is found. Once "descriptors" are found, an attempt to extract a set of criteria that will include all cases and exclude all non-cases is constructed and tested. If this is successful a strong definition can be formed. Mostly, if criteria or elements can be put into a rule or syntax, then a contextual meaning can be described and defined, which could then be understood and utilized by all members of that particular community.

Intrinsic to all these types of conceptual analyses are methodologies, that is, the specific design or model used to carry out the research. Depending on the source, some methodologies appear more suitable than others. In this study four main sources of data were available: 1) the professional literature dealing with the conceptual framework and definition of educational technology; and 2) the Concordia University Calendar; 3) entering students' original admission forms; and 4) finishing students theses. Therefore, the two first sources will be considered as primary sources of a non-measurable type constituting the professional model. The two latter sources are judged as measurable and quantifiable, and admissible to analysis using multivariate statistics, since a holistic perspective is desirable. It will be argued that multivariate analysis is a suitable methodology for creating the student model.

The overall research question of this study was "What is educational technology and how is it conceptualized over time both by its professionals and its students entering the field?" The target concept which was investigated is educational technology, the two main sub-concepts are education and technology, thus leading to a discussion of theories, methodologies, fields of research, practices, and ideologies invested in these concepts by its members.

A Historical Overview

What is educational technology?

It has been argued that educational technology has its roots with the ancient Greeks, who practised systemized techniques for teaching and learning and who viewed technology as combining the "theoretical with the practical" (Saettler, 1978). Others (Cambre, 1981; Reiser, 1987) see it as a maturation of the audio-visual movement in education and instruction stemming from the training programs developed in the army during and immediately after the First World War. Morgan (1978) and Popham (1980) link the roots of educational technology to the mastery learning and programmed instruction movements, naming James Finn, B.F. Skinner, Bob Mager and Bob Glaser in the fifty's, as the forerunners.

Common to the above mentioned authors and to many other sources (e.g., The A.E.C.T. Task force, 1977; Hawkridge, 1981; Ely, 1988; the International Encyclopedia of Educational Technology, 1989) is the idea that the foundations of educational technology are derived from theories and practices in management science, communications and behaviourial sciences, which were applied to the problems of teaching and learning in education and training.

However, there appears to exist an agreement on the fact that Arthur Lumsdaine coined the term educational technology in 1964 (e.g., Davies, 1971; Council of Europe, 1975; Popham, 1980; Hawkridge, 1981; Ely, 1988; Plomp and Pals, 1989), when he distinguished between two aspects of educational technology. The first meaning refers to the application of the physical sciences or engineering technology. This is a hardware or product (Romiszowski, 1981) concept, where the importance of teaching aids, mechanical or electromechanical devices such as A/V, TV and film equipment, is stressed and where the physical science applied to education is emphasized. The second concept refers to a software or the process approach (Romiszowski, 1981), and can be illustrated as the stages of instructional design, (e.g., performing a task analysis, writing performance objectives, selecting appropriate learning and teaching strategies, doing constant evaluation and the inclusion of motivational theories to improve learning). Lumsdaine goes on to argue that the interaction between these two concepts will "provide a better control over the learning situation by providing a richer array of stimulus material (e.g., through motion pictures)", and also by "providing for interaction between the responses of the learner and the presentation of instructional material" (Lumsdaine, 1964, p. 372).

Lumsdaine's division of educational technology into two conceptual dimensions is criticized by Davies (1971), who contends that such a division is "unfortunate", and that there is a need for a "new" whole view, meaning the systems approach and referred to by Romiszowski as the problem-solving approach. According to Plomp and Pals (1989) the systems approach emerged from the physical and management sciences, and is characterized by a holistic view where an educational problem has to be analyzed in its context and has to include the most important factors that determine the problem and its solution. Davies (1971) explains this approach as follows: "where both task and human, of the learning system, assists to determine how each of the many constituent parts interact with each other" (p. 13). He further names it educational technology (3), and describes its main purpose as " a conceptual framework able to deal with problems stemming from the needs of an education or training system to survive, grow, and develop the capacity to adapt and to manage change" (p. 16). In 1978 Davies furthers this view by stating that it is not only the systems or problem-solving approach but criticism, or evaluation, that has to become the underlying theory of educational technology in order to enhance understanding of complex human learning.

Hawkridge (1981) disagreed, in the same manner as Davies, to Lumsdaine's two dimensional concept of educational technology and criticized him for not providing any philosophical assumptions to guide both research and practice. He further contended that if educational technology is to achieve telesis (i.e.,"progress intelligently planned and directed" (p.4), then theoretical foundations have to be "understood, explained and formulated" (p.5). His literature search evolved into a conceptual map describing the different domains and subdomains relevant to educational technology (e.g., learning theories linked both to CAI and instructional design), and where a systems or problem-solving approach encompassed both a hardware or product as well as the software or process dimension. He further stated that this is not a final view, and he predicted that a book on foundations of instructional (educational) technology will be written.

In 1987 such a book was edited by Gagné, which confirms the broadness of the field, meaning that it consists of theories from many disciplines, both physical and cognitive sciences. The importance of a systems approach to education, including both products and processes, which is emphasized in the statement: "a total approach to facilitate learning", that according to Reiser (1987) defines the uniqueness of the field.

This book raises another ambiguous issue, which is inherent to the definition of educational technology, namely the difference between instructional and educational technology. It seems that in most conceptual or philosophical literature dealing with the foundations and emergence of the field the terms are used interchangeable (e.g., Heinich, 1968 1984; Hawkridge, 1981; Ely, 1984; Reiser, 1989; Winn, 1989).

However, this distinction appears clear when referring to the difference between education and instruction (e.g., Winn, 1989; Seels, 1989; Romiszowski, 1981; Mitchell, 1977; Braham, 1973). This difference between education and instruction is explained as follows: Education is seen as the aggregate of life-long learning processes during which a person develops abilities, attitudes and other forms of positive values in the society in which she or he lives. Further, it does not necessarily include a teacher. On the other hand, instruction implies a deliberate, predetermined and goal-oriented interaction between a teacher and at least one student. But this definition does not necessarily include learning. It is seen as a subset of education (Romiszowski, 1981). One explanation for this ambiguity in the use of instructional versus educational technology might arise from the fact that early institutions of educational technology mainly recruited students having both teaching education and teaching experience. Therefore, since teaching knowledge and experience was present, it seems educational technology departments emphasized courses in the audio-visual field rather than educational methodologies (Mitchell, 1977; Goldberg, 1980; Smith, 1984; Rossett & Gaborsky, 1987; The Concordia Calendar, 1968-1989).

Another explanation might stem from the rapid development and success of instructional systems design in education and training (Mager, 1977; Markle, 1977; Jonassen, 1989; Romiszowski, 1981; Banathy, 1968, 1987). In the present study the following distinction will be adopted. When referring to instructional technology, its definition will be congruent with instructional design movements and principles, and viewed as the practical dimension of educational technology.

Heinich (1984) stressed another point that contributes to the ambiguity of educational technology. He contended that it lies in the term technology itself. He explained the meaning of technology as the systematic collection of evidence and the problem-solving approach used in engineering and applied to education or training, and insisted that this orientation should constitute the basis for the field. Further, he argues that "the field is better considered as a subset of technology in general than as a subset of education"(p.67), however, this argument would exclude education, and therefore, not specify the context to which technology is used.

However, the term technology has many different connotations depending on by whom and in what context the term is used. Its meaning ranges from hardware and software products to methodologies, techniques and processes, and, therefore, deserves a clarification in order to define the field of educational technology.

What is technology?

Since the largest contributor to the ambiguity of the field appears to be the term technology, an attempt to clarify the meaning of this concept is dealt with primarily. First of all, the term technology is composed of "techno" which in Greek means art or craft and logia which means theory. The term theory refers to the analysis and construction of a set of facts and their relationship to one another, that can be verified (Bagozzi & Fornell, 1984). Analyses in turn is defined as "the separation of a whole into its component parts" (Flew, 1979). Hence, the term technology could linguistically be defined as "the crafting of a theory", which then indicates both the conceptual and empirical side of theory building.

The following definitions will underlie the clarification process:

1) " ... organization of activities designed to assist human adaptation to, participation in and utilization of the environment. ... it has an objective character. It concerns the manipulation and use of the external world, of the acts, objects and processes in the environment. ... it applies to a standardized and repeatable sequence of actions with the appropriate instruments, ..." (Braham, 1977, p. 71 - 72).

2) "We ... define technology as tools in a general sense, including machines, but also including such intellectual tools as computer languages and contemporary analytical and mathematical techniques. That is, we define technology as the organization of knowledge for the achievement of practical purposes." (Mesthene, 1970, p. 25).

3) "... technology [is] the deliberate, rationalized, and

standardized application of knowledge for the purpose of attaining some predetermined end". (Tesconi, & Van Cleve,1972, p. 6)

4) "[technology] encompasses all those forms of knowledge and technique which account for man's growing mastery over his physical environment and for his increasing ability to achieve human goals." (Rosenberg, 1971, p. 543)

5) " technologia is the systematic treatment of an art, that can take three meanings: 1) technical language; 2) a) applied science; b) a technical method of achieving a practical purpose; 3) the totality of means employed to provide objects necessary for human sustance and comfort." (Websters New Collegiate Dictionary, 1979, p. 1188).

In comparing these definitions, three main themes appear to be present: a) deliberate actions on the physical environment; b) the use of tools and techniques; c) applied to predetermined, practical and humanistic purposes or goals.

It seems that definitions 1, 4 and 5 are emphasizing the empirical part of what "technology" can do for humans by specifying that it "assists in the adaptation processes", that it concerns "man's mastery over the physical environment" and that it aims "to provide objects necessary for human sustance and comfort". Therefore, my most important criterion will be that technology must "serve human goals".

Definition 2 stress the use of scientific techniques and man-made tools, which I will call the hardware approach. Definitions 2 and 3 emphasize the application of knowledge for the purpose of attaining organization of knowledge, standardization and systematization of knowledge in order manipulate or master the physical environment. This implies effectiveness as a second criterion for the term technology.

They all agree that technology is somehow to manipulate the physical environment in order "to increase the ability" or "to achieve, attain" human goals" . The fact that the actions are "deliberate" and "predetermined" in relation to the goal implies "efficiency", which will constitute a third criterion.

"Acts, objects, and processes", "tools, and intellectual tools and processes", "application of knowledge", "knowledge and techniques", and "methods, means, and objects" indicate the threefold aspect of technology, including tools/devices, techniques, methods, processes and products that are standardized and repeatable and can manipulate and utilize the physical environment in such a way that human life is facilitated and/or enhanced.

The term 'education' appears to be less unclear, and is defined in Webster's dictionary as: 1) the action or process of educating or of being educated; 2) the field of study that deals mainly with methods of teaching and learning. Or as stated by Braham (1973) "education is the process of increasingly intentional self-optimization of individual and social life" (p.69). Toffler (1970) proposes a similar view in which he states that education is the process of adapting to and dealing with societal change, and where the main purpose should be to devise and to teach "survival=learning strategies".

Towards a definition

In 1977, AECT conceptualized educational technology in the following manner:

" Educational Technology is a complex, integrated process involving procedures, ideas, devices and organization, for analyzing problems and devising, implementing, evaluating and managing solutions to those problems involved in all aspects of human learning"(p.1).

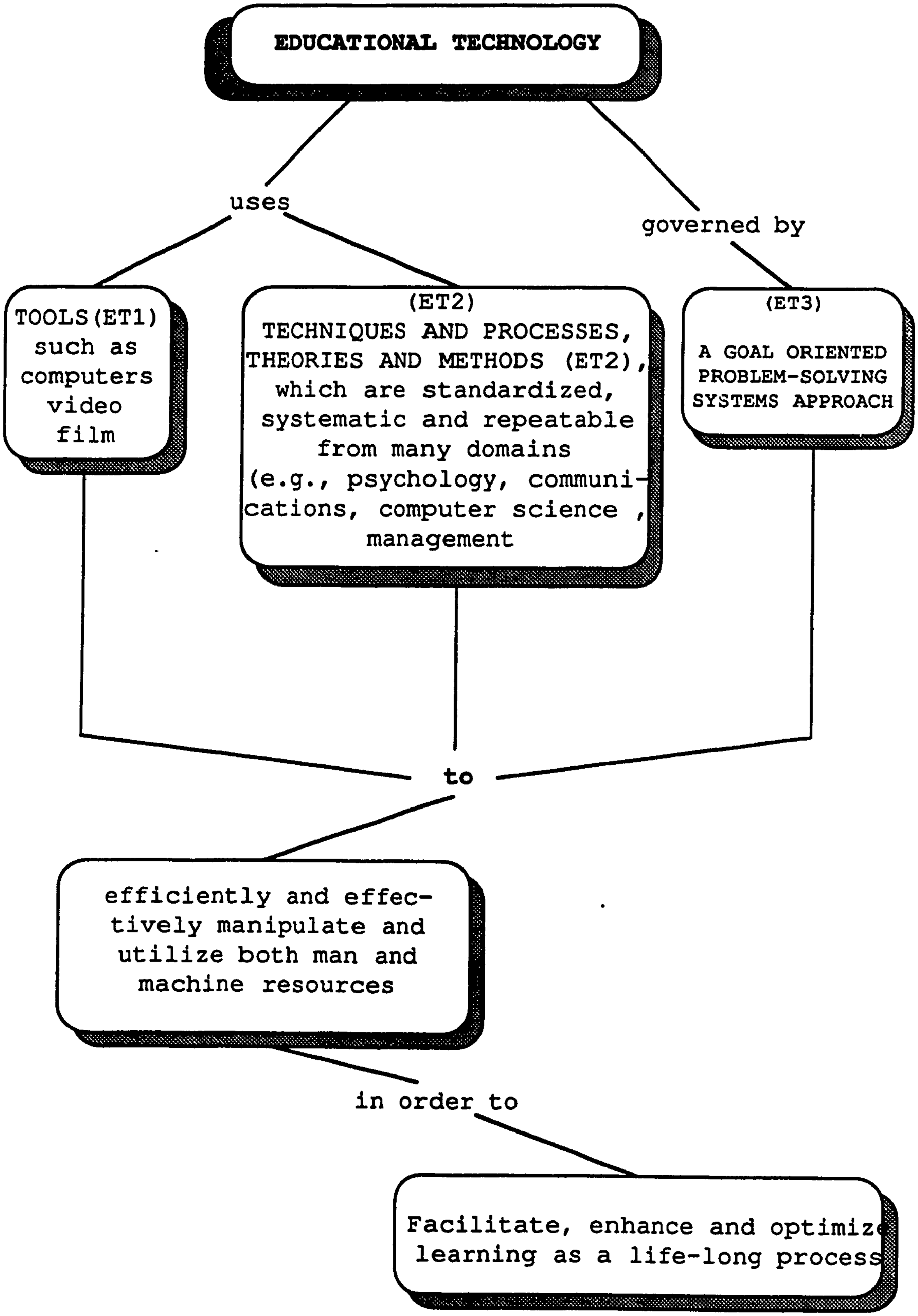
Ely and Plomp (1988) contend that "... educational technology is nothing more or less than a methodology for solving educational problems", reducing the field to a process concept. This statement is defended by an argument, emphasizing "... when solving educational problems one has to draw not only upon many disciplines, ... but also of theories of methodology, ..."(p.9). Finally, they conclude that educational technology, as a problem-solving process for teaching and learning, is "the current thinking derived from actual practice" (p.16).

This definition appears to emphasize a broader meaning of educational technology, implying a methodology for solving educational problems. Closely related to this definition is Mitchell's (1977) description of the "discernible roles" of an educational technologist. His description of the educational technologist as a learning consultant, educational materials producer, manager of learning resources, systems developer and planner, emphasized the importance of "theory and practice" walking hand in hand.

Even in the 1989 edition of the International Encyclopedia of Educational Technology the account of the functions of the educational technologist refers to the same roles as encountered in Mitchell's 1977 description, albeit in a slightly more detailed manner, where 18 functions are enumerated (Ely, 1989; p.25). Throughout these functions the importance of research and evaluation in order to improve "human learning" is emphasized. Other sources (Duchastel, 1989; Educational Media and Yearbook, 1988; Barrow and Milburn, 1986) further support this view and stress the point that the "learner" is to be put in the middle of all research and/or developmental activities.

Linking definitions and analyses together appears to yield a description of educational technology as a field of study concerned with efficient and effective learning, as a life-long process, in order to enhance, facilitate and optimize conditions of human life. In an attempt to visually describe the most important subconcepts, a conceptual map is presented in Figure 1 on page 21.

Figure 1. Conceptual Map of Educational Technology



Why Multivariate Statistics?

Since all the conceptual analyses reviewed in this thesis emphasize the importance of integrating as many aspects of the concept as possible in order to describe and define it in a way it that is unambiguously understood, it appears that multivariate analyses are called for. This thesis also deals with human systems, the professional as well as the student population of educational technology. In human systems, it is close to impossible to isolate one independent variable that causes a change in one other dependent variable, which is what univariate statistics treats. Multivariate statistics, on the other hand, provides a system of analysis and method of building complex models in cases where many independent and dependent variables are present and somehow correlated with, as opposed to causing, one another (Tabachnick & Fidell, 1983).

Multivariate statistics are especially useful when creating, confirming or testing models of "real life" situations. This could be described as the attempt to extrapolate the most important (i.e., statistically significant) dimensions/clusters of variables that influence a certain phenomenon, which is expressed by the canonical correlation coefficient.

Multivariate methods allow the consideration of multiple measures innate to a particular problem and are sensitive to how they change in relation to each other, which then can be said to describe a phenomenon closer to its natural complexity (Hardyck & Petrinovich, 1976) Therefore, it was felt that a brief overview of available methods and underlying assumptions would be indispensable.

Depending upon the research question(s), different models are available, which all build on the general linear model. These can be categorized into four major types:

1) degree of relationship among variables (bivariate r; e.g.one-way ANOVA/ANCOVA)
2) Significance of group differences (multiple R; e.g MANOVA)
3) Prediction of group membership (hierarchical R; e.g. MANCOVA, discriminant function analysis)
4) Structure (canonical R; e.g., principal-component; factor analysis (orthogonal or oblique); path analysis)(Tabachnick & Fidell, 1983; Loehlin, 1987).

Multivariate models dealing with the affective domain can be described as the modelling of peoples values, beliefs and attitudes (latent=a set of IDs) in relation to directly observable and easily measured variables such as, e.g., age, origin, performance scores. Measurement is one of the problems inherent to the investigation of the affective domain. According to Bagozzi (in Dillon & Goldstein, 1984) measurement is in part conceptual and in part empirically linked through a formal model. This differs from the traditional view, where measurement is a procedure apart, instead of being a direct part of the theory building (Bagozzi, 1984). He terms this formal model "the holistic construal" of measurement, where non-observational behaviour (latent variables) can be traced through structural equations, which are provided through factor or path analytical models. The structural equation is tested for a "goodness-of-fit", including procedures for estimation of the error of measurement derived from the residuals (an analysis of unexplained variance), which "go well beyond, conventional regression analysis and analysis of variance" (Jöreskog & Sörbom, 1984).

One of the major problems using multivariate statistical models is interpretation. Therefore, the "holistic construal of measurement"-theory appears as a reasonable solution to aid in the final interpretation of a series of multivariate statistical analyses. "Holistic construals" incorporates both theoretical (what others have found) and empirical (how is it measured) meaning or conceptualization of a latent variable structure (Fornell, 1982). According to Bagozzi and Fornell (in Dillon & Goldstein, 1984) a complete interpretation of concepts is achieved through the delineation of the conceptual (theoretical), empirical, and spurious (i.e., error of measurement coefficients) meaning, which are comprised in more sophisticated models like the LISREL (Linear Structural Relationships) model (Jöreskog, 1985). Tabachnick and Fidell point out the importance of having a 'good' (at least 200) sample size as one of the major factors influencing the interpretability of factor analysis, since it is extremely sensitive to sample size. Further, they advise strong theoretical support before setting hypothesis to guide the interpretation of dimensions (i.e., the latent variables). The choice of factor analysis in this study is justified by the large number of variables supposedly measuring (describing the same phenomenon "edtech") the same construct: educational technology. Factor analysis is an adequate empirical technique when the goal is to simplify a mass of crude data in order to find patterns of relationships that could provide suggestions for explanation.

As a conclusion to this review, it can be assumed that multivariate methods are appropriate when dealing with complex systems such as concept building, where a large sample size is present, and where both latent and directly observable variables are present, and where a description of relationships rather than a causal model is sought.

Problem Statements

The following problem statements refers to the two sources contituting the student model.

Study 1. The purpose of this study one was to compare the student model at Concordia with the professional model in the literature in order to investigate: a) whether a set of core concepts of educational technology exists; and b) how changes in conceptualization occur over time. A secondary goal was to look at changes in demographics over time, such as professional and personal background data.

Study 2. The aim of this study was to further enrich the description of the student model. It is believed that the content of the students' theses will also reflect what the field is about, what changes might occur, whether it tends towards classical research designs or qualitative studies (i.e., experimental versus case studies/evaluations) and whether one subject area is more common than another (as measured according to "reasons" factors in study 1).

Specific Research Questions

Study 1.

- Where do students come from? (age, location, educational background, professional experience)
- Have demographics changed over the years?
- Why do students enter the Educational Technology program?
- Have reasons for entering the program changed over the years?
- Is there a set of core concepts of Educational Technology?
- Are there concepts that have emerged and vanished?
- What are possible factors that influence these changes?

Study 2.

- Is there a discernable change in thesis content over the three periods reflecting changes from study 1?
- Can thesis content according to ET1, ET2 and ET3 be predicted by demographics, supervisor affiliation and REASONS for entering?
- Can a model of statistically significant relationships among demographics, reasons, concepts and theses be found?

Chapter 3

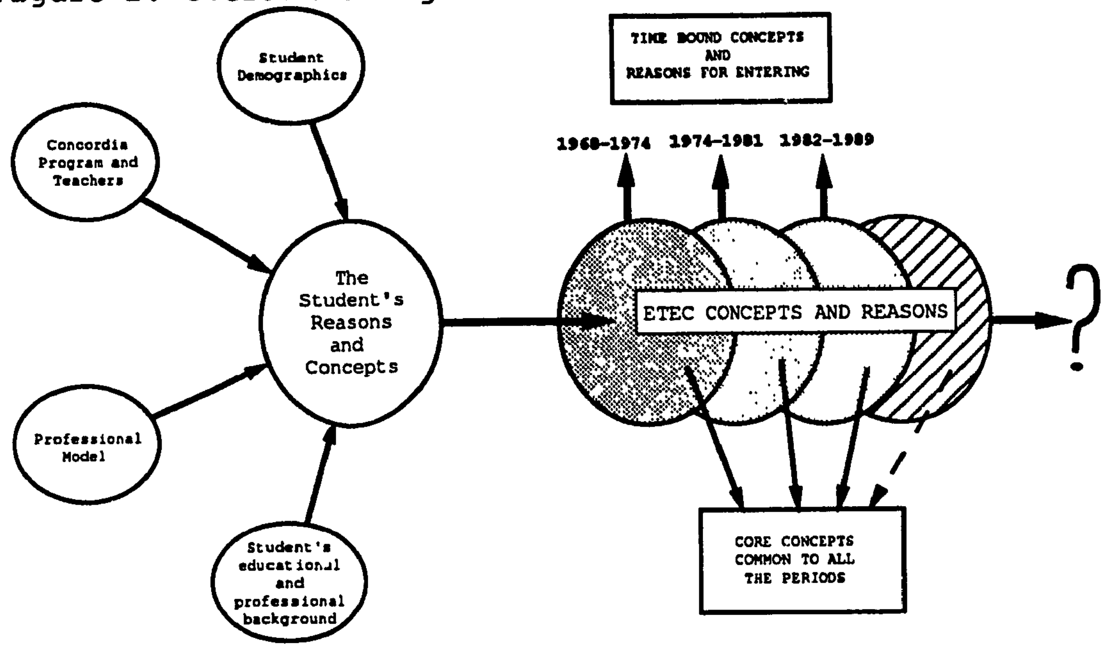
METHODS

Design

This study builds on two types of research designs, one for the overall conceptual analysis and one for each of the two sub-studies. The overall design derives from historical research methodology (McMillan & Schumacher, 1984, p. 277). This in turn refers to this conceptual analysis of educational technology, where the sources of information were the Concordia program calendar from 1968 to 1989, a review of pertinent literature over the three time periods, the results of study one and two. Studies one and two are defined as *ex-post facto* designs.

Historical research focuses on changes in emphasis or clarification of concepts, goals of institutions or movements, where the sources of data are documented facts (e.g., enrolment records, institutional minutes etc.), oral testimonies (e.g., participants in a historical event) and relics (textbooks, maps, materials) (McMillan & Schumacher, 1984, p.280). The intention of the historical researcher is to explain and/or describe an event or concept from as many different perspectives as possible and to suggest multiple causes of an eventual fluctuation in a particular problem. Figure 2 gives a schematic view of the design used in this study. It aims at modelling how a set of core concepts, relevant to educational technology, might be founded, and how they might change over time.

Figure 2. Overall design

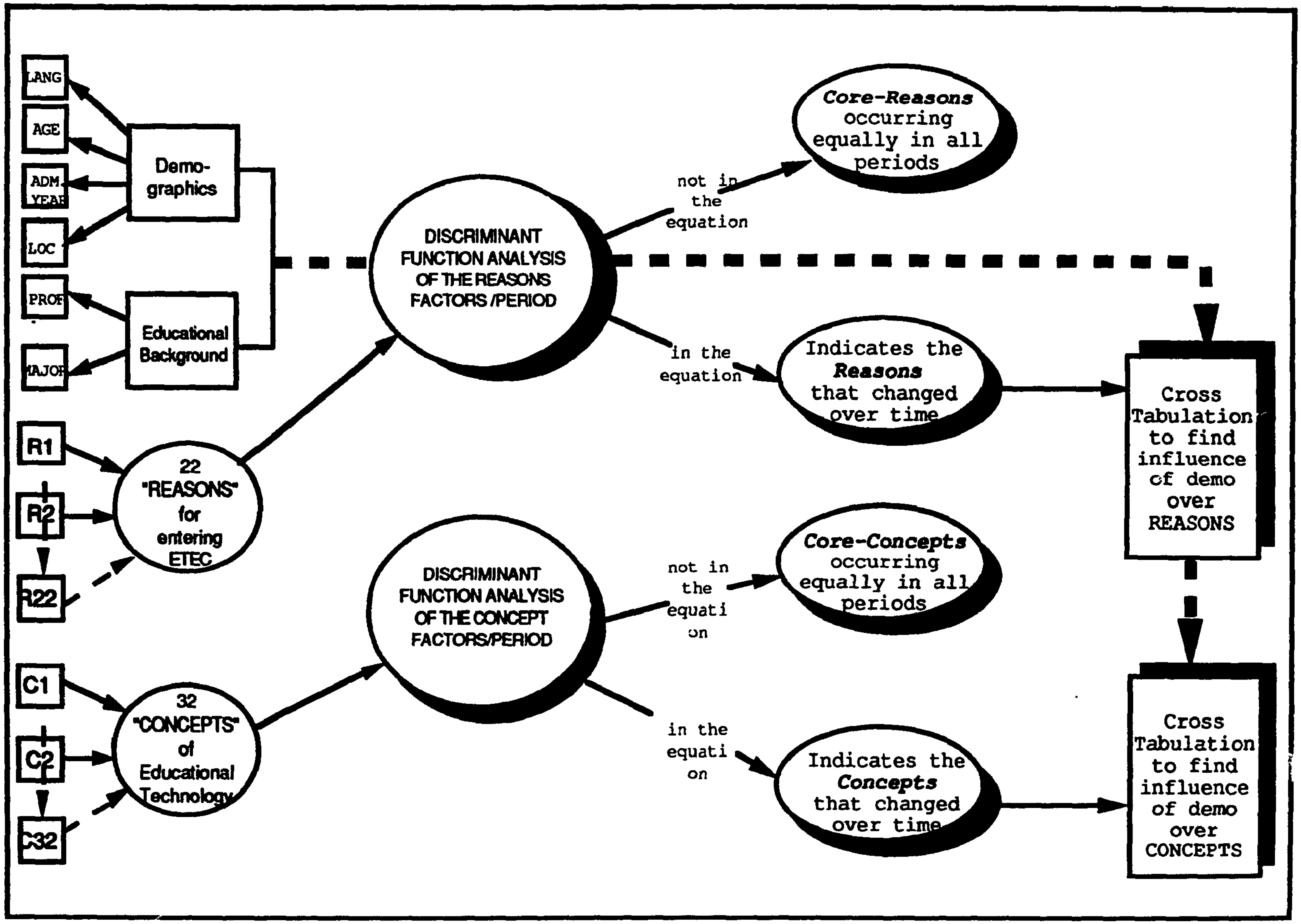


One of the primary limitations of *Ex post facto* designs is the fact that all variables, by definition, are not subject to manipulation, since they have already occurred in time (Kerlinger, 1974). However, they can be explored in a way that designates certain variables as independent, that is, invoking some kind of change. Thus, the purpose of these types of designs is to investigate whether one or more pre-existing conditions can predict subsequent differences in groups of subjects. Inherent in these types of design are multivariate statistics, which reflect the importance of clusters of variables. Closely related and often confused with *ex post facto* designs are *correlational* research designs, which only look at the linear relationship between two variables in the same group. On the contrary, *ex post facto* designs compare parameters from two or more groups.

Study 1 used the *ex post facto* design to investigate how demographic (DEMO), educational (MAJOR) and professional background (PROF), *REASONS* (R) and *CONCEPTS* (C) varied between the three periods. Students admitted to the program from a) 1968-74; b) 1975-81; and c) 1982-89 constitute the groups for this design. A graphical demonstration of how the design, the variables and their relationship are viewed is attempted in figure 3 on page 30.

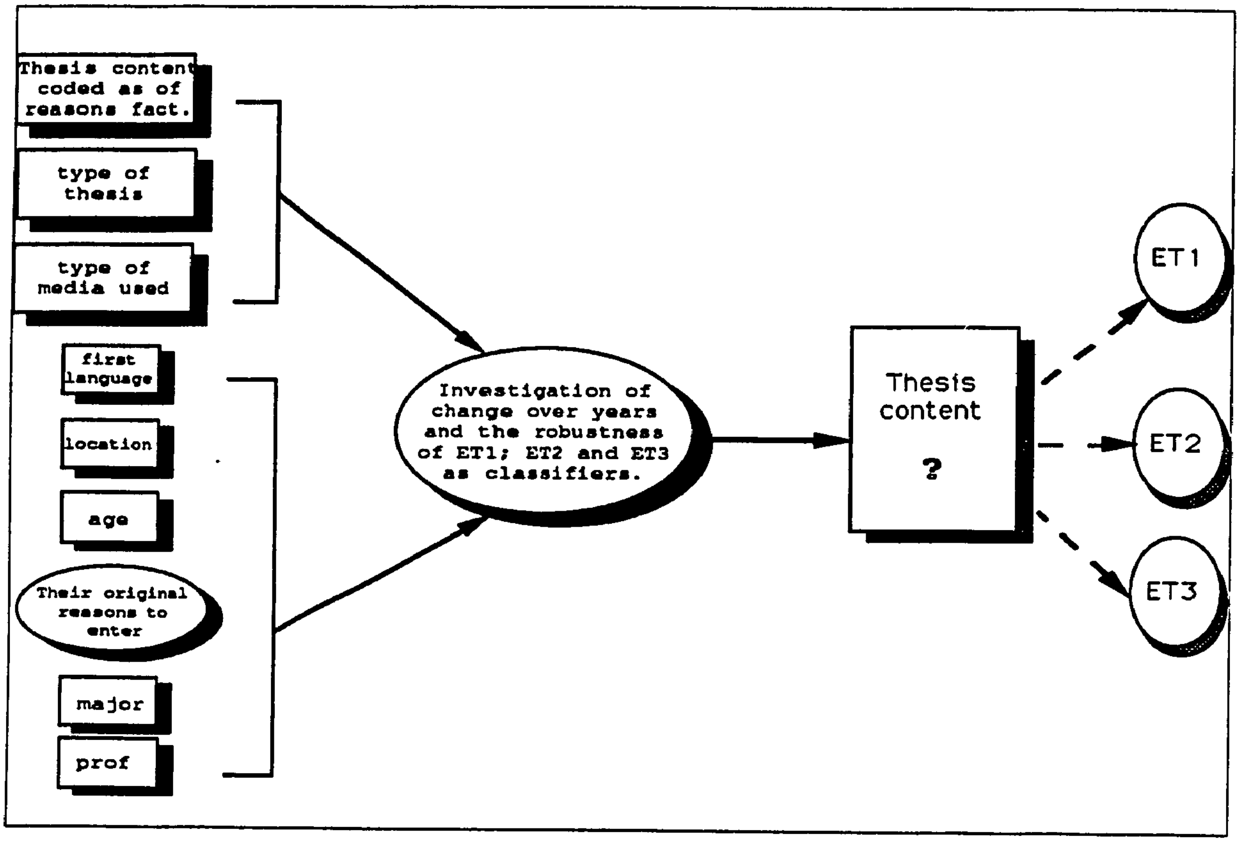
Study 2 is also classified as an *ex post facto* design, which focused on the influence that demographics (i.e., the students' majors in their B.A. program, professional background (work experience), REASONS for entering and their supervisor's main activity classified according to ET1,ET2 and ET3) have on thesis content (dependent variable). Figure 4 on page 31 displays a graphical representation of this design.

Figure 3. Graphical representation of Study 1



▭ = directly observed variables ◯ - latent variables

Study 4. Design for Study 2



Participants

Study one (1). The participants in this study consist of 408 students who were admitted to the Concordia M.A. programme in educational technology from its inception in 1968 to December 1989. This sample accounts for an estimated 60% of the total population. About 630 students are estimated to have entered the program, however, records of students that leave the programme for any reason are not kept more than five to ten years (Brown-McDougall, personal communication, 1990).

Of these 408 students 21% (n=82) was drawn from period

1, 1968-74, 29% (n=120) was drawn from period 2, 1975-81, and 50% (n=206) was drawn from period 3, 1982-89.

Study two (2). A 40% (N=98) quasi-random (SPSSX) sample was drawn from the sample in study 1 on the basis of their status, namely having completed all the requirements for the M.A. programme. Of those 36% (n=36) were sampled from period 1, 1968-75, 41% (n=41) from period 2, 1975-81, and 21% (n=22) from period 3, 1982-89.

Common to all the Study 2 students is the fact that they have gone through the whole program, including 4-6 obligatory courses (depending on period), 6-8 optional courses, an eighty (80) hour internship and have defended a thesis in either Option A: Research in of Development of Educational Technology or Option B: Production and Evaluation of Educational Materials (e.g. TV, radio, film, AV, CAI, etc).

Materials

Study 1 and 2. The first source of information for both studies consisted of the regular student admission forms that provided demographic, educational and professional background data. The second source of data came from a supplementary admission form used by the program of Educational Technology since its inception in 1968 (See Appendix A). This supplementary form includes two short essay questions where the student is asked to write down his/her responses to:

1) "What are your reasons for entering the Educational Technology Programme?" (henceforth REASONS)

2) "What is your conception of Educational Technology?" (henceforth CONCEPTS)

The answers to these questions ranged in length from approximately 100 to 300 words, where the main ideas were selected to represent the student's views in up to 10 reasons for entering and 15 for conceptualization of educational technology.

Study 2. This study provided supplementary information about the field of educational technology through the investigation of 98 theses at Concordia University. The information extracted from this source was: a) the main activity of the student's supervisor; b) the thesis content according to type of research method; and c) how it could be described in terms of REASONS factors. The supervisor's main activity, as well as the content of the thesis, was classified according to the definition of ET1, ET2 and ET3 (Plomp & Pals, 1989)

Procedures

Study 1. Due to the exploratory nature of Study 1 the only preplanned strategy was the preparation of the code book (see Appendix B), which describes the decisions on which demographic variables were included and how to code them. It should be noted that the categories within MAJOR, PROF, REASONS and CONCEPTS (see appendix B) were <u>not</u> made up in advance, since this would bias and direct the research. It is to be stressed that the study aimed at finding out what entering students thought before they started the program in order to build a student model as free as possible of preexisting theories and/or ideas about why students entered and how they conceptualized educational technology.

Coding. Records were coded in alphabetical order, hence assuring the random appearance of year of admission. This was considered one of the main criteria, since the primary purpose of the study was to investigate whether core concepts were present, as well as changes over time periods.

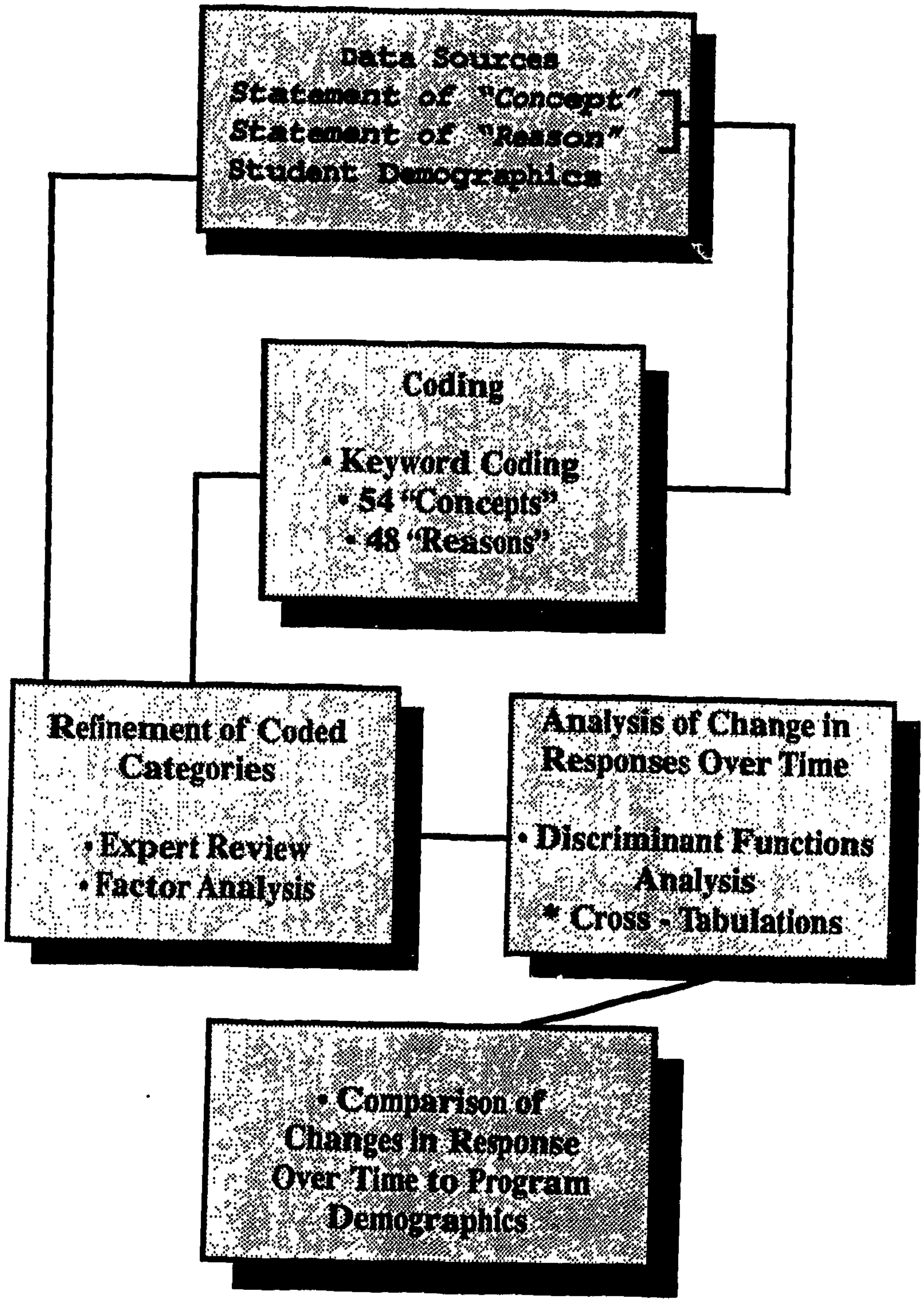
For each subject, the demographics were collected from the regular admissions form, where the categories for MAJOR and PROF were registered during the coding procedure. If students came from the same discipline or profession the same code number was used, if not a new category was created. Geographical location, language, and highest degree were preconceived categories (see appendix B.) For the first hundred subjects two coders were employed in order to get some estimate of reliability.

Concerning the categorical variables REASONS and CONCEPTS these were extracted from the original, written student statements using a keyword technique similar to that used in identifying "idea units" in verbal learning studies (Kulhavy, Schmid & Walker, 1977). These keywords or descriptors were coded numerically, ranging from the first concept found (#1) to the last (#54) (see Appendix C, pp. 117 -120). Space was left for up to ten REASONS and fifteen CONCEPTS, thus forming a floating variable, which was later transformed into a fixed variable by using a SPSSX tagging procedure, hence transforming a discrete variable (categorical) into a dichotomous variable (either present or not; that is 1 or 0). Earlier transcripts yielded more new keywords than later transcripts. Of the 48 keywords identified for REASONS and the 54 keywords found describing CONCEPTS, more than 50% were derived from the first 50 transcripts of 408. It is interesting to note that no new keywords were derived from the last 50 transcripts.

This technique required independent assessment and therefore the categories derived were scrutinized by two experts in the field of evaluation and educational technology. The outcome of this expert evaluation resulted in groupings of the derived categories, hence 22 categories of REASONS (Appendix C, p.118) and 32 categories of CONCEPTS (Appendix C, p.120) were created. These categories were subsequently employed as the basis for the statistical analyses. These steps are graphically represented in Figure 5 on page 36.

Study 2. With help of the statistical package, SPSSX (1986), a quasi-random sample of 98 students was identified. All variables had fixed categories. To describe a thesis in terms of REASONS factors up to 5 factors were allowed, however, more than four were never used. The variables coded according to the ET1, ET2 and ET3 concepts derived from professional model, used the thesis abstract and conclusions as the underlying source of information for this classification procedure. Before coding took place, consent was reached among several professors in Educational

Figure 5. Method of Investigation



Technology Program at Concordia, on how to classify the supervisor's main activity according to ET1, ET2 and ET3 (see pp. 3, 39-40).

Operational Definitions of Variables

Study 1: *Data gathered from 408 entering students*

A. Demographical Variables

- *year of application (YA)*: can vary from 68 to 89
- *location* (LOC): describes in 16 categories the geographical origin of the applicant
- *birth year* (BY): gathered to calculate age at the time of admission
- *age*: YA-BY= AGE (constructed using SPSSX features)
- *mother tongue* (LANG): three categories 1) english 2) french and 3/ other
- *highest grade obtained* (HBO): four categories were obtained: 1) B.A. 2) M.A.; 3) Ph.D.;4) Other, e.g., when a student was accepted on the grounds of experience
- *B.A. major (MAJOR)*: 49 categories were derived and were clustered into 7 groups: 1) education ; 2) psychology; 3) linguistics 4) miscellaneous 5) administration 6) natural sciences and 7) communications
- *professional background (PROF)*: 40 categories were derived. They were grouped into 1) educational; 2) technological; and 3) managerial functions

- *number of ETEC courses* (CONC): 1) 0 courses 2) 1-5 courses 3) 6 or more ETEC courses
- *number of relevant courses outside ETEC*(RELCO): this variable was coded as a numerical value with no indication from what related ETEC domain. However, it included courses from the following domains: communications, management, computer science behaviourial sciences, philosophy and statistics. It was considered as a non-reliable measure and was only used as an exploratory and verifying variable. Grouped into 1) none 2) 1-5 courses and 3) 6 or more courses
- *status at data collection* (STATUS): This variable refers to a) whether the student was still in the program, then the number of years was numerically coded b) whether the student was on extension, expelled or withdrawn c) if finished, the graduation year was coded (years:70 - 89)

B. Outcome Variables

- *reasons for entering the ETEC M.A. programme*(RW): this variable was derived using a keyword technique. Up to ten REASONS could be coded for each student.
- *total number of REASONS* (TRW): for each student the total number of REASONS were numerically coded
- *student's concept of ETEC* (CET): this variable refers to how students conceptualized educational technology at the time of their entry. These categories were derived

by the same keyword technique as the REASONS. Up to fifteen (15) descriptors per student were allocated.

- *total number of CET* (TCET): a numerical counter of how many keywords were used by each student in order to describe ETEC.

Study 2: Variables pertaining to the 98 students theses

A. Predictor variables

- demographics: same as in study 1
- thesis supervisor (SUP): this refers to the main activity within educational technology performed by the student's supervisor. This activity was classified according to the definitions of educational technology: ET1, ET2 and ET3 and verified by several Concordia faculty members.

B. Outcome variables

- *thesis content belonging (TBEL)* aimed at finding out the relationship between supervisor and thesis content according to the classification : ET1, ET2 and ET3 (p.3).
- *thesis content according to REASONS factors*(THESIS): aimed at finding out the relationship between what student said their reasons were for entering with what they actually did for their thesis work. The nine factors (9) derived in study one were used. A total of 5 factors were allotted, however 4 were maximally used
- *type of thesis (TYPE)*: coded as either 1) Experimental 2) Case Study or Survey 3) Philosophical/Conceptual 4) Evaluations (summative or formative) of instructional

materials.

- *type of media that was studied or evaluated (MEDIA):*
  1) TV; 2) Video; 3) Computer; 4) Slide tape; 5) AV;
  6) Text based material; 7) Film productions

Statistical Analysis

Study 1. The first procedure to be executed in order to facilitate the multivariate statistical procedures was frequency counts on all variables. This is standard procedure for checking accuracy of data files and was, hence, performed for both studies. It also assisted in defining the sample and in looking for possible variables that could serve as suitable predictors for grouping (e.g., coming from inside the department versus outside, finished versus not finished).

This analysis was followed by the preparation of the tagging procedure for both the REASONSand the CONCEPTS data (see appendix F, pp. 129 - 130) to enable factor and discriminant function analyses, since floating variables are not possible.

Factor Analyses

The second analysis refers to the factor analyses performed on first the REASONS and then the CONCEPTS variables. While the individually coded REASONS and*CONCEPTS* provide detailed information about a student, factor analysis reveals the structure of students global response (kind of an average), that is REASONS for entering and the multi-dimensionality of their CONCEPTS of educational technology.

This structural reduction was done by using a principal-components analysis with varimax rotation. Twenty-one rotations were necessary to maximize the explained variance, R^2= 62% for CONCEPTS and R^2= 56% for REASONS. The number of factors identified was determined by the scree test of the eigenvalues, the loadings on the eigenvectors, and by the stability and interpretability of the rotated factors. This procedure resulted in 14 factors for CONCEPTS and 9 factors for the REASONS. Since so many factors with an eigenvalue of more than 1 were found, this was interpreted as an indication of the multi-dimensionality of both Educational Technology and students reasons for entering the program. Therefore, they were used in a univariate sense, only describing groups of conceptual clusters.

When prediction of a specific behaviour is sought (the result of a factor analysis, i.e.,the structure of the latent variables) this behaviour is expressed as factor score for each student. The factor scores can subsequently be used as dependent variables to discriminate and/or predict group-membership, with e.g., discriminant function analysis or MANOVA (Tabachnick & Fidell, 1984, p. 377).Each individuals factor score was saved on an outfile and used in the discriminant function analysis. These scores can take values between 0 and 1, with a mean of 0 and a standard deviation of (±)1, and can be compared to a regular z-score.

Discriminant Function Analysis

Since the major goal of the discriminant function analysis is to predict group membership on the basis of a variety of predictor variables, in this exploratory study numerous discriminators were attempted before the arbitrary time periods 1) 1968-74; 2) 1975-81 and 3) 1982-89 were found to best describe how educational technology changes.

Scrutinizing the frequency analysis, one of the first assumptions of discrimination was to distinguish between students who had gone through the educational technology diploma programs (CAL and DIT), and those who had not. No interpretable results or significant differences were found. Another division that was tried out was between students who finished the program and who had not. A third division between males and females, revealed no statistically significant results or even interesting differences. Further reading and screening of frequencies pointed at year dependency, where the arbitrary division of the three time periods emerged.

Variables were entered into the equation by using Rao's V, which is a generalized measure of the overall separation between groups of variables. This procedure produces a stepwise analysis of the equation, thus an automatic decision on which of the variables that should either be included or excluded in the final equation constituting the structure. This procedure can be manipulated by asking for variables to enter in a pre-determined fashion (SPSSX Manual, 1987;

Tabashnick & Fidell, 1984). However, since the study aimed at as little manipulation of data as possible, the automatic procedure was chosen to be the most relevant.

Study 2.

This study included a frequency count in order to describe and compare this sample with the overall student profile found in Study 1. The cross-tabulation of background data and REASONS analysis over the three periods was performed to better depict the student population. A discriminant function analysis using the ET1, ET2 and ET3 classification as groupings and the variables from Study 1, was executed to investigate whether thesis content can be classified and anticipated to a statistically significant degree.

In order to use the classification procedure, Box's *M* was calculated for testing homogeneity of variance-covariance matrices among groups. If this test shows no significant difference, $p > .05$, it can be assumed that the variance-covariance matrices do not deviate among groups defined on the grouping command. This means, that the null hypothesis is not rejected, and the groups can be considered as a correct random sample, even if group sizes are very different (Tabashnick & Fidell, 1984)

Chapter 4

RESULTS

Introduction

This conceptual analysis used four sources: the professional literature and the Concordia University Graduate Calendar; analyses from Study 1 and analyses from Study 2. The first two sources consist of the professional literature, books and journals within educational technology dealing with historical overviews, definitions and descriptions, and course and curricula descriptions according to the Calendar.

This chapter is separated into two sections, the professional model and the student model. The professional model is further divided into main ideas the literature and major changes in the curricula for each period. Each period will be concluded with a set of descriptors pertaining to summarize main themes for each period. An overview is provided on page 58.

This is followed by an overview of frequency distributions of demographics comparing Study 1 to Study 2, then the overall results from the factor analyses and the discriminant function analyses. Then results from cross tabulation on each factor that changed over demographics both CONCEPTS and REASONS are reported. A summary tables is provided. Finally, the results from Study 2 will be reported.

Professionals: Period 1: 1968 - 1974

This period can be characterized by its search for and derivation of an identity acceptable to members of the educational technology community. In the beginning the movement was fuelled by the interests of communications' people and regular teachers. Its practice was mainly focused around how to integrate audio-visual aids into educational situations. However, it was soon realized that a conceptual framework was necessary in order to organize and define the field of study called educational technology (Heinich, 1968; Tickton, 1970). This framework is based on philosophical assumptions, (i.e., principles, theories, methodologies and practices) underlying the systems approach used in management and the physical sciences. These assumptions were subsequently translated into educational terms. They were aimed at solving educational problems, whether the problem was to integrate audio-visual aids in education or to develop new curricula that was supposed to adapt to technological and societal changes (Eraut, 1989; Council of Europe, 1975; Davies, 1970; Banathy, 1968).

In his opening address at the 'Conference on Programmed Learning and Educational Technology' in 1968, Kenneth Richmond stressed the necessity for a conceptual framework that could guide both the theory and practice of educational technology. He contended that a "sophisticated educational technology" will be typified as a self-correcting system, always striving to find new and better solutions to educational problems. Banathy (1968) expressed the overall purpose of educational development as the creation of new alternatives for the improvement of educational practice. Davies (1970) and Braham (1973) also promoted a goal-directed and disciplined systems approach as a necessary foundation for research and practice. Tickton (1970) emphasized the need for 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.5)

In these early days of educational technology most of the emphasis was laid on how to use hardware (i.e., TV, A/V, and Film), mostly to promote mass communication/education, but also computers for educational purposes, either as a management tool or an aid in instruction. This hardware view brought with it the acknowledgement of the field's need for interdisciplinary knowledge. Teachers became media specialists after going through educational technology programs, and saw themselves as facilitators for teachers and administrators, capable of designing instruction where media was incorporated (Kerr, 1977; Eraut, 1989). This view was met with resistance especially by teachers in the field who wanted the media, but not the design of instruction.

Boyd (1971) outlined the reasons why educational technologists need technical knowledge and skills in order to perform their job. He contended that technical knowledge was required in order to be able to: a) deal with people; b) develop software; and c) appraise hardware, hence confirming the idea of the educational technologist as a "school media consultant" capable of both developing instructional materials and solving problems pertaining to implementation.

Another line of thinking in this first era of educational technology was that the main purpose of the field was to improve the school system, helping teachers use media at all grade levels in an effective, efficient and appropriate way. However, the desire to include instructional design among the duties of the media consultant or educational technologist met with a lot of opposition from teachers and most of the time they were considered only as media specialists, organizers or hardware specialists (Kerr, 1977).

The field was highly influenced by the communication movement (e.g., mass-communication, McLuhanism) on the one hand, and by the behaviourists on the other. Programmed learning and behaviourial objectives for mastery learning came out of this latter theoretical perspective (e.g., Skinner, Mager, Glaser, Popham). Educational evaluation was separated into formative (Scriven, 1967) and summative evaluation of educational materials (Cambre, 1981).

The Concordia Program

Congruent with these movements the Concordia program offered educational film and television development, production and evaluation. The entry requirement was a B.A. in teaching and/or teaching experience, and if this was not met, pre-requisite courses in education were assigned, keeping the educational part of educational technology intact. It was thought that producing educational technologists with an educational background was essential.

"The intention of the programme is to introduce a high degree of professional and academic competence into the rapidly developing field of educational technology. This is a field which is having a major impact upon educational theory, teaching, learning, curriculum design and school organization" (The Concordia Calendar, 1968-1974). Contrary to traditional educational programs, emphasis was put on a need for change of educational practices.

The courses put emphasis on teaching, instruction, communication, however, incorporating education courses on philosophy, psychology, sociology of education and statistical methods as obligatory and by 1974 these courses were specific to educational technology. Courses and laboratories on TV production were offered, including topics like research, writing, editing, how to apply information systems' and communication systems theory. In 1971 systems analysis courses were introduced where educational problems on planning and innovation were treated. Educational Cybernetics was proposed as a special subject.

Conclusions for this period lead to descriptors like:

- conceptualization of educational technology, including what skills and knowledge are necessary

- educational film and television
- mass communication
- media specialist or consultant
- formative evaluation
- a goal-directed systems approach to educational problems
- rapid educational change both in the curricular and learning methods

Period 2: 1975 - 1981

As a milestone, the meeting of the Council of Europe, Steering Group on Educational Technology in Strasbourg (1975), designated the beginning of this period by a sincere attempt to establish an acceptable and appropriate conceptual framework for and definition of educational technology. The outcome of this meeting was the adoption of a definition of educational technology, described as the optimization of human learning, technology as "the tools, techniques and methods necessary for effectiveness" and a systems approach "that will ensure that needs, values and efficiency measures are taken into account" (p.4 & 23). Further, they presented four main concepts to be considered a) the Hardware concept that included the "application of physical science and engineering technology for educational purposes"; b) the mass-media concept was characterized by immediateness, openness, and fitness for the learner (e.g., continuous education) c) the systems' concept meaning "optimization of the whole"; and d) the interactionism concept promoting increased learner control.

Leedham (1975) presented 'Continuous Education' or 'lifelong education' as the main theme for the 1975 Conference of Educational Technology. This concept included not only that education should be a life-long activity, but that it should be accessible to all. It encompasses distance education, night courses or customized education and training for developing nations. Hubbard's (1975) opening address is an elaboration of this theme, where his stratagem for successful life-long education lies in "facilitating access and stimulating interest in existing opportunities" (p.18), pointing out the it is "general right rather than a restricted privilege" (p. 17). He further stressed that the role educational technology should play is to provide learning resources in all forms and to design appropriate and effective learning situations, thus emphasizing learning as a opposed to teaching.

The A.E.C.T. task force (1977) adopted three aspects of educational technology, namely as a theory, a field of study and a profession all concerned with educational problem solving, where theory guides study, which in turn guides the practical side of the field. They also pointed out the importance of systematic stepwise strategies within the systems approach in order to obtain efficiency and effectiveness of instruction. They went on to explain what an educational technologist is and described it as follows: "anyone who performs one of the tasks or activities of one of the functions of educational technology in relation to learning resources, in terms of the theory, employing the intellectual technique, in the field of educational technology" (p.135). Criteria were defined to attempt to make educational technology into a profession. These criteria stemmed from a statement made by James Finn in 1953, which could be summarized as follows: that a person belonging to a profession "must spend a majority of his/her time performing one or more of the Domain of Educational Technology functions related to the learning resources" (p. 137). Mitchell (1975) outlined five possible functions of the educational technologist in an attempt to define the professionals of the field. He describes the roles as follows: 1) learning consultant; 2) learning resources manager; 3) materials Producer; 4) Systems Developer; and 5) Educational Planner. This combined A.E.C.T's efforts into a composite of roles, including the three conceptual parts of educational technology as expressed by many professionals of the field (Davies, Romiszowski, Plomp and Pals), the systems approach, the hardware concept and the software concept. Elaborating on this theme, Mitchell (1981) attempted to answer the question about what the educational technologist does. Through a conceptual analyses of the field, he came up with a detailed description of a curriculum for preparing both the general and specialist educational technologist. These discriptions stressed the importance of interdisciplinarity, general knowledge of learning theories, perception, motivation, production and special research, evaluation and systems analytic skills.

The task force's efforts to make educational technology into a defined field of study and a profession brought forth many discussions of what educational technology was, is and will be (e.g., Morgan, 1978; Saettler, 1978; Gagné, 1980; Popham, 1980; Hawkridge, 1981). Common to these analyses is the attempt to establish the roots, definition of educational technology and to outline alternative futures of the field. They were all somewhat critical of the promises of educational change and emphasized that "the hardware" stamp that has been put on educational technology must be reduced. More stress, they said, had to be put on the capacity to solve educational problems in order to win a wider acceptance from educational institutions and decision makers. Hawkridge (1981) stressed the importance of conceptual and philosophical analyses of the theoretical foundations of the field, and came up with a conceptual map describing educational technology. Multi-disciplinarity in particular was identified as a defining factor. He further contended that telesis educational technology (purposeful direction) required a thorough and ongoing "analysis, synthesis and analysis again" (p.17).

The Concordia Program

At Concordia the intentions of the programme stayed the same until 1980, where a change to the Calendar indicated what careers that a finishing student would be qualified for. These careers were listed as "learning consultants, producers and evaluators of educational media, designers of instructional materials and systems, managers of learning resources and educational planners." The courses in this calendar were organized into 11 headings, ranging from education, communication theory and systems analyses to TV and Film production and management of learning resources, thus, displaying the inter-disciplinarity of the programme.

Available for the first time in 1979/80 at Concordia is the Diploma in Instructional Technology (DIT), offering acceptance with advanced standings to the M.A. programme, hence fulfilling the promise of accessibility to continuous education. Computer Assisted Instruction and Computer Based Systems were offered in this period. In 1980/81 Educational Information Systems were introduced under a separate heading, including "simulation and gaming" and "small computer systems for teachers and trainers". This indicated the upcoming availability and introduction of micro-computers in the public schools systems.

Descriptors for this period could be

- continuous education
- learning resources
- distance education

- education for developing nations
- ETEC "hardware", "software" and systems concept
- educational problem solving, systems analysis
- multi-disciplinarity
- collaboration
- computers in education

Period 3: 1982 - 1989

As a beginning of this period Nisbet's opening keynote address at the Association for Educational and Training Technology's annual meeting (1982), could serve as the telesis of educational technology. Essentially, he argued that theory building and research must precede practice, even though results do not necessarily indicate immediate directions. He cited especially the changes in educational practices that could be claimed by research done by educational technologists. He distinguished between the direct and indirect impact of educational research and development, where direct positive effects of innovative ideas are difficult to discern and also less important. However, the indirect effects of research is, he contended, the "long-term effects ... ; which lies in providing a theoretical base, is a rationale for the improvement of teaching" and advances cognitive psychology inherent in "... studies on memory, information processing, on learning styles and strategies" (p. 6). Further, he stressed the necessity for research-based materials and instruction, which would facilitate the tasks of the teacher, concluding that this type of research and development is the real strength of educational technology. Nisbet also argued that the availability of micro-computers in schools would produce a change in the type of research performed, meaning that research now had to focus on the learner. As a member of the quiet revolution (indirect change), he proclaimed that "a gradual but steady absorption of the ideas of educational technology into the fabric of educational practice ... becoming a part of the established conceptual framework for tackling educational issues" (p. 8) would be the way to produce "real change".

Dominating in this period, within the professional model, is the conceptualization and research of the cognitive domain (Heinich, 1984; Spencer, 1988; Reigeluth, 1987; Duschastel, 1989; Wenger, 1987; Winn, 1989). This includes cognitive theories of learning and instruction, knowledge representation and communication, seen by some as the application of educational psychology to educational problems and by others as the fruit of research in artificial intelligence (Winn, 1989; Wenger, 1987). One of the interests of instructional designers is to develop methodologies for needs assessment procedures (Kaufman, 1982; Rossett, 1987), where special emphasis is given to problem solving methods, learner characteristics and finding out whether a problem is due to the instructional unit or other factors, such as motivational problems or the physical environment.

The fact that micro-computers were introduced (at a reasonable price) both in homes, offices and educational institutions in 1982/83, brought with it not only an explosion of software and courseware production, but also a lot of problems and criticism (Berthelot, 1985; Weizenbaum, 1986). In elementary schools micro-computers were bought and installed and put to the single task of teaching children the Turtle-Logo language in order to improve their mathematical, problem-solving and critical thinking skills, which effects were studied and criticized (Papert, 1981; Berthelot, 1985; Huber, 1985). This was an initiating period and soon the "computer" was put to all kinds of uses, such as tutorials, motivational games, simulations, and as a tool to manage and facilitate administrative tasks and wordprocessing (Merrill, 1987).

This explosion of "computer uses" had an effect on the educational technology program at Concordia. The Computer Assisted Learning Diploma (offering standing credits for an eventual M.A. application) was introduced for the first time in 1984, absorbing students from educational, computer science, and industrial training backgrounds into the program. A trend towards interest in training can be discerned, when looking at what educational technologists do and where they come from. Colville (1988) reports in her thesis that 26.2% of respondents held positions as training project managers/consultants after finishing their studies at Concordia (p.39) as compared to the next most frequent job category, which was teaching/lecturing with 19%.

At the end of this period Plomp & Pals (1989) expressed and justified the classification of educational technology to be ET1 which is defined as the "hardware" or "product" concept, ET2 which is the "software" or "process" concept and ET3 which is seen as the conceptual framework consisting of a goal directed systems and problem-solving approach (p.3). This might be seen as a simplified way of defining educational technology. However, it is valuable when attempting to illustrate in a coherent manner the multi-dimensionality of educational technology.

The main change in this period could be expressed as a discernible shift which puts the foci away from the process of teaching and the development of teaching aids towards the process of learning and design of learning aids. Research shifted away from teaching and teaching strategies towards learner-controlled learning (Heinich, 1984; Wenger, 1987; Merrill, 1986; Banathy, 1987; Duschastel, 1989; Eraut, 1989).

Descriptors for this period could be:

- computer managed, computer-based instruction
- computer assisted learning
- simulation and gaming
- "real" tangible educational change
- cognitive psychology
- training
- needs assessment
- product, process and systemic conceptualization
- learning how to learn (learning strategies)

• educational technology a learning technology.

Summary of the professional model

The following table is a summary of the preceeding description of the professional model. It indicates the author's assessment of the relative presence or absence of descriptors. The "presence" of a descriptor during a particular time period is indicated by ✓. A ✗ indicates the "rare or likely absence" (since some documents from the period might not have been examined). Questionable items (not in great abundance) are indicated by a ?.

Table 1. Belonging of Descriptors Over Period

Descriptors	**1968-74**	**1975-81**	**1982-89**
CONCEPTS			
ET1 (hardware)			
Media (ETV) Production	✓	✓	?
Mass Communication	✓	?	✗
Computers in Education	✗	?	✓
ET2 (software)			
Instructional Design	✓	✓	✓
Formative Evaluation	?	?	✓
Continuous Education	✗	✓	?
Distance Education	✗	✓	✓
Artificial Intelligence	?	?	✓
Cognitive Research	✗	?	✓
Learning Technology	✗	?	✓
ET3 (Guiding)			
Systems Approach	✓	✓	✓
Educational Problem-Solving	?	✓	✓
Philosophy for Educational Change	?	✓	✓
Holistic & Futuristic	?	✓	✓
Multi/Interdisciplinary	?	✓	✓

Table 2. Roles Associated with Educational Technology

Descriptors	**1968-74**	**1975-81**	**1982-89**
FUNCTIONAL ROLES			
Media specialist or consultant	✓	✓	✗
Learning consultant	?	✓	✓
Learning Resources Manager	?	✓	✓
Materials Producer	✓	✓	?
Systems Developer	?	✓	?
Educational Planner	?	✓	?
Interdisciplinary Collaborator	✗	?	✓
Instructional Designer	✗	✓	✓
Materials Evaluator	?	?	?
Learning Facilitator	✗	✗	✓
Computer Teacher	✗	✗	✓

The Student Model: A student profile (1968-89)

The overall frequency analyses showed that the average student was a 31 year old female (57%), came from Quebec (57%), spoke English as a first language (71%), had a B.A. (88%) in either education (16%), psychology (16%), linguistics (18%), communication (15%), natural (e.g., biology, geology) or health (nursing) science (14%) or the humanities (e.g., history, anthropology) (13%). Further, she mainly came from outside the educational technology diploma courses (67%) and had some type of teaching experience (59%). Of the 408 students in Study 1, 59% have already finished the program, 19% are on extended leave or withdrawn (> 4 years), and 22% are still in the program (≤ 4 years). The mean completion time for a master's of Art degree was 4.2 years. To describe their conceptualization of educational technology they used five keywords on the average. To delineate their REASONS for entering the educational technology programme they also used an average of five descriptors.

This profile was compared to the frequency results of Study 2, and shows a very similar distribution, which confirms the reasonableness of the sampling procedure. The difference between the two samples is that Study 2 consisted of a random selection of students who had finished the whole program, including their thesis, whereas Study 1 includes all available records of students who entered the program. These results are reported in Table 3 on the following page.

Table 3. Sampling differences over periods

	1968-74	**1975-81**	**1982-89**
Study 1 (n = 408)	21%	29%	50%
Study 2 (n=98)	36%	41%	21%

This distribution is explained by the fact that the automatic procedure in SPSSX (version 3) attempts to equally sample records on the account of frequencies of all variables. Therefore, since more people in period 1 and 2 had actually finished their thesis, more records were chosen from this period. A table comparing the distributions of the demographic variables in Study 1 and Study 2 is displayed on the following page. This summary shows that only quite minor differences are present among the students characteristics in Study 1 compared to Study 2. The demographics that did show a significant change over period in Study 1 also showed a significant change in Study 2. These variables will be denotated with an *.

Table 4. Overall demographics distribution over period (S1 = Study 1 and S2 = Study 2)

Demographics	**1968-74**		**1975-81**		**1982-89**		**1968-89**	
	S1	**S2**	**S1**	**S2**	**S1**	**S2**	**S1**	**S2**
***SEX**								
Female	40%	44%	55%	54%	66%	76%	57%	55%
Male	60%	56%	45%	46%	34%	23%	43%	45%
AGE								
Mean (years)							31	28
***LANGUAGE**								
English	76%	83%	63%	51%	74%	76%	71%	68%
French	11%	9%	7%	12%	17%	19%	12%	12%
Other	13%	8%	30%	37%	9%	5%	17%	20%
***LOCATION**								
Quebec	46%	56%	48%	42%	67%	67%	53%	52%
North America	21%	14%	19%	15%	21%	24%	20%	16%
Europe	10%	8%	6%	12%	3%	5%	6%	9%
Develop.Nations	23%	22%	28%	31%	9%	5%	22%	22%
MAJOR								
Education	8%	14%	18%	15%	17%	24%	16%	16%
Psychology	12%	14%	17%	20%	18%	24%	16%	18%
Liguistics	24%	22%	17%	10%	16%	10%	18%	14%
Business	5%	1%	7%	26%	10%	19%	8%	15%
Nat. Sciences	10%	8%	16%	12%	14%	14%	14%	11%
Communications	20%	22%	15%	5%	13%	0%	15%	12%
Humanistics	20%	19%	11%	12%	10%	10%	13%	14%
***PROFESSIONAL BACKGROUND**								
Educational	71%	75%	60%	54%	53%	67%	59%	64%
Managerial	21%	17%	21%	29%	25%	14%	23%	21%
Technological	9%	8%	18%	17%	22%	19%	18%	14%
ETEC DIPLOMA PROGRAM COURSES								
None	80%	81%	74%	78%	57%	62%	67%	76%
1 or more	20%	19%	26%	22%	43%	38%	33%	24%

It is encouraging to see that it is more common for students (S1 = 67% and S2 = 76%) to be admitted from outside the program than inside (S1 = 33% and S2 = 24%) even though more and more diploma courses became available. The field also seems to attract more females than males, a significant change from earlier years. Even though a bit more than half of the students appeared to come with a professional background within education (64%), a change can be discerned. Students with managerial (23%) and technical (18%) professions seek more and more to be accepted into educational technology. The significant change found for geographical origin, results from the wave of students from third world countries who were being accepted in the mid-seventies.

STUDY 1

Factcr Analyses

Several attempts were made to construct relationships among demographics, reasons for entering and conceptualization by including all and most of these variables into the factor analysis. However, no coherent or interpretable results were found. A final decision was made to execute two separate factor analyses, the first including the 32 CONCEPTS and the second including the 22 REASONS variables, depicting educational technology, into the analysis. These analyses are treated and presented separately.

CONCEPTS. The 32 variables describing how students conceptualized educational technology clustered into 14 factors, all with an eigenvalue over 1.0, and together explained 65% of total the variance. Of these 32 variables, two did not factorize. The first variable described educational technology as a field applying theories from other disciplines and was mentioned by 29% (n=119), the other defined educational technology as a Multi-Media Model and was mentioned only by 7.5% (n=31). An exact account of which and how variables loaded onto each factor is provided in Appendix D (pp.121 - 123).

It is interesting to note the leap in variance explained from the first factor (see Table 5), and the six following. Students describing educational technology by the utilization of A Systems Approach amounted to 8.3% of the total variance, whereas Design and Development (5.9%), a Philosophy for Change (5.3%), A/V Education (4.9%), Instructional Design (4.7%), Learner Centered Methods (4.3), and that educational technology is characterized by that it Improves Efficiency and Effectiveness of Learning (4.1%), together explaining 29.2% of the variance accounted for (62%). The remaining seven factors each accounted for between 3 and 4% of the total variance. Notable is that factor 7 had one significant negative loading variable of -.46, which could be interpreted as: if a student mentioned that educational technology is concerned with improvement of learning, they would not say that educational technology is defined by mass communication or ETV.

Important to remember is that each student used an average of 5 variables, which constitutes, on the average, two factors. A summary table is provided, giving the exact values of variance explained for each factor.

Table 5. Factors identified in "Concept of Educational Technology

Loading Rank	Factor name	Variance accounted for
1.	Systems Approach	8.3%
2.	Design and Development	5.9%
3.	Philosophy for Change	5.3%
4.	A/V Education	4.9%
5.	Instructional Design	4.7%
6.	Learner Centred Methods	4.3%
7.	Improve Efficiency and Effectiveness of Learning	4.1%
8.	Use of Learning Resources	3.9%
9.	Communication and Information Theory	3.7%
10.	Distance Education	3.6%
11.	Educational Strategies	3.4%
12.	Research Based Approaches (including cognitive research)	3.4%
13.	Cost Effectiveness	3.2%
14.	Refining Educational Techniques	3.2%
Total Variance Explained		62.0%

REASONS. Nine factors were identified in REASONS entering the educational technology program had an eigenvalue of 1.0 or over, and explained 56% of the total variance. All but one of the variables factorized. This variable denotes that students wanted to enter to learn about management of education, mentioned by 103 students (see Appendix D, pp. 124 - 125).

Two larger groupings could be discerned. Educational technology is Interdisciplinary (8.9%), applies Research-based design and development (8.1%), applies Learning theories (7.4%) and is concerned with Mass Communication/ETV (6.3%), explained together 30.7% of the total variance accounted for (56%). The remaining 5 factors, forming the second grouping, consisted of educational technology works for Developing countries (5.6%); I get Professional training (5.4%); methods and hope are given for introduction of Alternative Education (5.0%); is concerned with Educational Problem-solving (4.9%); and wants to Improve Teaching Effectiveness (4.7%). Together these accounted for 25.3% of the explained variance.

Students used on the average 5 keywords or descriptors, where 2-3 keywords created one factor. A detailed description of how variables loaded onto to the nine factors is provided in Appendix D (pp. 124 - 125). Table 6 describes these factors and the amount of variance accounted for.

Table 6. Factors identified in "Reasons for entering ET"

Loading Rank	**Factor name**	**Variance accounted for**
1.	Interdisciplinary	8.9%
2.	Research-based Design and Development	8.1%
3.	Apply Learning Theories	7.4%
4.	Mass Communication (ETV)	7.4%
5.	ET in Developing Countries	5.6%
6.	Professional Training	5.4%
7.	Alternative Education	5.0%
8.	Solve Educational Problems	4.9%
9.	Improve Teaching Effectiveness	4.7%
Total Variance Explained		56.0%

Discriminant Function Analyses (DFA)

The factors identified in the above reported factor analyses just reported served as univariate variables in the following discriminant function analysis which employed the factor score value for each student. As mentioned before, several trial runs were executed before the decision was taken to do two separate discriminant functions analyses, one each for CONCEPTS and REASONS. For each of these DFA's, attempts were made to include demographics; however the findings became too confused to interpret. Therefore, cross tabulations were performed on the factors that were found to be changing from one period to another. These results are reported below.

Finally, it was decided that the three time periods would serve as the grouping variable and the factor scores derived from the two separate factor analyses as predictors. It was believed that this method would more closely answer the two main questions, a) is there a set of core CONCEPTS and REASONS; and b) which or whether these change over time? The results of these two discriminant function analyses are displayed in Tables 7 and 8 and Figure 6 (pp. 67-69).

CONCEPTS

As can be seen from these tables and the figure, only three CONCEPTS changed over the three time periods. The apparently strongest factor change pertains to Improve Efficiency and Effectiveness of Learning, which showed to be

Table 9. Factor Analysis and Discriminant Functions Analysis of "Conception of Ed. Tech" Data

Factor Analysis		Discriminant Functions Analysis				
Factors (1 - 14)	Variance (%)† Explained	Category Means (Factor Scores)			F-Ratios	
		1968-74	1975-81	1982-89	Univariate	Multivariate
Systems Approach	8.3	.05	.05	-.05	< 1	
Design and Development	5.9	-.01	.12	-.06	1.25	1.36
Philosophy for Change	5.3	-.09	-.02	.05	< 1	
A/V Education	4.9	.30	-.01	-.11	5.12	5.47*
Instructional Design	4.7	-.13	-.05	.08	1.51	1.73
Learner Centered	4.3	-.02	-.04	.02	< 1	
Improve Effiency and Effectiveness of Learning	4.1	-.33	-.32	.32	23.45	24.22*
Use of Learning Resources	3.9	-.10	-.06	.08	1.25	1.44
Communication and Information Theory	3.7	.03	-.03	.01	< 1	
Distance Education	3.6	-.12	-.16	.14	4.08	4.59*
Educational Strategies	3.4	-.11	.08	.00	< 1	
Research Based Approaches	3.4	-.14	.03	.04	1.01	1.08
Cost Effectiveness	3.2	-.04	.06	-.02	< 1	
Refining Techniques	3.2	.08	.07	-.07	1.03	1.18

†Total Variance Explained = 62%   *$p < .05$ $n = 408$

Table 8. Factor Analysis and Discriminant Functions Analysis of "Reason Why I Applied to Ed. Tech" Data

Factor Analysis		Discriminant Functions Analysis				
Factors (1 - 9)	Variance (%)† Explained	Category Means (Factor Scores)			F-Ratios	
		1968-74	1975-81	1982-89	Univariate	Multivariate
Interdisciplinary	8.9	-.39	-.19	.27	16.90	21.03*
Research-based Design and Development	8.1	-.17	-.17	.17	5.90	7.55*
Learning Theories (Applied and Research)	7.4	.01	.08	-.05	< 1	
Mass Communication (Educational Television)	6.3	.69	.02	-.29	32.66	37.27*
Developing Countries (Interest in and from)	5.6	-.21	.26	-.07	6.32	6.42*
Training for Profession	5.4	.01	-.01	.00	< 1	
Alternative Education	5.0	.10	.19	-.15	4.89	6.03*
Educational Problem Solving	4.9	.01	-.08	.04	< 1	
Improve Teaching Effectiveness	4.7	.18	.17	-.17	6.00	7.69*

†Total Variance Explained = 56% *$p < .05$ $n = 408$

FIGURE 6. Differences in mean factor score (CONCEPTS) over periods.

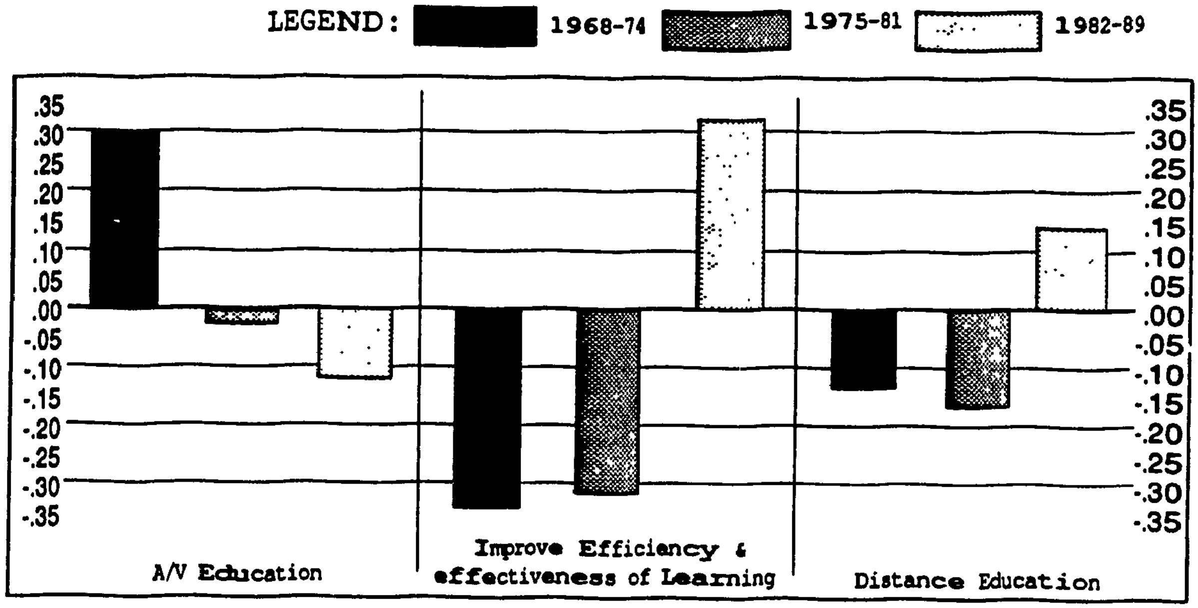
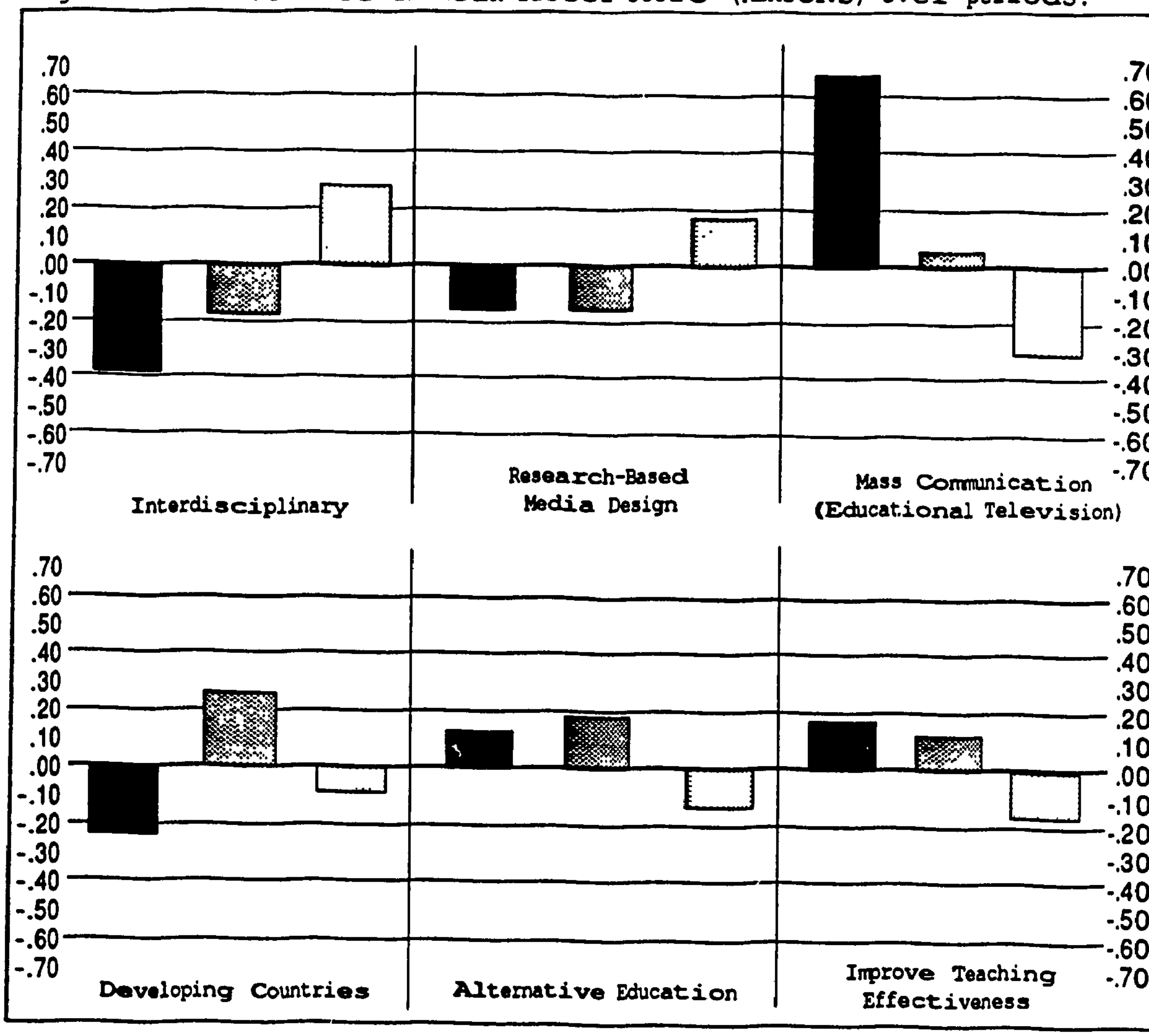


Figure 7. Differences in mean factor score (REASONS) over periods.



almost non-existent in the first two periods (mean factor score = -.33 and -.32) and about half a deviation larger in period 3 (mean factor score = .32) (keeping in mind that the mean of a factor score equals to 0, SD = 1.00). The next largest change was A/V Education ETV, which received an factor score mean of .30 in the first period, -.01 in the second, and -.11 in the third, which produced a statistically significant multivariate F-ratio ($F = 5.47$, $p < .05$). This indicates a switch from being a significant factor in period 1 to a rare category in period three. The third CONCEPT that changed was Distance Education which showed negative fscore means in the two first periods (-.12 and -.16), and then increased to a positive value of .14 with a multivariate F = 4.59 ($p < .05$).

The 11 remaining factors did not show a statistically significant difference ($p > .05$), and can therefore be considered constant over time periods, therefore composing the core *CONCEPTS* of Educational Technology. These eleven concepts might be summarized as follows:

> Educational Technology is defined by a systems approach, with a philosophy for change, including design and development of instructional designs, learner centred methods, learning resources and educational strategies utilizing research based approaches, such as cognitive psychology, communication and information theory, cost effectiveness analyses in order to refine educational techniques.

REASONS.

REASONS for entering the educational technology program were subjected to many more changes. The most dramatic change was found in the factor "I entered ETEC because I want to produce ETV programs for Mass Communication", obtaining an F = 31.27 ($p < .05$). This result seems to indicate that the emphasis of Educational Technology in the first period was mainly perceived as the production and evaluation of educational TV and film, which is also confirmed by the course descriptions from the Concordia Calendar (1968-74).

The next largest change was detected in the factor Interdisciplinary, which also had the highest singular percentage of variance explained in the REASONS taken as a whole (see p.65). It had a multivariate F = 21.03 ($p < .05$), and is explained through the mean factor scores of -.39 for period 1, -.19 for period 2, and +.27 for period three, a change which accounts for about half a standard deviation. This might indicate that Educational Technology became more and more known as an interdisciplinary field of study over the years.

Improve Teaching Effectiveness (F = 7.69, $p < .05$) can be seen as belonging essentially to periods 1 and 2, displaying positive mean factor scores (fscore = .18 in period 1 versus a fscore = .17 in period 2) as compared to period 3 where it is much less common (fscore = -.17). Research-Based Design and Development (F = 7.55, $p < .05$) changes in the same direction as Interdisciplinarity, meaning that the in first two periods it is less apparent than in the third, however less dramatic, fs = -.17 in period 1; versus fs = -.17 in period 2; versus fs = .17 in period 3.

The desire to learn about Alternative Education ($F = 6.03$, $p < .05$) appears to be more frequent in the first two periods (fs = .10 in period 1 and fs = .19 in period 2) when compared to the last period (fs = -.15). This might reflect the 'dream' of radical educational change in the public school systems as expressed by Toffler (1970), as an example.

A more frequent REASON for entering the field in the middle period was the interest in educational technology for Developing Countries, (fs = -.21 period 1; fs= .26 period 2; and fs = -.07 period 3; $F= 6.42$, $p < .05$). This might be explained by the fact that a lot of students from these countries applied for and were accepted to the program in the mid-seventies and the beginning of the eighties.

The remaining three REASONS for entering the program (all $p > .05$), Apply Learning Theories, Training for a Profession and Learn how to Solve Educational Problems appear to be the most common reasons for wanting to seek admission to educational technology. Thus, these REASONS might describe how the overall role of an educational technologist is perceived by most students from all periods:

> A professional able to solve educational problems by applying learning theories".

The fact that the reasons why people entered the Educational Technology program changed much more than the concepts of Educational Technology is interesting in itself. However, the REASONS that did not change appear to correspond to CONCEPTS of Educational Technology that did not change over periods. Simple correlations were executed and the result is provided in Table 9 (p.73), in order to substantiate these relationships (r's < .20 were not considered to display any significant relationship).

Table 9. Relationship among REASONS and CONCEPTS

	REASONS		
	Learning Theories	Professional Training	Educational Problem Solving
CONCEPTS			
1. Systems Approach			.34
2. Design and Development			
3. Philosophy for Change	-.23		
5. Instructional Design		.34	.29
6. Learner Centred Methods	**.50**		
8. Learning Resources			.36
9. Communication Theory			
11. Educational Strategies		-.27	
12. Research Based Approaches (cognitive research)			
13. Cost Effectiveness	-.22		
14. Refining Techniques			

Cross Tabulations

To further describe and explain the changes reported above, cross tabulations were performed to disentangle changes in demographics over the factors that changed. For each of these factors the significant changes in demographic, professional and educational background variables will be provided. The three factors pertaining to the CONCEPTS of Educational Technology will be presented first, followed by the six REASONS for entering the program at Concordia.

CONCEPTS

FACTOR 4: Educational Technology is A/V Education (ETV)

Ninteen percent (78/408) of the students mentioned items from this factor to conceptualize educational technology. Of those, 39% belonged to period 1, 33% period 2 and 28% from period 3. The only demographic that changed with statistical significance was first language, $\chi^2 = 9.76$; $df = 4$; $p < .05$, which can not be explained in this thesis. Table 10 shows the trends in first language as well as in professional bakground, since the latter was also close to significance ($p < .10$)

Table 10. Factor 4: ETV and Mass Communication

	Period 2	**Period 3**	**Period**
Language			
English	83%	65%	59%
French	3%	8%	27%
Other	14%	27%	14%
Prof. bkg.			
Educational	73%	52%	36%
Managerial	20%	32%	36%
Media based	7%	15%	28%

It is interesting to note that the profile of the student who chose to include this factor in his/her CONCEPT of educational technology differed from the sample as a whole. Twenty-six percent majored in communication studies (26%), whereas only 14% majored in communication studies on the whole. Worthwhile mentioning is the fact that only 4% came with a B.A. in business and/or administration as compared to the whole, where 8% belonged to this category. The other domains follow the distribution of the sample (408) as a whole, that is about 15% for each category ($p > .05$).

As shown above, they came mostly with a professional background within education (53%; $.05 < p < .10$; Pearson's $r = .32$; $p < .01$), but showing a trend to become less and less frequent.

A reasonable explanation for this factor appearing more often in period 1 than the two other periods might be the abundance of courses that was given on educational Film & TV production and evaluation in the Concordia program. A similar trend can be detected in the professional model too, where the importance of mass instruction/communication using public and internal television as the media for transfer can be discerned in the first period.

FACTOR 7: Improve Efficiency and Effectiveness of Learning

Thirty-six percent of the students (145/408) chose to include items from this this factor in their attempts to conceptualize educational technology. They distributed over periods with 10% in the first period, 15% in the second and 75% in the last period.

Four demographic variables appeared to contribute to this statistically significant change: Geographical location $\chi^2 = 39.44$; $df = 6$; $p < .01$; First Language: $\chi^2 = 16.07$; $df = 6$; $p < .01$; Professional Background $\chi^2 = 8.12$; $df = 4$; and finally the presence of educational technology diploma courses: $\chi^2 = 5.53$; $df = 2$ (See Table 11, p.76).

Table 11 Factor 7: Significant changes

	Period 1	Period 2	Period 3
Language			
English	80%	55%	69%
French	0%	4%	19%
Other	20%	41%	11%
Location			
Quebec	20%	36%	73%
N.America	20%	9%	17%
Europe	13%	5%	1%
Dev. Countries	48%	50%	9%
Professional Background			
Educational	73%	73%	51%
Management	27%	18%	25%
Media	0%	9%	24%
Diploman Courses			
None	80%	68%	52%
1 or more	20%	32%	48%

Of these, the most interesting change might be that 48% in period 3 actually had one or more diploma courses as compared to the whole sample where only 33% (p.60) came from within the program boundary, suggesting that students were influenced to mention items in this factor by the program.

FACTOR 10: Educational Technology is concerned with Distance Education.

Twenty-two percent (88/408) of the whole sample indicated their interest in items belonging to this factor. Of these, 21% belonged to period 1, 18% to period 2 and 61% to period 3. The relationship between demographics and the increased occurrence of this variable, discerned in period 3, seem to be due to the statistically significant changes in gender distribution, $\chi^2 = 6.76$; df = 2; p < .05, geographical location, χ^2 = 18,79; df = 6; p < .05 and first language, χ^2 = 10.27; df = 4; p < .05 (see table 12).

Table 12. Changes in Demographic distribution

Demographics	**Period 1**	**Period 2**	**Period 3**
		Sex	
Male	72%	44%	37%
Female	28%	56%	63%
		Language	
English	72%	56%	70%
French	22%	6%	20%
Other	6%	**38%**	9%
		Location	
Quebec	44%	19%	**61%**
N.America	22%	6%	30%
Europe	17%	0%	2%
Developing Countries	17%	**25%**	7%

The interpretation of these results appears to confirm the increase of foreign students, especially from the developing countries, during the mid-seventies (Mitchell, 1990).

One explanation for the steep increase in the occurrence of this factor in the eighties might be that Distance Education as a specific course occurred at the end of the second period, and was established as a Ph.D. speciality in the third. The professional model also supports the emphasis given to Distance Education as a specific educational problem area in the third period in North America.

REASONS

FACTOR 1: Interdisciplinarity

Thirty-eight percent (153/408) of the sample chose to include some mention of interdisciplinarity in their REASONS for entering the program. An over-representation can be discerned in the third period, with 64%, compared to the second with 25% and the first period (11%).

The average student using this factor to delineate their reasons for entering was a female (57%; $\chi^2 = 13.78$; df = 2; $p < .01$), English speaking (74%), possessing a B.A. (88%) with a major in any of the 7 domains. The professional background changes from being 77% educational, to 23% managerial and 0% media related in period 1, to 48% educational, 21% managerial and 24% from media-related background ($\chi^2 = 10.50$; df = 4; $p < .05$). Students who mentioned items from this factor increasingly tended to come from one of the diploma programs ($p > .05$; 12% in period 1; 24% in period 2; and 48% in period 3).

FACTOR 2: Design and Development of Educational Materials.

This is the most popular REASON for entering, included by 50% (203/408) of the sample, and distributed over the periods as follows: Period 1: 17%; Period 2: 27% and Period 3: 56%. This same distribution seem to be the main agent for change, since the only demographic that showed statistical significance was gender distribution, $\chi^2 = 16.01$; df = 2; $p < .01$, which showed the same changes as the sample as a whole.

However, since more than half of these students came from period 3, a description of the most common characteristics of this student will follow. She (72%) came with a B.A. (90%) in Communication studies (20%), born in Quebec (64%) and was english speaking (76%). Interesting enough the professional experience in education amounted to 49%, managerial occupations 33% and media related professions 18% as opposed to the first period, where the distribution was 60% educational, 31% managerial and only 9% from media- related professions ($p > .05$).

FACTOR 4: Mass Communication (Educational Television)

Twenty percent of the students (83/408) contributed to the creation of this factor, of those 49% belonged to the first period, 23% to the second and 28% to the third. The average student including this variable applied to educational technology in the early seventies, spoke English (77%), and majored in one of the four most common disciplines (education, psychology, linguistics or communication = together 77%). The first period attracted more males compared to the second and third period where females dominate, a significant change, $\chi^2 = 9.64$; $df = 2$, $p < .01$. A discernible trend was also found in the variable professional experience, where in the first period students had mainly educational experience (67% versus managerial positions at 28% versus Media-related positions at 6%). Compare this to the distribution in the third period where 52% came from education, 24% from Management and 24% from Media related professions. This change amounted to a $\chi^2 = 7.70$; df = 4; $p < .10$.

FACTOR 5: Interest in Educational Technology for Developing Countries

This REASON to enter the program come from 18% (75/408) of the sample, with 8% in the first period, 43% in the second, and 49% in the third period. Significant changes in demographic variables were discerned in gender distribution ($\chi^2 = 8.18$; df = 2; $p < .05$) and geographical origin $\chi^2 = 9.59$; df = 6; $p < .05$) (see Table 13, p.81).

It is interesting to note that in the first period ***nobody*** came from Quebec, whereas 76% of the total came from developing countries. This increase of 46% coming from Quebec and decrease to 27% from developing countries in the third period. It appears that the interest in developing countries came mainly from students from that part of the world in the first period and somehow changed, maybe due to more opportunities for Quebec students to work for organizations (C.I.D.A., Northern Telecom, etc.) operating in third world countries in the last period? Another explanation could be that an increase and then a decrease in students admitted from developing countries of the whole sample can be distinguished, which was a ratio of 23% versus 28% versus 9%.

Table 13. Factor 5 Over Period and Demographics

Demographics	**Period 1**	**Period 2**	**Period 3**
		Sex	
Male	88%	45%	32%
Female	12%	55%	68%
		Location	
Quebec	0%	23%	46%
N.America	12%	26%	22%
Europe	12%	0%	5%
Dev. Countries	76%	51%	27%

FACTOR 7: Alternative Education

This factor was a combination of alternative, adult and continuous education and drew students mostly from the first (34%) and second period (37%) as opposed to 29% in the third period. Of the 34% (129/408) that mentioned items in this factor for entering graduate study in educational technology, most came with an educational background (65% versus 17% from managerial positions, and 18% from media related work). The only demographic showing a significant change was language: $\chi^2 = 16.19$; $df = 4$; $p < .01$.

A possible explanation for the change in this factor is the fact that a diploma program in adult education became available within the Education Department in the early eighties, which may have attracted some student interested in this speciality.

FACTOR 9: Improve Teaching Efficiency and Effectiveness

Forty-four percent of the students (44% = 180/408) mentioned items from this factor, of those 73% came from outside the department. Most of them had a professional background in education (66%), however a decrease can be discerned over the years, 84% in period 1, 63% in period 2 and 58% in period 3 $\chi^2=10.22$; $p < .05$). This might be explained by the fact that it was clearly stated in the two first periods of the Calendar that educational and/or teaching background was necessary, and in the third this was not the case. A tendency to major ($p <.10$) in either education, linguistics or communication (about 20% each versus about 8 to 12% for the others) was found. First language changed in the same way as the entire sample, by showing an increase of the category 'other' languages in the middle period $\chi^2 = 10.59$; $p < .05$).

STUDY 2

Since the main purpose of Study 2 was to try to verify the utility of the three main concepts derived from the professional model (i.e., ET1, [Plomp & Pals, 1989] or the "hardware" [Davies, 1971; Lumsdaine, 1964], or the product concept [Romiszoviski, 1981]; ET2 or the software or the process concept, and ET3 globally referring to a goal oriented problem-solving and holistic approach ([Davies, 1971; Mitchell, 1975, 1977, 1988; Plomp & Pals, 1989]), emphasis was put on looking at those categories within the student model from two aspects.

First, cross tabulation was performed on the supervisors' main activity compared with the content of a sample of student theses. Second, theses coded as ET1, ET2 and ET3 were used as a grouping variable in discriminant function analysis. Further, simple correlations of students REASON for entering and thesis coded according to these factors were executed.

Results of Cross Tabulations

Table 4 (p.61) shows that the sample of 98 thesis possess approximately the same background characteristics as the sample in study 1. Therefore, these frequencies will not be reported here.

Of the 98 thesis, 30% was coded as belonging to ET1, 59% to ET2 and 11% to ET3. Forty-three percent used an experimental research design; 11% were case-studies or surveys; 10% were philosophical or conceptual analysis of educational technology; and 35% were evaluations, either summative or formative, of instructional materials. Thirty-five percent did not treat a specific media in their thesis (see Appendix E, p. 126).

Those theses (65%) that were coded as belonging to Design and Development of Media (REASONS Factor 2), were further classified into the type of media which their thesis dealt with. This was an attempt to find out what type of media that educational technology was mostly insvestigated, and whether a change over periods is discernible.

Table 14. Distribution of Media over three periods

Categories	Period 1	Period 2	Period 3
		Type of Media	
TV production	17%	21%	0%
Video	25%	4%	31%
Computers	8%	42%	37%
A/V	33%	16%	0%
Textual Materials	13%	17%	13%
Film	4%	0%	10%

A significant change was found $\chi^2 = 30.30$; $p < .01$), which seems to lie in the fact that TV production and evaluation decreased and Computer Software production and/or evaluation increased across periods. This confirms the finding in study 1, where ETV predominated in the first period and interest in uses of computers in education dominated in the third. The non-existence of ETV production and A/V (slide-tape production) in the third period are most probably not a correct reflection of reality, and must be referred to as sampling error. However, one can probably safely conclude that these types of media productions have become less important in later years.

The results of the cross tabulations performed on the supervisors main activity by thesis content, coded both according to ET1, ET2, and ET3 concepts and the nine REASONS factors, revealed that if the supervisor was classified as an 'ET1' person, 91% of the theses included some type of media production. Often this was found in some type of connection with learning theories (36%), alternative education project

(27%), in order to solve some educational problem (27%) or improving teaching (27%) (up to 4 factors was used to describe the thesis content). Further, if the supervisor belonged t^ ET1 most of thesis content (73%) could also be described in terms of ET1, none appeared to belong to ET3 in that case. If the supervisor belonged to ET2 the same type of phenomenon seemed to occur (70%). However, if the supervisor belonged to ET3 most of the theses were coded as ET2 (55%), 27% as ET1 and only 18% as ET3 (see Table 15, p.86). Therefore, it seems like the influence of the supervisor was quite large if they belonged to ET1 or ET2, but not if the supervisor belonged to ET3. Many possible explanations for this could be suggested, (e.g., error of measurement and coding, occasions for a certain type of investigation, etc...) and no conclusions can be made.

When looking at type of thesis, experimental investigations appear to be the most common when the supervisor's main activity was within ET2 or ET3 (45% and 42%)(see Table 15, p.86). When the supervisor's activity was coded as ET1, the most common type of investigation was to perform an evaluation (55%), either formative or summative. This information might indicate that Educational Technology uses quantitative research methods more often than it uses qualitative approaches. This would then support the CONCEPT factor, saying that Educational Technology uses Research Based Design and Development.

Table 15. Thesis content and supervisor's main activity

Factors	ET1 n=11	ET2 n=53	ET3 n=33
	Supervisor belonged to:		
	Thesis content		
Interdisciplinary	18%	37%	41%
Media production	91%	48%	62%
Learning Theories	36%	21%	35%
ETV	0%	9%	14%
Developing Countries	0%	13%	9%
Professional Training	0%	9%	3%
Alternative Education	27%	15%	29%
Problem-Solving	27%	35%	29%
Improve Teaching	27%	61%	41%
	Category of Thesis		
ET1	73%	21%	27%
ET2	27%	70%	55%
ET3	0%	9%	18%
	Type of Thesis		
Experimental	36%	45%	42%
Case Study	9%	13%	10%
Philosophical or Conceptual Analysis	0%	8%	18%
Evaulation	55%	34%	30%

Discriminant Function Analysis

A discriminant function analysis was performed to illustrate which student demographics, REASONS, CONCEPTS, and thesis content fell into the three categories of the grouping variable. This grouping variable produces two functions that discriminate among groups. A canonical correlation coefficient of .66 was produced for Function 1, and .47 for Function 2 (χ^2 = 73.6; p < .01 (df = 26,12). Rotated correlations between canonical discriminant functions and discriminating variables in Function 1 (which discriminates

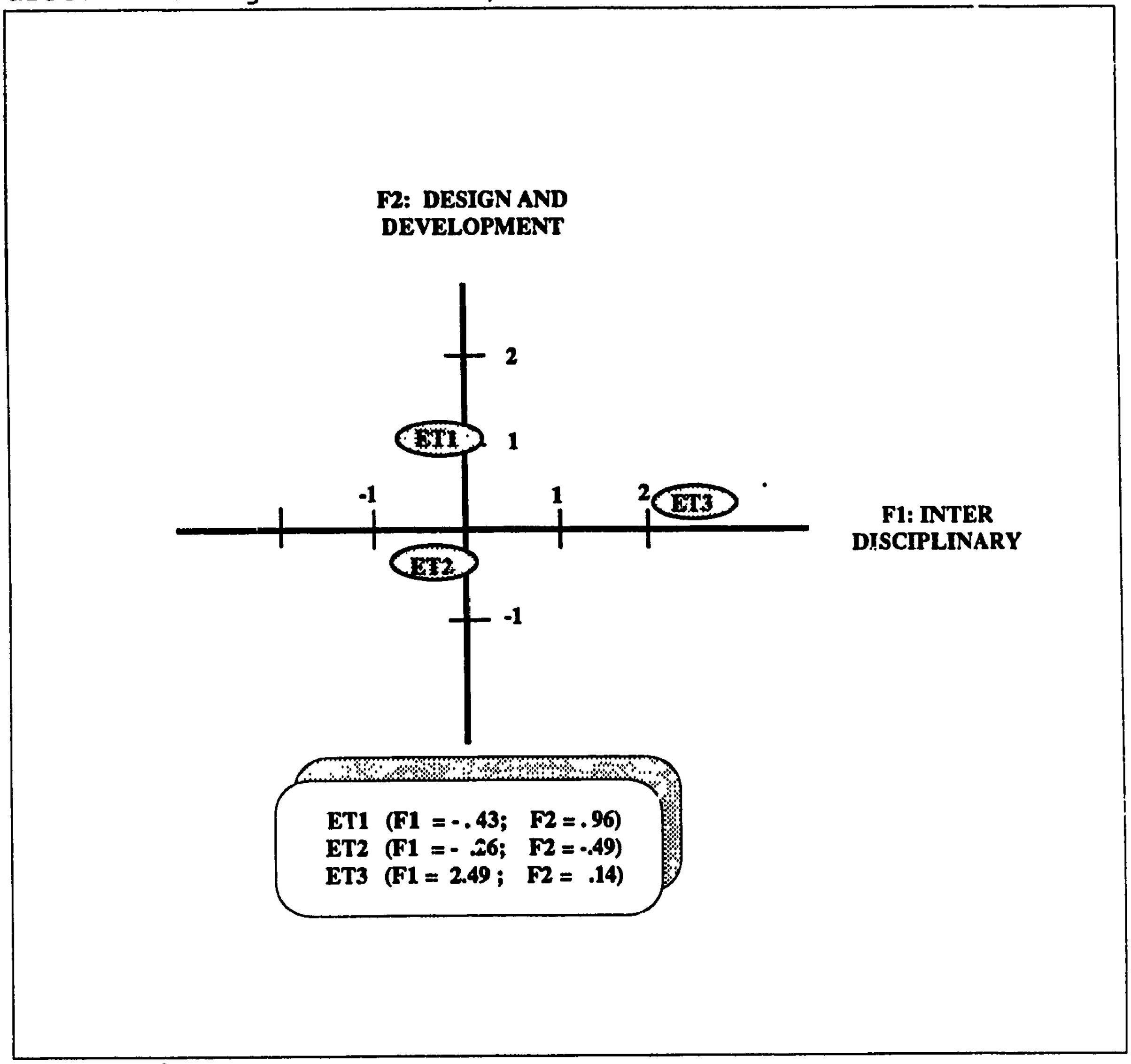
ET1 against ET2 and ET3) and Function 2, discriminating ET3 against ET1 and ET2 are displayed in Table 16.

Table 16. Rotated correlations between functions and variables

Variable Name		**Function 2**	**Function 1**
CONCEPT:	Design and development	.50	
MAJOR:	Towards Communication	.30	
REASON:	Alternative Education	.28	
REASON:	Interdisciplinary		.40
	Research based Design and Development		.34
PROF:	Towards Media Related Background	.39	
CONC:	Come from outside Concordia		-.33
CONCEPT:	Cost Effectiveness		.24
	Refining Techniques		.22
	(NOT a) Philosophy for Change		-.24

Function 1 could be described as dealing with design and development, where there is a tendency for people to have majored in communication and been interested in alternative education. The second Function appear to illustrate the interdisciplinarity of educational technology.Figure 10 is an attempt to graphically represent how the two functions discriminate among the thesis content, coded according to ET1, ET2 and ET3.

Figure 10. Graphical representation of the two functions discriminating between ET1, ET2 and ET3.



The classification analysis (Box's M = 64.43; df = 55, 16779.7; p > .05) is statistically "robust" according to Tabaschnick & Fidell (1984) and appears to classify thesis correctly in 71.43% (about 3/4) of the cases. This result is shown on page 89 in Table 17.

Table 17. Classification Results

		Predicted Group Membership		
Actual Group	Freq	ET1	ET2	ET3
ET1	29	19 65.5%	8 27.6%	2 6.9%
ET2	58	13 22.4%	40 69.0%	5 8.6%
ET3	11	0 0%	0 0%	11 100%
POWER OF CLASSIFICATION :				71.43%

The three equations that were obtained in this analysis were tested on the remaining (243 - 98=149; 149/245=.596) 60% of the total student thesis and verified by Dr. R. M. Bernard (Concordia University, Educational Technology). It was interesting to note that the result of this verification barely classified 2 out of 3 thesis correctly, and can then only be perceived as an interesting coincidence. It has been noted elsewhere (e.g., Loehlin, 1987) that valuable classification equations must have a Box'*sM* which is non significant and a power of classification higher than 90%.

REASONS for entering and thesis content

To further study the relationships between REASONS for entering and what type of issue the thesis dealt with, coded using the REASON Factors derived in Study 1, cross tabulations between these two variables over periods were performed. The results are displayed in Table 18 below.

Table 18. Distribution of students reasons and thesis content over the three periods

REASONS Factors	1968-74 RW	ABS.	1975-81 RW	ABS.	1982-89 RW	ABS.
Interdisciplinary	36%	25%	30%	44%	23%	43%
Research Based Design and Development	42%	58%	51%	51%	81%	76%
Learning Theories	27%	44%	24%	42%	19%	19%
ETV	47%	47%	15%	10%	29%	0%
Interest in Developing Countries	6%	8%	25%	17%	19%	0%
Prof. Training	17%	3%	15%	10%	25%	5%
Alternative Education	42%	19%	37%	32%	43%	43%
Educational Problem Solving	16%	28%	17%	32%	29%	43%
Improve Teaching Effectiveness	55%	53%	42%	51%	67%	57%

RW= original reason
AB= abstract

Judging from these results it appears that if their reason for entering was to improve teaching effectiveness their thesis often dealt with such issues, on the whole and across periods. This seem to be same in the cases of research -based design and ETV in the first period. Looking at only the abstracts, it appears that research-based design and development has a stronghold in the department of educational

Results of simple Pearson's correlations between REASONS as coded in study 1 and abstracts are reported in Table 19. It seems necessary to mention that the original variables for entering were used they were simply transferred from the datafile of Study 1 to datafile of Study 2. The abstracts were coded separately a year later using the factors derived in Study 1. Only statistically significant correlation coefficients will be reported.

Table 19. Correlations between REASONS and thesis content

REASONS for entering	**THESIS CONTENT**
1. Interdisciplinary	+.30 ($p < .01$) with factor 7
2. Research Based Design/Development	no significant relationship
3. Learning Theories	-.25 ($p < .05$) with factor 2 +.29 ($p < .05$) with factor 3
4. ETV Production	+.31 ($p < .01$) with factor 2 +.26 ($p < .05$) with factor 4
5. Interest in Developing Countries	+.23 ($p < .05$) with factor 1 +.39 ($p < .01$) with factor 5
6. Prof. Training	no significant relationship
7. Alternative Education	no significant relationship
8. Educational Problem Solving	no significant relationship
9. Teaching Effectiveness	no significant relationship

These results could be interpreted as if a student mentioned one of the descriptors within the REASON factor Interdisciplinarity, then their thesis content might deal with an issue in Alternative Education ($r = +.30$).

If the student had included items within learning theories as their reason for entering, a tendency to investigate learning theories in their thesis project was present (r = +.29). If their reason for entering could be described as interest in developing nations a positive correlation of r = .39 was found, which further confirms the results in study 1 concerning this factor. If theses dealt with Research based design and development and ETV, then their original reason for entering seems to lie within the items belonging to this factor.

Chapter 5

"The theoretical basis of our field is very fragmented and eclectic."
(Winn, 1989)

DISCUSSION

The "rapidly changing field of educational technology" (Concordia Calendar, 1971-1989) does not refer to an extrinsic change of the theoretical framework, but how this theoretical framework has changed from a teaching to a learning field, i.e., efficient and effective learning through research on and in all of the components of instructional design. The extrinsic change is often referred to as "Media X giving way to Media Y", which is only one component of Educational Technology. However, general findings from the three sources appear to agree that it is its usefulness in any training situation, including techniques and processes from many other disciplines, that is the major change.

This thesis looked at how this framework has evolved from Lumsdaine's (1964) first attempt at defining the field by including definitions of technology into an educational context through the hardware-software perspective, to Davies'

(1971) and Romiszowski's (1981) attempts to further clarify the field by incorporating the systems approach as the binding force. Finally, these attempts were simplified into a useful classification model, namely ET1, ET2 and ET3, ascending to the 1989 version of The International Encyclopedia of Educational Technology (Plomp & Pals, 1989).

The most conspicuous difference between the professional model and the student model appear to be that the professionals describe general definitions and the students refer to specific cases within the general model. As an example of this, one can look at Hawridge's map (1981), Jonassen's (1988) map of the structure of Instructional Technology or the Elton model (1977) of educational technology, where most aspects appear to be accounted for, compared to the average student who conceptualized the field by using about five concepts related to specific aspects of the field. However, when looking at all the students concepts of educational technology represented by the 14 CONCEPTS factors, the reflection of the professional model becomes evident.

It is interesting to note that students conception of educational technology swings in the same manner as the professional model. An example of this is the diminished interest in and research on Educational T.V. and Mass Communication over time. By contrast, cognition of the learning process (Improve efficiency and effectiveness of learning) becomes more and more apparent in the student as well as in the professional model.

In answer to the main question whether a set of core CONCEPTS of Educational Technology, both the student and the professional models appear to agree that this is the case. As an example, a systems approach to educational problems was found to be one of the most overriding concepts across the periods and on the whole, both in the professional as well as in the student model.

Another point that might be drawn from this conceptual analysis, which is expressed in both models, is the acceptance of the idea that educational technology adopts and utilizes theories, tools, techniques, and procedures from other fields, thus acknowledging the interdisciplinarity of the field. This aspect of educational technology also turned out to be the most appealing REASON for students to seek admission into Educational Technology, and moreover is confirmed by the diversity of professional experiences and B.A. majors recorded in students admitted. This multi-dimensionality of the field is perceived as being its strength, but also renders the theoretical framework difficult to define.

Influence of Demographics

Looking at which demographic changed in relation to factors across years (see Table 20, p.96) reveals that the most common statistically significant change pertained to the fact that in the first period more male than female students

Table 20. Demographic influence on CONCEPTS and REASONS

Factor	**Variables** **Sex**	**Lang**	**Loc.**	**Major**	**Prof.**	**ETEC**
			CONCEPTS			
A/V in Education	$p > .05$	**$p < .05$**	$p > .05$	**$p < .10$**	$p > .05$	$p > .05$
Improve Eff. and Effec. of Learning	$p > .05$	**$p < .05$**	**$p < .05$**	$p > .05$	**$p < .05$**	**$p < .05$**
Distance Education	**$p < .05$**	**$p < .05$**	**$p < .05$**	$p > .05$	$p > .05$	$p > .05$
			REASONS			
Inter-disciplinary	**$p < .05$**	$p > .05$	$p > .05$	**$p < .05$**	**$p < .05$**	**$p < .10$**
Design and Development	**$p < .05$**	$p > .05$	$p > .05$	$p > .05$	$p > .05$	$p > .05$
ETV	**$p < .05$**	$p > .05$	$p > .05$	$p > .05$	**$p < .10$**	$p > .05$
Developing Countries	**$p < .05$**	$p > .05$	**$p < .05$**	$p > .05$	$p > .05$	$p > .05$
Alternative Education	$p > .05$	**$p < .05$**	$p > .05$	$p > .05$	$p > .05$	$p > .05$
Improve Teaching	**$p < .05$**	**$p < .05$**	$p > .05$	**$p < .10$**	**$p < .05$**	$p > .05$

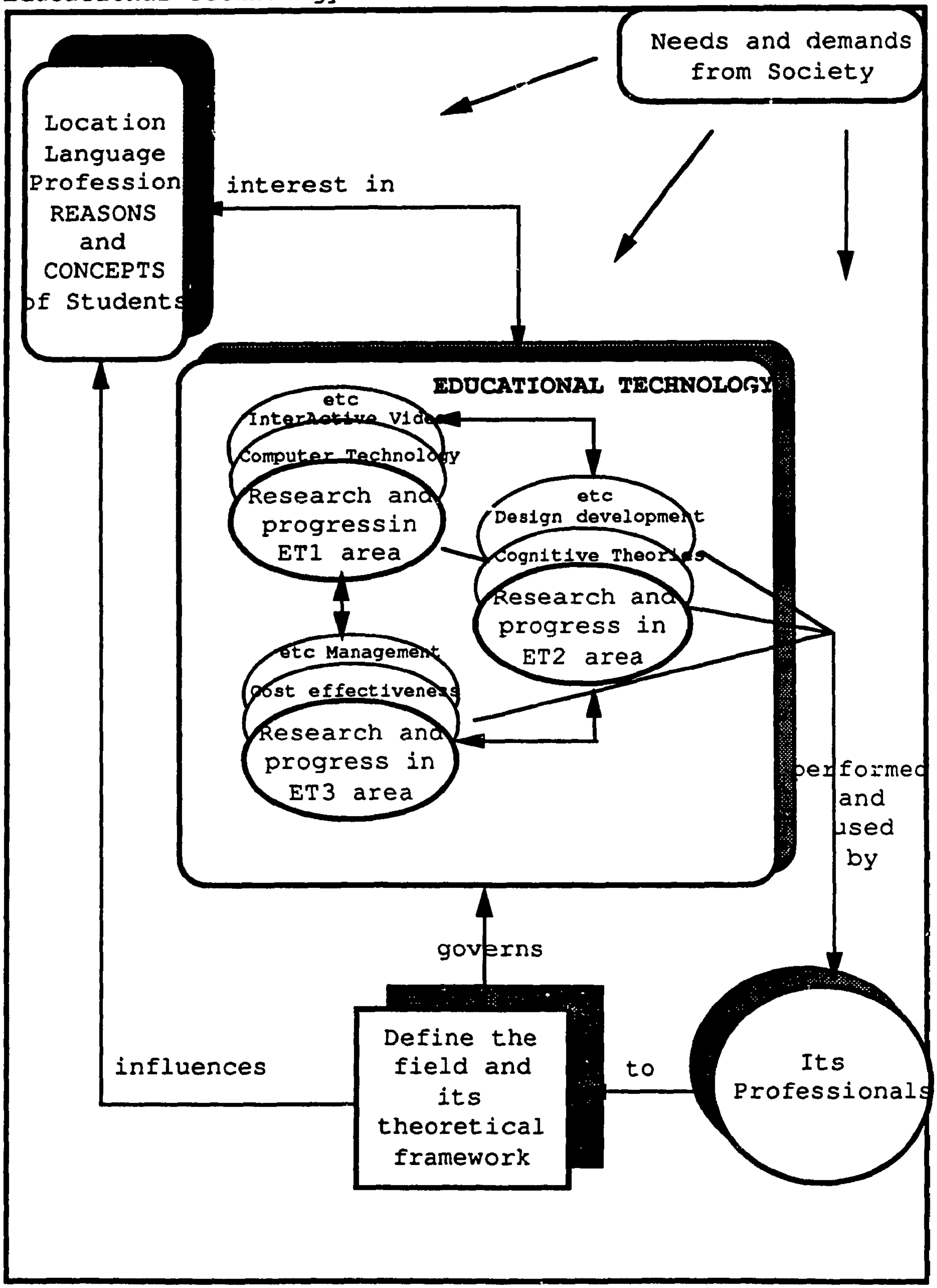
were admitted, and in the third more female than male students were admitted. This change shows up in many of the factors, and can probably be referred to as a trend of time in general, that is more women return to finish their studies or to reducate them-selves, in the third than in the first period (The Hudson Report, 1989). Geographical location of a student seems influence factors pertaining to developing nations, which were found to increase in the mid-seventies, and could easily be explained by the fact that more students from developing nations were admitted to the program. The fact that professional background shifted from an high percentage of educational experience in the first period (71%), to a much more even distribution across the three categories in the third: 53% educational; 25% managerial and 22% media related professions. This appears to be a reflection of the Concordia program as well as of the evolution of the field, educational technologist are not only from the teaching profession. The fact that students majors did not significantly change over time (see p. 61), but instead distributed evenly across the major categories and so over time. It seems to be the evidence that will support the finding that Educational Technolgy is interdisciplinary.

Finally, to visualize the findings of this conceptual analysis and to show a model of variables pertinent to how educational technology appears to stay dynamic (page 98). This simplified model attempts to describe how concepts might evolve and change and how this process in turn might affect the students interest in educational technology.

Methodological Problems

The examination of definitions, course and future job descriptions in the Concordia Calendar (1968-1989) strongly suggested that in fact students do read the Calendar before applying. This is probably a normal procedure within any

Figure 8. A model of the rapidly changing field of Educational Technology.



field. It could, therefore, be argued that the students were biased in their views, and that this study could only relate a description of student characteristics. However, this study reveals relationships among demographics, educational and professional background data and conceptualization and reasons for entering, that does support the assumption that more than the Calendar affects a student's conceptualization of and beliefs about what educational technology is. As an example is the interdisciplinarity that has emerged, and that an interest in learning theories has always been present.

Another problem is the coding procedures that were used. The method used to extract keywords could be suspect, since it was done only once and by mainly only two people. A way to verify the student data was thought of, i.e., a 20% to 40% random selection of subjects that could undergo complete recoding of both reasons and concepts, using the same methods. However, time and money did not allow for this verification procedure.

Concerning the second study a bigger sample would probably have yielded more useful results, since the sampling procedure seem to have biased some of the variables.

The use of factor analyses appears limiting in that it does not lend itself well to the investigation of relationships between different types of variables, e.g., demographics and attitudes. It can be a good solution, though, to problems where the intention is to find clusters of beliefs or attitudes. However, the results of factor analyses can be the basis for further study using for example anovas or discriminant function analysis, wherein other types of variables can be incorporated, such as demographics. In study 1, attempts to include the demographics into discriminant factor analysis were made, but led to results that became too difficult to interpret. However, using the study 1 data to predict type of thesis seems possible (60% correctly classified), and leads to believe that discriminant function analysis could be a useful method to predict membership using both demographical and attitudinal variables.

These problems that became evident and the choices that were made, lead one to believe that more sophisticated methods of investigation must exist. A brief examination of the of literature on this issue uncovered methods such as LISREL (Jöreskog, 1985; Fornell, 1982), cross lagged path analysis, (Kerlinger, 1973; McCutcheon, 1987) and Bayesian predictions (Berger & Berry, 1988), which all seem to be dealing with latent and observable variables. There are numerous studies that have successfully tried these methods in the social sciences (Fornell, 1982; Jöreskog, 1985).

Future Research

Since this study only examined admitted students reasons for entering and their conceptualization of educational technology, it might be interesting to investigate rejected students demographics, reasons and concepts for comparison.

It would be interesting to reproduce the methodology used here, that is look at how (clusters or factors of believes) latent variables and demographical variables could create a model of relationships. This can be seen as a reduction of a complex situation into a more explanatory and simple model, that would, however, point at significant relationships worthwhile further investigation. The risks of modelling lies in oversimplifying a phenomenon, which would then lead to non-reliable "speculations about the future dynamics of a system" (Denning, 1990).

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APPENDIX A

Application Forms

CONCORDIA UNIVERSITY

Sir George Williams Campus

Department of Education

SUPPLEMENT TO THE APPLICATION FOR MASTER OF ARTS (EDUCATIONAL TECHNOLOGY AND PH.D. (EDUCATIONAL TECHNOLOGY)

1. Please write a page or two describing your background and aspirations relevant to this programme. This should include:

   a) your experience, if any, as a professional educator, trainer, media producer, systems analyst, planner or any relevant work experience;

   b) your reason for wanting to enter this graduate program and the field of educational technology.

   c) an evaluation of your ability to undertake graduate study in this field (this might include, but need not be limited to, an assessment of your previous academic and professional work).

2. Please write a paragraph or so outlining <u>your</u> conception of the field of educational technology.

3. **FOR M.A. APPLICANTS:** Please indicate the option you would like to follow (i.e., thesis <u>or</u> non-thesis option). NOTE: If you choose the thesis option, please indicate what area of concentration appeals to you (i.e., Area A: Research in and Development of Educational Technology or Area B: Production and Evaluation of Educational Materials).

   FOR PH.D. APPLICANTS: Indicate what curriculum concentration(s) you prefer (e.g. Instructional Design; Human Resources Development; Educational Cybernetics, Systems Analysis and Design; Theory, Development and Research in Educational Media; Distance Education).

4. Outline any ideas you may have formulated for research and development activities you might pursue if you were to be accepted. (THIS DOES NOT COMMIT YOU TO THESE AREAS.)

NOTE: THIS SUPPLEMENT SHOULD BE SUBMITTED IN DUPLICATE

<u>SPECIAL NOTE</u>: <u>All</u> documents must be received by March 31st for Summer or September admission <u>or</u> by September 30th for January admission.*

NOTE: For the Ph.D. program, these dates may be slightly flexible.

*January is not a main admission period for the Educational Technology programmes; choice of courses is limited for this period.

Concordia
UNIVERSITY

APPLICATION FOR ADMISSION
DIVISION OF GRADUATE STUDIES

IMPORTANT The information entered on this form becomes part of your permanent record at this university. Please use a ball point pen
PLEASE PRINT CLEARLY AND FIRMLY

NAME

SURNAME (FAMILY NAME) ONLY

FORMER LAST NAME(S) IF ANY | FORMER MAIDEN NAME

HAVE YOU PREVIOUSLY REGISTERED AT CONCORDIA, LOYOLA, S.G.W.?
CONCORDIA I.D. NO.
LAST YEAR ATTENDED 19___

ADDRESS TO BE USED ON ALL CORRESPONDENCE CONCERNING YOUR APPLICATION)

STREET NUMBER STREET NAME APT NUMBER

MUNICIPALITY | POSTAL CODE

PROVINCE STATE COUNTRY

BUSINESS TELEPHONE: AREA C | EXCH NUMBER | EXTENSION

HOME TELEPHONE: AREA C | EXCH NUMBER

PERMANENT ADDRESS

STREET NUMBER NAME | MUNICIPALITY

PROVINCE/STATE COUNTRY | POSTAL CODE | TELEPHONE NUMBER

DATE OF BIRTH: DAY | MTH | YEAR

SEX: MALE 1 ☐ FEMALE 2 ☐

FIRST LANGUAGE LEARNED | OTHER LANGUAGES WHICH YOU

LANGUAGE CURRENTLY USED | WRITE | READ

SPEAK | UNDERSTAND

Citizenship

I am ☐ Canadian
☐ Landed immigrant/permanent resident
☐ On a student visa/authorization
☐ On a ______________ visa

If not Canadian what is your citizenship? ______________

IMPORTANT NOTICE TO NEW GRADUATE STUDENTS WHO ARE CANADIANS OR PERMANENT RESIDENTS (LANDED IMMIGRANTS)

In order to avoid higher tuition fees charged to international (foreign) students, you must provide documentary proof that you are a Canadian citizen or permanent resident (landed immigrant). One of the following documents (or certified true copies thereof) must be submitted with the application for admission: BIRTH CERTIFICATE (CANADIAN), BAPTISMAL CERTIFICATE (CANADIAN), CITIZENSHIP or PERMANENT RESIDENT (LANDED IMMIGRANT) PAPERS, VALID PASSPORT (CANADIAN), AFFIDAVIT. No other document is acceptable.

PROGRAM TO WHICH APPLICATION IS MADE ______________
INSERT NAME OF PROGRAM E.G. PSYCHOLOGY

PROPOSED LEVEL OF STUDY	PROPOSED TERM OF ENTRY	PROPOSED STATUS
QUALIFYING ______	SEPTEMBER 19 ______	FULL TIME ______
MASTERS ______	JANUARY 19 ______	PART TIME ______
DOCTORAL ______	SUMMER ______	INDEPENDENT ______
DIPLOMA ______	______	______

EDUCATIONAL OR PROFESSIONAL BACKGROUND AND SKILLS

LIST IN CHRONOLOGICAL ORDER ALL INSTITUTIONS WHERE YOU HAVE EVER BEEN ENROLLED FOR UNIVERSITY LEVEL WORK. INCLUDE PROFESSIONAL SCHOOLS

SEPARATE SHEET ☐

NAME OF INSTITUTION	CITY & COUNTRY	YEARS ATTENDED	MAJOR FIELD	DEGREES RECEIVED OR EXPECTED AND DATE
		19___ TO 19___		
		19___ TO 19___		
		19___ TO 19___		
		19___ TO 19___		

LIST ANY SCHOLARSHIPS, FELLOWSHIPS OR OTHER ACADEMIC HONORS RECEIVED, INDICATING THE DATES HELD OR RECEIVED

SEPARATE SHEET ☐

NAME OF AWARD	WHERE HELD OR RECEIVED	DATE(S)

TITLE OF THESIS OR OTHER PUBLICATIONS, IF ANY

SEPARATE SHEET ☐

LIST PLACES WHERE YOU HAVE BEEN EMPLOYED AND INDICATE WHETHER YOU FEEL THIS WORK EXPERIENCE IS RELEVANT TO YOUR PROPOSED PROGRAM OF STUDY

SEPARATE SHEET ☐

EMPLOYER NAME - PLACE	TYPE OF WORK	INCLUSIVE DATES	RELEVANT TO PROPOSED STUDIES?
		19 TO 19	
		19 TO 19	

DO YOU EXPECT TO BE EMPLOYED IN A JOB IN THE COMING YEAR WHICH WILL BE RELEVANT TO YOUR PROGRAM OF STUDY? *YES ☐ NO ☐

*IF YOU ANSWERED YES, PLEASE INDICATE PROBABLE EMPLOYER, TYPE OF WORK AND NUMBER OF HOURS TO BE WORKED PER WEEK

DO YOU CONSIDER YOUR TRANSCRIPTS OF UNIVERSITY LEVEL WORK AN ACCURATE INDICATION OF YOUR ACADEMIC ABILITY?

YES ☐ *NO ☐ *IF YOU ANSWERED NO, PLEASE OUTLINE YOUR REASONS

SEPARATE SHEET ☐

OTHER INFORMATION

PLEASE LIST THE NAMES AND ADDRESSES OF THE THREE PERSONS WHOM YOU HAVE ASKED TO RECOMMEND YOU FOR GRADUATE STUDY

NAME	ADDRESS

PLEASE WRITE A FEW PARAGRAPHS EXPLAINING WHY YOU WISH TO DO GRADUATE STUDY IN THE PROGRAM PROPOSED. INDICATE PROPOSED AREA OF SPECIALIZATION, IF ANY

SEPARATE SHEET ☐

I HEREBY CERTIFY THAT THE INFORMATION GIVEN BY ME ON THIS APPLICATION IS COMPLETE AND ACCURATE

PRINT NAME SIGNATURE DATE

DIVISION OF GRADUATE STUDIES

APPENDIX B

Code Book: Study 1

STUDY 1

CODE BOOK

COLUMNS	CODE
1 - 3	Subject Number (001 to 408)
4 - 5	Date of Application (e.g., 78)
6 - 7	Geographical Location

01 = Eastern Canada	09 = Caribbean
02 = Quebec	10 = Western Europe
03 = Ontario	11 = Middle East
04 = Plains (MB, SK, AB)	12 = Africa
05 = BC & YUKON & NWT	13 = India
06 = USA	14 = Far East
07 = South America	15 = Indonesia S. Pac. Islands
08 = Central America (Mexico)	16 = Australia

8 - 9	Birth Year
10	Mother Tongue 1 = Eng., 2 = FR., 3 = Other
11	Sex 1 = M, 2 = F, 3 = UK
12	Highest Degree Obtained 1 = B.A., 2 = M.A., 3 = Ph. D., 4 = OTH.
13 - 14	Graduation Year of Highest Degree Obtained
15 - 16	Major (see p. 118)
17 - 18	Profession (see p. 119)
19 - 20	Number of relevant courses at Concordia Educational Technology Program (C.A.L., D.I.T, or Independent)
21 - 22	Number of relevant courses elsewhere if 98 = some but no explicit record
23 - 43	Up to 10 different key concepts of REASONS according to Question 1b (see p.)
44 - 45	Total Number of REASONS concepts

46 - 76	Up to 15 different key concepts of CONCEPTS according to Question 2 (see p.)
77 - 78	Total Number of CONCEPTS
79 - 80	STATUS 70 - 89 = refers to graduation year 01 - 10 = Number of years in program and currently registered 11 = Withdrew 12 = Failed to register 13 = Finished all courses, no thesis 14 = Thesis rejected/ 'F' grades > 2 15 = extension expired

Field 15 - 16: MAJOR of Highest Degree Obtained

1	Education
2	Psychology/Psychoped.
3	TESL
4	History
5	Economics/Commerce
6	English
7	Chemistry
8	Applied Linguistics
9	Library Sciences
10	French
11	Sociology/APPS
12	Mathematics/Commercial Mathematics
13	Spanish
14	Fine Arts/Visual Arts
15	Special Education
16	Biology/Zoology
17	Political Sciences
18	Sciences & Technology/Engineering
19	Cinema
20	Photography
21	Philosophy
22	Administration
23	Communications (Radio/T.V./News Casting)
24	Health Sciences (Nursing)
25	Speech Therapy
26	Music
27	Educational Technology (G.B., Indonesia)
28	T.V. & Radio Production
29	Social Communications
30	Educational Research (Special Case, 1 case)
31	Early Childhood Education
32	Es Lettres (from France)
33	General Arts
34	Geography
35	Accounting
36	Literature
37	Occupational Therapy/Rehabilitation
38	Journalism
39	Industrial Design
40	Leisure Studies
41	Instructional Media
42	Physical Education
43	Anthropology
44	Theology
45	Diet Studies
46	German
47	Jewish Studies
48	Agriculture
49	Graphics Design

Field 17 - 18: PROFESSION

1	Irrelevant (None/Mother)
2	Professional Student
3	Teacher /Trainer / Instructor
4	TV-Producer / Assistant Producer
5	Director / Planner /Producer of Film
6	Librarian or Assistant Librarian
7	TV-Ad Manager / Director
8	Instructional Media Director/Manager
9	Learning Centre / Special Education Teacher
10	Radio Producer / Production Manager
11	Language Lab Operator / Technician
12	Teaching Nurse / Nurse / Health Program Instructor
13	Research / Assist. within Educ. /Psych. /Ed. Adm.
14	Journalist / Reporter / Assistant Editor
15	Communication Advisor
16	Program / Systems Analyst / Developer
17	Computer Programmer / Technician
18	Radio / TV / FILM Technician/Assistant Producer
19	Instructional Program Designer (Early Childh.)
20	Social Worker
21	Lecturer (University / Cegep levels)
22	Photographer
23	Video Consultant / Producer
24	Technical Instructor
25	Audio - Visual / Media Coordinator
26	Pre - School Teacher
27	Salesman and/or Evaluator of Software
28	Evaluator of A/V materials
29	Principal
30	Occupational Therapist
31	Teacher Assistant (University Level)
32	Instructional Technologist
33	Music Teacher
34	Administrator for adult education
35	Educational Counselling
36	Graphics Artist for Educational Materials
37	Priest
38	Missionary
39	Physical Education Teacher
40	Human Resources Person

APPENDIX C

REASONS AND CONCEPTS VARIABLES

Field 23 - 44 : Q1B: REASONS for entering Educational Technology

"To learn about", "to become", "because ETEC" or "so that":

1 Mass Communication
2 Educational Television
3 Advance / Deepen / Improve my teaching ability
4 A/V educator or instructor
5 Teaching Materials / Resource Centres
6 Organization of Educational Systems
7 Computers in Education
8 Educational Planning / Development / Management
9 Industrial Training
10 Individualized instruction
11 Improve eff. & eff. of Ed. through eval. & Res.
12 Pass / share /communicate knowledge to students
13 Ed. Design and Teaching in Developing Countries
14 Course & Curriculum Design for Educational Change
15 Instructional Technology for Adult Education
16 Ed. stays dyn. / pos. change / a creative process
17 How to apply Learning Theories
18 Res. on Learning Processes (Learn How to Learn)
19 Innovative applications of technology in Education
20 Distance Educator
21 Technology for education of disabled
22 Production of instructional materials
23 Research, eval. & development of materials
24 "Hardware" to enrich the teaching/learning process
25 Improve efficiency of instruction
26 Educational Image Transfer (?)
27 Implementation of media
28 Software Production / Programmed Text / CAL, CAI)
29 Promote learning techniques as opposed to teaching
30 Philosophy for future needs in education
31 Analyze and problem-solve educational dilemmas
32 Artificial Intelligence / ITS, ICAI
33 Improve comm. between stud./teach. through techn.
34 Qualified for a Career in Education and Training
35 Professional Educator / Formal Accreditation
36 Recruiting, Training & placing people
37 it is Interdisciplinary
38 How to reduce misuse of technology (media) in Ed.
39 Examine, investigate, research the process of Ed.
40 Allows specializing in 'My Own' field / Flexib.
41 Interactive VIDEO development and production
42 none in my country
43 Visual Communication /Networking/ Teleconferencing
44 ETEC Concordia Unique
45 Holography (1 person from India)

The above variables became after Expert Review:

1	24	Mass Communication
2	51	Educational TV
3	99	Improve Teaching
4	84	A/V in instruction
5	103	Manag. / Planning / Organi. of Ed.
6	60	Computer in Education
7	60	Industrial / on job Training
8	94	Apply Learning Theories
9	69	Improve effectiveness of Education
10	33	Teach. and Design for Develop. Nat.
11	87	Creative Ed. Change necessary
12	26	Adult Education
13	30	Research on Learning
14	60	Innovation / Systems Approach
15	131	Product. of instructional materials
16	99	Research & Development of Media
17	25	Problem Solve Education problems
18	42	Prof. and Formal Accreditation
19	36	Because Interdisciplinary
20	41	Research the processes of Education
21	71	Specializing in own field
22	11	None in my country

Field 46 - 76 (15): Q2. Defining the CONCEPT of ETEC.

98	Obviously, directly from the ETEC Calender
1	Mass Communication (Mc Luhanism)
2	Educational Television
3	Audio Visual Communication / Education
4	Communication Theory
5	Org. and structures learning materials / resources
6	Evaluation of learning materials and processes
7	Use of teaching aids, devices or media
8	Use of computers (specified as the single media)
9	Distance education
10	Independent learning
11	Solving / analyzing / identifying ed. problems
12	Applies innovations /new technology to education
13	Systems Approach
14	Television (Media) & or Production
15	Educational Planning and Design
16	Needs and Goals oriented
17	Applies theories from other areas of study
18	Information dissemination / Knowledge Transfer
19	Efficient and economic use of resources
20	Theor. Aspects of learning and learning process
21	Reaching Objectives
22	Instr. Techn. for teach. and trainers / Adult ed.
23	Research and & Dev. of ETEC material
24	Brings change based on Evaluation / Research
25	Implementation based on evaluations
26	A Cybernetic system (man-machine)
27	Applying improving and refining ed. techniques
28	Uses Games / Drama/Theatre/Music to improve educ.
29	A Multi-Media Model
30	Learner Centr./Imp. Learn. as opposed to teach.
31	Improves student-teacher interaction
32	Includes cost-analysis
33	A "Know-How" to use techn. in educational contexts
34	Equals Instructional Design
35	Is research methodologies
36	Synthesis of theory and practice from many discip.
37	A tool for management of education
38	Design process of teaching and learning
39	Futuristic and dynamic approach to education
40	A Philosophy for change
41	Methods to reduce misuse of media in education
42	Creates and updates prof.'s knowledgebase in ed.
43	Shows the importance of media in education
44	Improves the eff. & eff. of the learning process
45	Is a Meta-Method Plus
46	Allows exp.s in real life learning situations
47	Displays a logic approach to edu. and society
48	A philosophy / Discipline of education

49	"Teaching Machine" designs (1968; 1 subject)
50	Formative Evaluation
51	Knowledge Engineering
52	Interface between knowledge and learner
53	The physiology of perception
54	Information Systems

After Expert Review these variables converted into:

1	23	Mass Communication / McLuhanism
2	53	Educational TV
3	41	A/V increases eff. and eff. of educ.
4	45	Cybernetics and Communication Theory
5	48	Organizes and structures Learning
6	114	Evaluation (F&S) of educ. materials
7	75	Applies teaching aids
8	41	Computers in educ. / Knowledge Eng.
9	23	Dist., Adult and Indep. study of learn
10	148	Research based ed. / Cognitive research
11	93	Ident., analys. and solving ed. Problems
12	109	Educational Innovations
13	94	A Systems Approach
14	78	TV & other Productions
15	133	Education Planning, Development & Design
16	83	Goals and Needs oriented
17	119	Applies Theories from other disciplines
18	34	Inform. dissem. / Knowledge Transfer
19	25	Eff. & eff. use of res./Cost analyses
20	47	Theor. aspects of learning & learner
21	31	Reaching Objectives
22	51	Refining Educational Techniques
23	31	Multi-Media Model
24	44	Learner Control or centred methods
25	47	ETEC teaches educational 'know-hows'
26	57	Uses Instructional Design
27	100	Synthesis of theory and practice
28	45	Futuristic and dynamic approach to educ.
29	42	Displays Philosophy for change
30	19	Updates one's profes. knowledge base
31	22	Emphasizes Media in Education
32	80	Improve Eff. and Eff. of human learning

APPENDIX D:

REASONS and CONCEPTS FACTORS

CONCEPTS

FACTORS AND THEIR ORIGINS

Number according to R2		Loading	FACTOR and variable Names
FACTOR #1:			8.3% SYSTEMS APPROACH
	var11	.72	Identi., analyz. and solving educational problems.
	var12	.69	Educational Innovations
	var13	.61	Application of a Systems Approach
FACTOR #2:			5.9% DESIGN AND DEVELOPMENT
	var15	.78	Planning, Design and Development of educational materials
	var16	.76	Goals and Needs orientation
	var14	.46	TV and Other productions
FACTOR #3:			5.3% PHILOSOPHY FOR CHANGE
	var28	.83	Futuristic and dynamic change
	var29	.81	Displays philosophy for change
FACTOR #4:			4.9% AUDIO-VISUAL EDUCATION
	var03	.70	A/V increases ed. efficiency and effectiveness
	var02	.68	Educational TV
FACTOR #5			4.7% INSTRUCTIONAL DESIGN
	var26	.70	Uses Instructional Design
	var21	.64	Reaching Objectives
FACTOR #6			4.3% LEARNER CENTRED METHODS
	var24	.75	Learner control or centred methods
	var20	.69	Theoret. aspects of learn. & learning

FACTOR #7		4.1%	IMPROVE EFFICIENCY & EFFECTIVENESS OF LEARNING
	var32	.74	Improve eff. & eff. of learning
	var27	.48	Synthesis of Theory and Practice
	var01	**-.46**	**Mass communication / McLuhanism**
FACTOR #8		3.9%	USE OF LEARNING RESOURCES
	var05	.73	Organis./structuring of learning resources
	var06	.51	Evaluation (F&S) of educational materials
	var31	.49	Emphases of Media in Education
FACTOR #9		3.7%	COMMUNICATION AND INFORMATION THEORY
	var04	.70	Cybernetics and Communication Theory
	var18	.61	Information dissemination or Knowledge transfer
	var01	.41	Mass communication / McLuhanism
FACTOR #10		3.6%	DISTANCE EDUCATION
	var09	.78	Distance, Adult & Independent study
	var07	.59	Apply teaching aids
FACTOR #11		3.4%	EDUCATIONAL STRATEGIES
	var25	.80	Teaches "Know-how"'s in education
FACTOR #12		3.4%	RESEARCH BASED APPROACHES
	var10	.62	Research based educ./ Cognitive research
	var08	.51	Computers in Education with Knowledge Engineering
	var30	.42	Update knowledge base

FACTOR #13			3.2% COST EFFECTIVENESS
	var19	.82	Efficient and effective use of resources / Includes Cost-Analyses
FACTOR #14			3.2% REFINING TECHNIQUES
	var22	.84	Refining educational techniques

VARIABLES NOT FACTORIZED:

var17	119	Applies theories from other disciplines
var23	31	A meta method plus

REASONS

FACTORS AND THEIR ORIGINS

Number according to $R2$	Loading	FACTOR and variable Names
FACTOR #1:		8.9% INTERDISCIPLINARY
var19	.69	Because Interdisciplinary
var21	.64	Allows Spec. in own field
var14	.50	Innovation
FACTOR #2:		8.1% RESEARCH BASED DESIGN AND DEVELOPMENT
var16	.82	Research, Design and Development of Media
var15	.81	Production of ed. Media
FACTOR #3:		7.4% LEARNING THEORIES
var13	.73	Research on learning
var08	.71	Applying Learning Theories
var04	**-.42**	**A/V in Education** (not)
FACTOR #4:		6.3% MASS COMMUNICATION (ETV)
var01	.75	Mass Communication (ETV)
var02	.66	Educational TV
FACTOR #5		5.6% INTEREST IN DEVELOPING NATIONS
var10	.75	Teaching in Developing Nations
var22	.66	None in My Country
FACTOR #6		5.4% TRAINING FOR A PROFESSION
var06	**-.66**	**Computers in education**
var18	.59	Formal Accreditation
var07	.49	Industrial Training

FACTOR #7		5.0%	ALTERNATIVE SCHOOLS
	var11	.65	Creative educational change
	var12	.62	Adult Education /Continuous education
FACTOR #8		4.9%	EDUCATIONAL PROBLEM SOLVING
	var17	.73	Analyzing and solving educational problems
	var20	.55	Research the process of education
FACTOR #9		4.7%	IMPROVE TEACHING EFFECTIVENESS
	var03	.76	Improve my teaching capability
	var09	.63	Improve effectiveness and efficiency of education

VARIABLE 05 Management of Education including planning organization of education as an institution
MENTIONED BY 103 SUBJECTS

APPENDIX E

Code Book: Study 2

CODE BOOK: RECORD 2 (ETDATA3)

Column	Freq.	Variable Name and categories
1		Supervisor's Main Activity for each thesis
	11	1=ET1: Media Production/Design
	53	2=ET2: Processes/Strategies (I.D., Formative Evaluation)
	33	3=ET3: Philosophy of Educational Technology)
2 - 6		Reasons Factors applied to thesis content (up to 4 factors allowed) i.e., thesis dealt with
	36	1=F1: Interdisciplinarity
	64	2=F2: Research Based Production of Media
	37	3=F3: Learning Theories
	11	4=F4: Mass Communication (ETV)
	10	5=F5: Developing Countries
	6	6=F6: Professional Training Issues
	21	7=F7: Alternative Schooling
	32	8=F8: Educational Problem-Solving
	55	9=F9: Improve Teaching Effectiveness
7		Type of Thesis
	42	1=Experimental Studies
	10	2=Case study or Survey
	11	3=Philosophical/Conceptual Analysis
	35	4=Formative or Summative Evaluation of production or specific strategy
8		Thesis belonged mainly to
	29	1=ET1: Media Production/Design
	58	2=ET2: Processes/Strategies (I.D., Formative Evaluation)
	11	3=ET3: Philosophy of Educational Technology)
9		If content included F2, type of Media was coded (n=64):

9	1=TV	12	4=A/V
12	2=Video	9	5=Printed Material
18	3=Computers	4	6=Film Production

APPENDIX F

Examples of SPSSX programs:

Factor and Discriminant Function Analyses

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>WARNING  2031
>RENEWAL OF THE SOFTWARE LICENSE AGREEMENT FOR THIS SPSS INC PRODUCT IS NOW
>PAST DUE; THE GRACE PERIOD WILL EXPIRE SOON.  ASK YOU SPSS-X COORDINATOR TO
>CONTACT SPSS INC IMMEDIATELY.

SPSS INC LICENSE NUMBER:   10283

                       NEW FEATURES IN SPSS-X RELEASE 2
           FOR MORE DETAILS, USE THE COMMAND:  INFO OVERVIEW FACILITIES.

          PLOT - SCATTER PLOTS, OVERLAY PLOTS, CONTOUR PLOTS ON THE PRINTER.
   HILOGLINEAR - FAST LOGLINEAR ANALYSIS FOR HIERARCHICAL MODELS.
       CLUSTER - HIERARCHICAL CLUSTER ANALYSIS.
 QUICK CLUSTER - FAST CLUSTER ANALYSIS FOR A FIXED NUMBER OF CLUSTERS.
 IMPORT/EXPORT - PORTABLE SYSTEM FILES FOR TRANSFER TO OTHER KINDS OF COMPUTERS.
        PROBIT - DICHOTOMOUS PROBIT AND LOGISTIC REGRESSION ANALYSIS.
     SET WIDTH - WIDTH CONTROL FOR PRINTED OUTPUT.
         XSAVE - ALLOWS NEW FLEXIBILITY IN SAVING SYSTEM FILES.
END SUBCOMMAND - WITH DATA LIST, YOU CAN DETECT END OF FILE.

   1  0         FILE HANDLE ETDATA2/
   2  0         DATA LIST FILE=ETDATA2/SUBJ 1-3 YEAR 4-5 LOC 6-7 BIRTH 8-9 LANG 10 SEX 11
   3  0            EDUC 12 GRADEY 13-14 MAJOR 15-16 PROF 17-18 CONC 19-20 RELCO 21-22
   4  0            COL1 COL2 COL3 COL4 COL5 COL6 COL7 COL8 COL9 COL10 23-42 TOTQ1B 43-44
   5  0            CONC1 CONC2 CONC3 CONC4 CONC5 CONC6 CONC7 CONC8 CONC9 CONC10 CONC11
   6  0            CONC12 CONC13 45-70 TOTQ2 77-78 STATUS 79-80
   7  0

THE ABOVE DATA LIST STATEMENT WILL READ    1 RECORDS FROM FILE ETDATA2 .

          VARIABLE   REC  START   END         FORMAT  WIDTH  DEC

          SUBJ         1      1     3           F         3    0
          YEAR         1      4     5           F         2    0
          LOC          1      6     7           F         2    0
          BIRTH        1      8     9           F         2    0
          LANG         1     10    10           F         1    0
          SEX          1     11    11           F         1    0
          EDUC         1     12    12           F         1    0
          GRADEY       1     13    14           F         2    0
          MAJOR        1     15    16           F         2    0
          PROF         1     17    18           F         2    0
          CONC         1     19    20           F         2    0
          RELCO        1     21    22           F         2    0
          COL1         1     23    24           F         2    0
          COL2         1     25    26           F         2    0
          COL3         1     27    28           F         2    0
          COL4         1     29    30           F         2    0
          COL5         1     31    32           F         2    0
          COL6         1     33    34           F         2    0
          COL7         1     35    36           F         2    0
          COL8         1     37    38           F         2    0
          COL9         1     39    40           F         2    0
```

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             COL10        1     41    42         F          2   0
             TOTQ1B       1     43    44         F          2   0
             CONC1        1     45    46         F          2   0
             CONC2        1     47    48         F          2   0
             CONC3        1     49    50         F          2   0
             CONC4        1     51    52         F          2   0
             CONC5        1     53    54         F          2   0
             CONC6        1     55    56         F          2   0
             CONC7        1     57    58         F          2   0
             CONC8        1     59    60         F          2   0
             CONC9        1     61    62         F          2   0
             CONC10       1     63    64         F          2   0
             CONC11       1     65    66         F          2   0
             CONC12       1     67    68         F          2   0
             CONC13       1     69    70         F          2   0
             TOTQ2        1     77    78         F          2   0
             STATUS       1     79    80         F          2   0

END OF DATALIST TABLE.

         VARIABLE LABELS
            LOC 'LOCATION CODE'
            LANG 'FIRST LANGUAGE'

         VALUE LABELS
            LOC 1 'EAST CANADA' 2 'QUEBEC' 3 'ONTARIO' 4 'PLAINS' 5 'BC YK' 6 'USA'
            7 'SOU AMER' 8 'CENT AM MEX' 9 'CARRIBEAN' 10 'WEST EUROPE' 11 'MIDDLE EAST'
            12 'AFRICA' 13 'INDIA' 14 'FAR EAST' 15 'PACIFIC' 16 'AUSTRALIA'/
            LANG 1 'ENGLISH' 2 'FRENCH' 3 'OTHER'/
            SEX  1 'MALE' 2 'FEMALE' 3 'UNKNOWN'/
            EDUC 1 'BA' 2 'MA' 3 'PHD' 4 'OTHER'/
            STATUS 11 'WITHDRAWAL' 12 'FAILED TO REQ' 13 'ON EXT' 14 'EJECTED'
            15 'EXP EXT'/
         MISSING VALUES  COL1, CONC, CONC1 TO CONC13 (00,00)

         RECODE CONC1 TO CONC13 (41-01)(47-13)(54-18)(32-19)(45-35)
            (31-30)(33-31)(34,39-32)(38-33)(36,45-34)(37-35)(39-36)(40,48-37)
            (42-38)(43-39)(44-40)(50-41)(51,52-42)(53,49-00)

         RECODE CONC1 TO CONC13 (41-08)(42-09)(10-09)(23,24,25,33-10)(35-18)
            (27-22)(29-23)(30-24)(31-25)(33-26)(34-27)(36-28)(37-29)(38-30)
            (39-31)(40-32)(28-00)


         RECODE COL1 TO COL10 (39-01)(37-09)(16-14)(17-16)(18-17)(19-18)(20-19)
                  (21-19)(22-21)(23-22)(24-23)(25-24)(44,26-25)(27-26)(28-27)(29-28)
                (30-29)(31-30)(32-31)(33-32)(34-33)(35-34)(36-35)(38-36)(40-37)
                (41-38)(42-39)(43-40)(46,45-00)

         RECODE COL1 TO COL10 (23,24,32-03)(25,26,29-04)(05,08-06)(07,27,31-08)
                (09,33-07)(10,12,16,28-09)(11-09)(13,19-10)(14-11)(15-12)(17-13)
                (18,34,29-14)(21-15)(22-16)(30-17)(35-18)(36-19)(37-20)(38-21)
                (40-22)

         DO REPEAT XVAR=VAR1 TO VAR32
         COMPUTE XVAR=0
         END REPEAT
         DO REPEAT [illegible]
```

```
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC2 = X)V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC3=X)V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC4=X)V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC5=X) V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC6=X) V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC7=X) V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC8=X)V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC9=X) V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC10=X) V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC11=X) V = 1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC12=X) V=1
END REPEAT
DO REPEAT V=VAR1 TO VAR32/X=1 TO 32
IF (CONC13=X) V=1
END REPEAT
COMPUTE CASE=$CASENUM

DO REPEAT XFAR=FAR1 TO FAR22
COMPUTE XFAR=0
END REPEAT

COMPUTE X=0
DO REPEAT F=FAR1 TO FAR22/X=1 TO 22
IF (COL1 = X)F = 1
END REPEAT
DO REPEAT F=FAR1 TO FAR22/X=1 TO 22
IF (COL2 = X)F = 1
END REPEAT
DO REPEAT F=FAR1 TO FAR22/X=1 TO 22
IF (COL3=X)F = 1
END REPEAT
DO REPEAT F=FAR1 TO FAR22/X=1 TO 22
IF (COL4=X)F = 1
END REPEAT
DO REPEAT F=FAR1 TO FAR22/X=1 TO 22
IF (COL5=X) F = 1
END REPEAT
```

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             END REPEAT
             DO REPEAT F=FAR1 TO FAR22/X=1 TO 22
             IF (COL7=X) F = 1
             END REPEAT
             DO REPEAT F=FAR1 TO FAR22/X=1 TO 22
             IF (COL8=X)F = 1
             END REPEAT
             DO REPEAT F=FAR1 TO FAR22/X=1 TO 22
             IF (COL9=X) F = 1
             END REPEAT
             DO REPEAT F=FAR1 TO FAR22/X=1 TO 22
             IF (COL10=X) F = 1
             END REPEAT
             COMPUTE CASE=$CASENUM

             RECODE MAJOR (19,29,27,30,31,42,47=01)(11=02)(8,9,10,13,36=03)
                  (21,33,34,43,44,=04)(12,17,22,39=05)(07,16,49=06)(09,18=07)
                  (18,20,26,38,40,41,48=08)(14,23,28,28,38=09)(24,37,45=10)

             RECODE PROF (41,38,37=01)(13,31=02)(26,39,33=03)(06,07,10,14,15,16,18,19,
                  22,23,28,28,32,36=04)(05=05)(08,09,11,29,35,40=06)(12,20,30,38=07)
                  (17,24,27=08)(21=09)

             RECODE PROF (02,03,09=01)(04=02)(05,06,07,08=03)

             RECODE LOC (2=1)(1,3,4,5,6,7=2)(10=3)(ELSE=4)

             RECODE MAJOR (04,08=04)(05,07=05)(09,10=06)(ELSE=COPY)

             RECODE RELCO (0=1)(1,2,3,4,5,6,7,8,9=2)

             RECODE CONC (0=1)(ELSE=2)

             COMPUTE AGE=YEAR-BIRTH

             IF (YEAR LT 75) PER=1
             IF (YEAR GT 74 AND YEAR LT 82) PER=2
             IF (YEAR GT 81) PER=3


             VALUE LABELS
                MAJOR 1'EDUC' 2'PSYCH' 3'LING' 4'HUMANIS' 5'BUS1.ADM.' 6'MATH.SCI.'
                7'COMMUNIC.'/
                PROF 1'EDUC' 2'MAN.PLAN' 3'TECHNO'/
                RELCO 1'NO COURSES' 2' ONE TO 9' /
                LOC 1'QUE' 2'N.AM' 3'EUR.' 4'THIRD'/
                PER 1'68-74' 2'75-81' 3'82-88'/
                CONC 1'NONE' 2'1 TO 8'/


             COMMENT FACTOR ANALYSIS ON CONCEPTS (VAR1-32)

             FACTOR VARIABLES=VAR1 TO VAR32/
                MISSING=LISTWISE/
                ANALYSIS=VAR1 TO VAR32/
                FORMAT=SORT BLANK (.4)/
                EXTRACTION=PC/
                ROTATION=VARIMAX/
                SAVE
```

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 168  0           COMMENT FACTOR ANALYSIS ON REASONS WHY (FAR1-32)
 169  0

    50000 WORDS OF WORKSPACE AVAILABLE,
    15000 WORDS RESERVED FOR SYSEM USE,
          BIGGEST CONTIGUOUS BLOCK HAS      20608 WORDS.

THIS FACTOR ANALYSIS REQUIRED      18000 (      11.0K) WORDS OF MEMORY.
```

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FACTOR ANALYSIS

ANALYSIS NUMBER 1 LISTWISE DELETION OF CASES WITH MISSING VALUES

EXTRACTION 1 FOR ANALYSIS 1, PRINCIPAL-COMPONENTS ANALYSIS (PC)

INITIAL STATISTICS:

VARIABLE	COMMUNALITY	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
VAR1	1.00000	1	2.66680	8.3	8.3
VAR2	1.00000	2	1.89608	5.9	14.3
VAR3	1.00000	3	1.68846	5.3	19.5
VAR4	1.00000	4	1.56814	4.9	24.4
VAR5	1.00000	5	1.50780	4.7	29.1
VAR6	1.00000	6	1.37876	4.3	33.4
VAR7	1.00000	7	1.30480	4.1	37.5
VAR8	1.00000	8	1.28774	4.0	41.5
VAR9	1.00000	9	1.18188	3.7	45.1
VAR10	1.00000	10	1.14274	3.6	48.7
VAR11	1.00000	11	1.10136	3.4	52.2
VAR12	1.00000	12	1.07512	3.4	55.5
VAR13	1.00000	13	1.02271	3.2	58.7
VAR14	1.00000	14	1.01370	3.2	61.9
VAR15	1.00000	15	.98760	3.1	65.0
VAR16	1.00000	16	.92037	2.9	67.9
VAR17	1.00000	17	.85887	2.7	70.6
VAR18	1.00000	18	.81176	2.5	73.1
VAR19	1.00000	19	.77417	2.4	75.5
VAR20	1.00000	20	.76720	2.4	77.9
VAR21	1.00000	21	.75686	2.4	80.3
VAR22	1.00000	22	.73800	2.3	82.6
VAR23	1.00000	23	.68813	2.1	84.7
VAR24	1.00000	24	.67030	2.1	86.8
VAR25	1.00000	25	.65564	2.0	88.8
VAR26	1.00000	26	.62165	1.9	90.8
VAR27	1.00000	27	.61282	1.8	92.6
VAR28	1.00000	28	.54081	1.7	94.4
VAR29	1.00000	29	.51780	1.6	96.1
VAR30	1.00000	30	.45856	1.4	97.5
VAR31	1.00000	31	.41372	1.3	98.8
VAR32	1.00000	32	.38832	1.2	100.0

PC EXTRACTED 14 FACTORS.

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FACTOR ANALYSIS

FACTOR MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
VAR15	.66102							
VAR11	.62625							
VAR16	.61669							
VAR13	.60481							
VAR12	.55327							
VAR28		.60839						
VAR29		.59361	-.40678					
VAR2		-.41698						
VAR3								
VAR27								
VAR21								
VAR20								
VAR1				.48768				
VAR14								
VAR18					-.47884			
VAR7					.40030			
VAR6								
VAR24						.91100		
VAR8								
VAR4								
VAR5							.45417	
VAR31								
VAR26								
VAR23								
VAR10								
VAR32								
VAR19								
VAR25								
VAR17	.43721							
VAR30								
VAR9								
VAR22								

	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
VAR15						
VAR11						
VAR16						
VAR13						
VAR12						

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- F A C T O R   A N A L Y S I S -

	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
VAR29						
VAR2						
VAR3						
VAR27						
VAR21						
VAR30						
VAR1						
VAR14						
VAR16						
VAR7						
VAR8						
VAR24						
VAR9						
VAR4						
VAR6						
VAR21						
VAR26	.46048					
VAR23	-.41873					
VAR10		.42683				
VAR32		-.40405				
VAR19			-.47414			
VAR28						
VAR17				.48863		
VAR30				.42762		
VAR5	-.42816				.48758	
VAR22						.52117

FINAL STATISTICS:

VARIABLE	COMMUNALITY	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
VAR1	.53206	1	2.66690	8.3	8.3
VAR2	.54811	2	1.89608	5.9	14.3
VAR3	.67278	3	1.68046	5.3	19.5
VAR4	.56282	4	1.56814	4.9	24.4
VAR5	.62779	5	1.50789	4.7	29.1
VAR6	.52035	6	1.37575	4.3	33.4
VAR7	.50716	7	1.30480	4.1	37.5
VAR8	.64337	8	1.25774	3.9	41.5
VAR9	.74151	9	1.18148	3.7	45.1
VAR10	.65042	10	1.14274	3.6	48.7
VAR11	.60016	11	[illegible]	3.4	52.2
VAR12	.585[illegible]	[illegible]	[illegible]	3.4	55.5
VAR13	.612[illegible]	[illegible]	[illegible]	3.2	58.7
VAR14	.54182	14	1.01378	3.2	61

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- F A C T O R A N A L Y S I S -

VARIABLE	COMMUNALITY	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
VAR15	.73117				
VAR16	.66604				
VAR17	.86178				
VAR18	.80634				
VAR19	.72750				
VAR20	.83435				
VAR21	.80372				
VAR22	.74163				
VAR23	.80260				
VAR24	.60288				
VAR25	.68012				
VAR26	.68037				
VAR27	.67740				
VAR28	.72808				
VAR29	.71795				
VAR30	.80924				
VAR31	.82917				
VAR32	.66207				

VARIMAX ROTATION 1 FOR EXTRACTION 1 IN ANALYSIS 1 - KAISER NORMALIZATION.

VARIMAX CONVERGED IN 17 ITERATIONS.

ROTATED FACTOR MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
VAR11	.71977							
VAR12	.67098							
VAR13	.63601							
VAR15		.77724						
VAR16		.74842						
VAR14		.49684						
VAR29			.83270					
VAR28			.81430					
VAR3				.70848				
VAR2				.69668				
VAR26					.69832			
VAR21					.64858			
VAR24						.74749		
VAR20						.69425		
VAR32								

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```

F A C T O R   A N A L Y S I S

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
VAR17								
VAR4								.88195
VAR18								.81615
VAR1							-.44311	.45846
VAR5								
VAR6								
VAR21								
VAR9								
VAR7								
VAR25								
VAR10								
VAR8								
VAR30								
VAR19								
VAR23								
VAR22								

	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
VAR11						
VAR12						
VAR13						
VAR15						
VAR16						
VAR14						
VAR29						
VAR28						
VAR3						
VAR2						
VAR26						
VAR31						
VAR24						
VAR20						
VAR32						
VAR27						
VAR17						
VAR4						
VAR18						

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CONCORDIA UNIVERSITY COMP CT CYBER 180/8300 NOS 2.4.3 PAGE 11

- F A C T O R   A N A L Y S I S -

	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
VAR1						
VAR5	.73778					
VAR6	.50728					
VAR31	.49240					
VAR9		.78741				
VAR7		.69167				
VAR28			.78893			
VAR10				.61818		
VAR8				.51287		
VAR30				.41846		
VAR19					.81819	
VAR23						
VAR22						.83430

FACTOR TRANSFORMATION MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
FACTOR 1	.63488	.63789	.01812	-.23127	.15418	.11148	.18870	-.08811
FACTOR 2	-.11372	-.18885	.07489	-.81483	.18240	-.05763	.33063	.20002
FACTOR 3	-.12468	-.20868	-.48806	-.08182	.44481	.38281	.41643	.08248
FACTOR 4	.08431	-.00416	.37877	.46900	.22764	.06840	-.18232	.40428
FACTOR 5	-.11726	-.01602	.12422	.23819	.43734	-.42963	.09597	-.47178
FACTOR 6	.12044	-.00772	.33486	.37841	-.03862	.56622	-.16486	-.34784
FACTOR 7	-.38589	.11328	.01846	-.02438	-.11218	.50700	.13407	.00776
FACTOR 8	.53333	-.48838	.06627	.32001	-.30388	-.08208	.36660	.08308
FACTOR 9	.30811	-.07841	-.01874	14164	.59015	.06870	-.15196	.28185
FACTOR 10	-.04768	.00948	.03838	-.24381	.00627	.02187	-.47788	.31118
FACTOR 11	.06272	.20404	-.22810	.00774	-.15284	-.19831	.01044	.37331
FACTOR 12	-.26108	.30824	.06588	.40388	-.11611	-.08744	.38543	.26881
FACTOR 13	-.11048	.25283	-.00448	.04217	.08820	-.17833	-.04331	-.14729
FACTOR 14	-.17218	.26148	.18803	.18882	-.04805	.04588	.20736	.12738

	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
FACTOR 1	.17380	.03665	-.04059	.13818	.03472	-.02336
FACTOR 2	-.11121	.08423	.10806	-.03686	-.09852	-.11734
FACTOR 3	-.12414	.33007	-.13382	.19766	-.10372	.05868
FACTOR 4	.30328	.42182	-.38368	-.07232	-.01088	-.28309
FACTOR 5	.35213	.09896	.33222	.12879	-.21851	.24120
FACTOR 6	-.3858[illegible]	[illegible]	[illegible]	.13182	-.33561	[illegible]
FACTOR 7	.5480[illegible]	[illegible]	[illegible]	-.38836	.21483	[illegible]
FACTOR 8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

- F A C T O R   A N A L Y S I S -

	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
FACTOR 9	-.10786	-.50496	.27826	-.23730	.17410	.12068
FACTOR 10	.08130	.10660	.10043	.56174	.11612	.44656
FACTOR 11	-.08610	.21072	.40910	-.28914	-.61608	.07422
FACTOR 12	-.14528	-.22418	.22040	.40922	.10668	-.16678
FACTOR 13	-.43104	.52137	.32220	-.24620	.83861	.00708
FACTOR 14	-.11063	-.06490	-.48404	-.21683	-.04113	.70676

14 PC EXACT FACTOR SCORES WILL BE SAVED WITH ROOTNAME: FCONC

FOLLOWING FACTOR SCORES WILL BE ADDED TO THE ACTIVE FILE:

NAME	LABEL
FCONC01	REGR FACTOR SCORE 1 FOR ANALYSIS 1
FCONC02	REGR FACTOR SCORE 2 FOR ANALYSIS 1
FCONC03	REGR FACTOR SCORE 3 FOR ANALYSIS 1
FCONC04	REGR FACTOR SCORE 4 FOR ANALYSIS 1
FCONC05	REGR FACTOR SCORE 5 FOR ANALYSIS 1
FCONC06	REGR FACTOR SCORE 6 FOR ANALYSIS 1
FCONC07	REGR FACTOR SCORE 7 FOR ANALYSIS 1
FCONC08	REGR FACTOR SCORE 8 FOR ANALYSIS 1
FCONC09	REGR FACTOR SCORE 9 FOR ANALYSIS 1
FCONC10	REGR FACTOR SCORE 10 FOR ANALYSIS 1
FCONC11	REGR FACTOR SCORE 11 FOR ANALYSIS 1
FCONC12	REGR FACTOR SCORE 12 FOR ANALYSIS 1
FCONC13	REGR FACTOR SCORE 13 FOR ANALYSIS 1
FCONC14	REGR FACTOR SCORE 14 FOR ANALYSIS 1

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PRECEDING TASK REQUIRED      144.80 SECONDS CPU TIME;        207 SECONDS ELAPSED.

 170  0          FACTOR VARIABLES=FAR1 TO FAR22/
 171  0            MISSING=LISTWISE/
 172  0            ANALYSIS=FAR1 TO FAR22/
 173  0            FORMAT=SORT BLANK (.4)/
 174  0            EXTRACTION=PC/
 175  0            ROTATION=VARIMAX/
 176  0            SAVE REG (ALL NUFACT)
 177  0
 178  0
 179  0          COMMENT DISCRIMINANT FUNCTION ANALYSIS  YEAR @DEPENDENCY
 180  0

    56417 WORDS OF WORKSPACE AVAILABLE.
    15000 WORDS RESERVED FOR SYSEM USE.
          BIGGEST CONTIGUOUS BLOCK HAS      20608 WORDS.

THIS FACTOR ANALYSIS REQUIRES       5888 (       5.7K) WORDS OF MEMORY.
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CONCORDIA UNIVIVERSITY COMP CT CYBER 180/830D NOS 2.4.3

- - - - - - - - - - F A C T O R   A N A L Y S I S - - - - - - - - - -

ANALYSIS NUMBER 1 LISTWISE DELETION OF CASES WITH MISSING VALUES

EXTRACTION 1 FOR ANALYSIS 1, PRINCIPAL-COMPONENTS ANALYSIS (PC)

INITIAL STATISTICS:

VARIABLE	COMMUNALITY	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
VAR1	1.00000	1	1.96942	8.9	8.9
VAR2	1.00000	2	1.78648	8.1	17.0
VAR3	1.00000	3	1.63288	7.4	24.4
VAR4	1.00000	4	1.38726	6.3	30.7
VAR5	1.00000	5	1.21946	5.5	36.2
VAR6	1.00000	6	1.17871	5.4	41.6
VAR7	1.00000	7	1.09900	5.0	46.6
VAR8	1.00000	8	1.07936	4.9	51.5
VAR9	1.00000	9	1.01940	4.6	56.1
VAR10	1.00000	10	.92720	4.2	60.3
VAR11	1.00000	11	.92168	4.2	64.5
VAR12	1.00000	12	.90068	4.1	68.6
VAR13	1.00000	13	.85287	3.9	72.5
VAR14	1.00000	14	.80494	3.7	76.2
VAR15	1.00000	15	.78812	3.6	79.8
VAR16	1.00000	16	.76738	3.5	83.3
VAR17	1.00000	17	.74230	3.4	86.6
VAR18	1.00000	18	.68358	3.2	89.8
VAR19	1.00000	19	.63175	2.9	92.7
VAR20	1.00000	20	.57335	2.6	95.3
VAR21	1.00000	21	.54115	2.5	97.7
VAR22	1.00000	22	.49038	2.3	100.0

PC EXTRACTED 9 FACTORS.

FACTOR MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
VAR21	.60190							
VAR19	.53436							
VAR7	.44440							
VAR20	.41136							
VAR16								
VAR4								
VAR15				.48038				
VAR6								
VAR2								

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- F A C T O R   A N A L Y S I S -

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
FAR22			.53008		.40039			
FAR10			.50082					
FAR5			.48472					
FAR6								.41760
FAR16		-.45930		.53003				
FAR13								
FAR12								
FAR17								
FAR1							.47247	
FAR3							.41104	
FAR11		.41428						-.47208
FAR15								.43704
FAR8								

	FACTOR 9
FAR21	
FAR18	
FAR7	
FAR20	
FAR18	
FAR4	
FAR15	
FAR8	
FAR2	
FAR22	
FAR10	
FAR5	
FAR6	
FAR16	
FAR13	
FAR12	
FAR17	
FAR1	
FAR3	.41706
FAR11	
FAR14	.42224
FAR9	

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CONCORDIA UNIVIVERSITY COMP CT CYBER 180/8300 NOS 2.4.3

- F A C T O R   A N A L Y S I S -

FINAL STATISTICS:

VARIABLE	COMMUNALITY	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
FAR1	.60770	1	1.95842	8.9	8.9
FAR2	.58348	2	1.78848	8.1	17.0
FAR3	.61610	3	1.62258	7.4	24.4
FAR4	.40368	4	1.38728	6.3	30.7
FAR5	.57108	5	1.21858	5.5	36.2
FAR6	.56576	6	1.17871	5.4	41.6
FAR7	.57814	7	1.08900	5.0	46.6
FAR8	.55621	8	1.07835	4.9	51.5
FAR9	.50137	9	1.01840	4.6	56.1
FAR10	.60781				
FAR11	.47192				
FAR12	.37760				
FAR13	.54866				
FAR14	.65084				
FAR15	.71916				
FAR16	.69454				
FAR17	.58072				
FAR18	.45988				
FAR19	.50534				
FAR20	.57019				
FAR21	.58388				
FAR22	.58701				

VARIMAX ROTATION 1 FOR EXTRACTION 1 IN ANALYSIS 1 - KAISER NORMALIZATION.

VARIMAX CONVERGED IN 21 ITERATIONS.

ROTATED FACTOR MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
FAR19	.69062							
FAR21	.65145							
FAR14	.48640							
FAR16		.81459						
FAR15		.81311						
FAR13			.73258					
F[illegible]8			.70846					
FAR4			-.40843					
[illegible]				.74492				
FAR2				.66258				

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- - - - - - - - - - - - - - - - - - - - - - -   F A C T O R   A N A L Y S I S   - - - - - - - - - - - - - - - - - - - - - - -
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	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
FAR10					.78281			
FAR22					.74480			
FAR6						-.66295		
FAR18						.58099		
FAR7						.48305		
FAR8							.64860	
FAR11							.61664	
FAR12								
FAR17								.72860
FAR20	.43121							.65114
FAR3								
FAR9								

	FACTOR 9
FAR19	
FAR21	
FAR14	
FAR16	
FAR15	
FAR13	
FAR5	
FAR4	
FAR1	
FAR2	
FAR10	
FAR22	
FAR6	
FAR18	
FAR7	
FAR8	
FAR11	
FAR12	
FAR17	
FAR20	
FAR3	.78863
FAR9	.93306

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- F A C T O R   A N A L Y S I S -

FACTOR TRANSFORMATION MATRIX:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
FACTOR 1	.68228	.03033	.13784	-.40663	-.04637	.24773	-.38133	.32820
FACTOR 2	-.03677	-.84480	.48433	-.38631	.01388	-.12622	.43603	.14788
FACTOR 3	-.29137	.08167	-.26801	-.30668	.62661	.53288	.16663	.18348
FACTOR 4	-.07644	.60670	.48426	-.07240	.36182	-.40489	-.15018	.20673
FACTOR 5	.30328	-.24202	-.36184	.12760	.87661	-.47647	-.08128	-.02380
FACTOR 6	.00142	.28138	-.64076	-.33288	-.34376	-.31418	.81634	.40687
FACTOR 7	.00667	-.16820	.07001	.66518	-.03241	.20783	-.06671	.70648
FACTOR 8	.14308	.17604	.03666	.27380	.08063	-.11114	.73188	.12623
FACTOR 9	.60388	.28628	.02821	.16387	.00838	.30211	.30668	-.32540

	FACTOR 9
FACTOR 1	-.31628
FACTOR 2	.30134
FACTOR 3	.03410
FACTOR 4	.19411
FACTOR 5	.08487
FACTOR 6	.27440
FACTOR 7	.24387
FACTOR 8	-.84868
FACTOR 9	.68301

9 PC EXACT FACTOR SCORES WILL BE SAVED WITH ROOTNAME: RWFACT

FOLLOWING FACTOR SCORES WILL BE ADDED TO THE ACTIVE FILE:

NAME	LABEL
RWFACT1	REGR FACTOR SCORE 1 FOR ANALYSIS 1
RWFACT2	REGR FACTOR SCORE 2 FOR ANALYSIS 1
RWFACT3	REGR FACTOR SCORE 3 FOR ANALYSIS 1
RWFACT4	REGR FACTOR SCORE 4 FOR ANALYSIS 1
RWFACT5	REGR FACTOR SCORE 5 FOR ANALYSIS 1
RWFACT6	REGR FACTOR SCORE 6 FOR ANALYSIS 1
RWFACT7	REGR FACTOR SCORE 7 FOR ANALYSIS 1
RWFACT8	REGR FACTOR SCORE 8 FOR ANALYSIS 1
RWFACT9	REGR FACTOR SCORE 9 FOR ANALYSIS 1

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22 OCT 80   SPSS-X RELEASE 2.0 FROM NORTHWESTERN UNIVERSITY                                                    PAGE  19
            CONCORDIA UNIVIVERSITY COMP CT CYBER 180/8300   NOS 2.4.3

PRECEDING TASK REQUIRED      12.84 SECONDS CPU TIME;         21 SECONDS ELAPSED.

 181  0          DISCRIMINANT GROUPS=PER(1,3)/
 182  0             VARIABLES=FCONC01 TO FCONC14 RWFACT1 TO RWFACT8/
 183  0             METHOD=RAO/
 184  0             FIN=3.0
 185  0          OPTION  4 7 11
 186  0          STATISTICS 1 2 6 7 8 11 12 13

    56896 WORDS OF WORKSPACE AVAILABLE.
    15000 WORDS RESERVED FOR SYSEM USE.
          BIGGEST CONTIGUOUS BLOCK HAS      39608 WORDS.

SINCE ANALYSIS= WAS OMITTED FOR THE FIRST ANALYSIS ALL VARIABLES
ON THE VARIABLES= LIST WILL BE ENTERED AT LEVEL 1.

*NOTE*  OPTION 11 MEANS CLASSIFICATION USING THE GROUP COVARIANCE MATRICES OF THE CANONICAL DISCRIMINANT FUNCTIONS,
        NOT THOSE OF THE ORIGINAL VARIABLES.  IF THERE ARE FEWER FUNCTIONS THAN VARIABLES, THAT MAKES A DIFFERENCE.

THIS DISCRIMINANT ANALYSIS REQUIRES      2714 WORDS OF WORKSPACE.
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CONCORDIA UNIVIVERSITY COMP CT CYBER 180/8300 NOS 2.4.3 PAGE 20

- D I S C R I M I N A N T   A N A L Y S I S -

ON GROUPS DEFINED BY PER

407 (UNWEIGHTED) CASES WERE PROCESSED.
0 OF THESE WERE EXCLUDED FROM THE ANALYSIS.
407 (UNWEIGHTED) CASES WILL BE USED IN THE ANALYSIS.

NUMBER OF CASES BY GROUP

PER	NUMBER OF CASES UNWEIGHTED	WEIGHTED	LABEL
1	82	82.0	68-74
2	120	120.0	75-81
3	205	205.0	82-88
TOTAL	407	407.0	

GROUP MEANS

PER	FCONC01	FCONC02	FCONC03	FCONC04	FCONC05	FCONC06	FCONC07	FCONC08
1	.04951	-.00801	-.08417	.30026	-.12313	.02034	-.32604	.03391
2	.09768	.11760	-.02203	-.01617	-.05180	-.04403	-.22078	-.02561
3	-.08063	-.06636	.04703	-.11044	.07058	.01764	.31689	.00143
TOTAL	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

PER	FCONC09	FCONC10	FCONC11	FCONC12	FCONC13	FCONC14	RWFACT1	RWFACT2
1	-.10432	-.12036	-.10822	-.14116	-.03071	.07770	-.38783	-.17783
2	-.05846	-.15713	.07754	.03643	.05551	.06047	-.18780	-.17190
3	.07683	.14012	-.00290	.04088	-.01701	-.07178	.27087	.17168
TOTAL	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

PER	RWFACT3	RWFACT4	RWFACT5	RWFACT6	RWFACT7	RWFACT8	RWFACT9
1	.00898	.88832	-.20684	.01757	.08284	.01028	.17614
2	.07829	.01962	.25507	-.00692	.18118	-.07853	.15946
3	-.04882	-.28682	-.06657	-.00288	-.14306	.04244	-.16340
TOTAL	.00000	.00000	.00000	.00000	.00000	.00000	.00000

GROUP STANDARD DEVIATIONS

PER	FCONC01	FCONC02	FCONC03	FCONC04	FCONC05	FCONC06	FCONC07	FCONC08
1	.89132	1.02830	.81330	1.04138	.83118	.88873	.81074	.83908
2	.88508	.87677	.88718	1.00728	.85433	.86073	.81897	1.00478
3	1.05060	1.00148	1.08783	.89867	1.04811	1.03130	1.06526	1.02888
TOTAL	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

PER	FCONC09	FCONC10	FCONC11	FCONC12	FCONC13	FCONC14	RWFACT1	RWFACT2
1	1.00848	.72010	.88013	.78607	1.02333	.87801	.88171	.90028
2	1.04848	.88273	1.00708	.82887	1.00883	1.07802	.88866	.87241
3	.86781	1.14884	1.03728	1.11112	.88898	.88868	1.08252	1.07823
TOTAL	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

PER	RWFACT3	RWFACT4	RWFACT5	RWFACT6	RWFACT7	RWFACT8	RWFACT9
1	1.09328	1.18232	.81108	.88074	1.00401	.90003	1.04209
2	1.01888	.90024	1.13831	.88834	1.07383	.83043	1.03887
3	.87764	.84874	1.01850	1.17768	.83488	1.07600	.83688
TOTAL	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

WILKS' LAMBDA (U-STATISTIC) AND UNIVARIATE F-RATIO
WITH 2 AND 404 DEGREES OF FREEDOM

VARIABLE	WILKS' LAMBDA	F	SIGNIFICANCE
FCONC01	.99738	.5283	.5900
FCONC02	.99374	1.373	.2811
FCONC03	.99730	.5472	.5790
FCONC04	.97553	5.067	.0067
FCONC05	.99289	1.438	.2384
FCONC06	.99919	.1648	.8484
FCONC07	.89647	23.33	.0000
FCONC08	.99957	.8632E-01	.9173
FCONC09	.99380	1.260	.2847
FCONC10	.97986	4.181	.0164
FCONC11	.99594	.8235	.4386
FCONC12	.99492	1.031	.3578
FCONC13	.99864	.2760	.7587
FCONC14	.99478	1.068	.3483
RWFACT1	.92087	17.33	.0000
RWFACT2	.97001	6.249	.0021
RWFACT3	.9869	[illegible]	[illegible]
RWFACT4	.8626	[illegible]	[illegible]

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VARIABLE	WILKS' LAMBDA	F	SIGNIFICANCE
RWFACT6	.99992	.1630E-01	.8838
RWFACT7	.87826	4.484	.0117
RWFACT8	.98720	.8672	.5678
RWFACT9	.87281	8.648	.0038

COVARIANCE MATRIX FOR GROUP 1, 68-74

	FCONC01	FCONC02	FCONC03	FCONC04	FCONC05	FCONC06	FCONC07	FCONC08
FCONC01	.7844411							
FCONC02	-.2800701E-01	1.083200						
FCONC03	.5226841E-01	.1600034E-01	.8341080					
FCONC04	-.1827186	-.2671086E-01	-.4023721E-01	1.084420				
FCONC05	-.4308666E-01	-.2870232	.1870437	-.8072524E-02	.0870367			
FCONC06	.6488665E-02	.1693785	.3000880E-01	-.3748280	-.1066856	.8738433		
FCONC07	.1487806	.1763484	.5639030E-01	-.6476004E-01	-.1306080	-.4375637E-01	.6873068	
FCONC08	.1247872E-01	.7616843E-01	-.7117881E-02	-.3147428E-01	.8451684E-01	-.4768881E-01	-.1437820	.8557368
FCONC09	-.6084781E-01	.1447852	.8380880E-03	-.1658000	.1377728	.3077660E-01	.6742374E-01	.1338880
FCONC10	.1350333	-.4484703E-01	-.8107873E-01	-.1085312	.4591479E-01	-.8838437E-01	-.1173986E-01	.1340703
FCONC11	.8150385E-01	.1112318	.5616473E-02	-.2108421	.1284806	.1221360	.1603782	.8338398E-01
FCONC12	.1814728	-.3843537E-01	.2074081E-01	-.1838400	-.8714888E-03	.1308384	.8440178E-03	.1249800E-01
FCONC13	.7122688E-01	-.4066136E-01	-.8802628E-01	.1225482	-.7086210E-01	-.4788708E-01	.1281042	.8678641E-01
FCONC14	.8640501E-01	-.3871877E-01	-.7780034E-01	.3162608E-01	.8440708E-01	.8065233E-02	-.4778428E-01	.4382381E-01
RWFACT1	.3210383E-02	.4674873E-01	.1484161	.1806417E-01	-.4839018E-01	-.8210660E-01	.1140783	-.3840892E-01
RWFACT2	.9987079E-01	.5449384E-02	-.1830479E-01	.9291758E-01	-.8714785E-02	.1134619E-01	.4074929E-01	-.7184428E-01
RWFACT3	.3136028E-01	.1348676	-.1261868	-.3080471	-.1113800	.4760432	.6324445E-01	-.8388730E-01
RWFACT4	-.8211761E-01	-.2127718	.8186606E-01	.3874383	-.8632885E-01	-.1858101	-.1407726	.2882836
RWFACT5	.1462100	.1241288	-.1102474E-01	-.1267880	-.8632347E-01	-.1237363E-01	.3786801E-01	.4606839E-01
RWFACT6	.4806988E-01	-.1186828	-.8838783E-01	.6627382E-01	.2530173E-01	-.1388687	.2040680E-01	.1838418E-01
RWFACT7	.3380784	.1783243	.2208670	-.1402364	-.7827831E-01	.1436602	.2840588	.2311360E-01
RWFACT8	.2273688	.1270288	.4580910E-01	-.2447898	.8987708E-01	-.1080622E-01	.2362780	.1237706
RWFACT9	-.1303488	.1786278	.2788850E-01	.2818730	.2870288	-.1783870	.8417741E-01	-.8888872E-01

	FCONC09	FCONC10	FCONC11	FCONC12	FCONC13	FCONC14	RWFACT1	RWFACT2
FCONC09	1.012009							
FCONC10	.1520860	.8185400						
FCONC11	.8338818E-01	.7628064E-01	.7823380					
FCONC12	.7711567E-01	.2312113	.3311634E-01	.6178018				
FCONC13	.6364873E-01	-.2664040E-01	-.8716064E-01	-.8205336E-01	1.047184			
FCONC14	-.4684473E-01	.4481870E-01	.3282370E-01	-.1168606	-.6117800E-01	.9685063		
RWFACT1	-.8605222E-02	.2287430E-02	.7648008E-02	-.4680261E-01	-.8780309E-01	-.8758631E-02	.4784698	
RWFACT2	-.3248243E-01	-.1428884E-01	.1081414	.1240123	-.1446886	.7884112E-01	.8449710E-02	.8104890
RWFACT3	-.1840180	.6834886E-01	.8078316E-01	.1731183	-.2616122	-.3614838E-01	.6166376E-01	.7768788E-01
RWFACT4	-.3420706	-.1186653	-.1261413	-.1101710	-.1777871	-.1145366E-01	.1108632	.1807380
RWFACT5	.3625873E-01	.4861648E-01	.4637384E-01	-.1738084E-02	.1380783	.3636107E-01	.3683073E-01	.1588401E-01
RWFACT6	-.6838403E-01	-.8882248E-01	-.4830666E-01	-.6632012E-01	.8574417E-01	.8647432E-01	-.7300217E-01	-.1344666E-01
RWFACT7	.8852760E-02	.1885365E-01	.1250702	-.8392201E-01	.7804340E-02	.1031140	.3841148	-.4436122E-01
RWFACT8	.1702268	[illegible]	[illegible]	.5381161E-01	.1443085	[illegible]	[illegible]	-.1046607E-01
RWFACT9	-.2835728E-[illegible]	[illegible]	[illegible]	.8011874E-01	.1468718	[illegible]	[illegible]	-.8778288E-01

	RWFACT3	RWFACT4	RWFACT5	RWFACT6	RWFACT7	RWFACT8	RWFACT9
RWFACT3	1.068858						
RWFACT4	-.78311114E-01	1.327600					
RWFACT5	.30679398E-01	-.67807218E-01	.3734171				
RWFACT6	-.34062078E-01	.1348143	.30103848E-01	.4308761			
RWFACT7	.1378877	-.88708108E-01	.8272890	-.98881092E-01	1.000039		
RWFACT8	.2270398	-.1074378	.1305481	-.35020108E-01	.1593735	.8100583	
RWFACT9	-.1363618	-.2206808	-.1140207	.1140832	-.82318048E-01	-.86836208E-01	1.068881

COVARIANCE MATRIX FOR GROUP 3, 78-81

	FCONC01	FCONC02	FCONC03	FCONC04	FCONC05	FCONC06	FCONC07	FCONC08
FCONC01	.8703184							
FCONC02	-.78280168E-02	.8840804						
FCONC03	-.65414032E-01	.86080888E-01	.8181401					
FCONC04	.86086888E-01	.37820888E-01	-.1007682	1.014828				
FCONC05	.1113106	.1008204	.16220178E-01	.40848008E-01	.8107207			
FCONC06	-.37817838E-01	.81817768E-01	.79820188E-01	.88037988E-01	-.87810408E-01	.8229783		
FCONC07	-.21093372E-01	.1378347	-.22480008E-01	-.84872325E-01	.20322088E-01	-.1457614	.8480988	
FCONC08	.1287781	-.1302278	-.46031298E-01	.1332830	.13852068E-01	-.20078088E-01	-.87504858E-01	1.008330
FCONC09	.43878538E-01	-.38008888E-01	-.17280888E-01	-.41332878E-01	-.1234583	.40188888E-01	-.1887086	.11177888E-01
FCONC10	-.84808898E-01	.88811888E-01	.1882208	.74288128E-01	-.1180311	.48845838E-01	-.1348802	-.44335878E-01
FCONC11	-.81871088E-01	-.20873738E-01	.30883188E-01	-.32328888E-01	.1133468	-.40813448E-01	.89025878E-01	.73211308E-01
FCONC12	.24401048E-01	.1606002	-.28341118E-01	-.82118628E-01	.42636138E-01	.83967748E-01	.88152818E-01	-.1086871
FCONC13	-.72873098E-01	.80420888E-02	.28701278E-02	-.31900038E-01	.38808818E-01	-.85068848E-01	-.38832008E-01	-.1033786
FCONC14	.20588838E-01	.78858038E-01	.38031238E-01	-.10557468E-01	-.40100738E-01	.34188048E-01	.1050420	-.16268238E-01
RWFACT1	.1483824	.1088083	.21088808E-01	.88773818E-01	-.1670012	.1123108	.47844168E-02	.1183086
RWFACT2	.83244788E-02	.1036787	.1836170	-.88888898E-01	.33302808E-01	-.68471118E-01	-.70871188E-01	.1172838
RWFACT3	.2188804	-.83830468E-03	.87113628E-01	-.1167851	.64584758E-01	.83351618E-01	.35308338E-01	.82857628E-03
RWFACT4	.38404168E-01	-.46956028E-01	.10338478E-01	.3660827	-.88670848E-02	.70732078E-01	-.1822840	.1827842
RWFACT5	.11483488E-01	.1789363	-.78478768E-01	-.87836788E-01	-.1034132	.1053130	.33948898E-01	.48807928E-01
RWFACT6	.20887808E-01	.46081838E-01	-.40180818E-01	-.1220706	.11814158E-01	-.64868108E-01	.38826088E-01	.87818388E-01
RWFACT7	.86437378E-01	.2300415	.1372801	-.61071168E-01	.1076810	-.41302488E-01	.44028028E-01	-.76073818E-01
RWFACT8	.1110884	.1769110	.33788738E-01	-.1849834	.2461793	-.80230838E-01	.72371468E-01	-.84888848E-01
RWFACT9	.80022388E-01	.2078180	.88384888E-01	.68868278E-01	-.44781308E-01	.78473128E-01	.68281048E-01	.32740168E-01

	FCONC09	FCONC10	FCONC11	FCONC12	FCONC13	FCONC14	RWFACT1	RWFACT2
FCONC09	1.008084							
FCONC10	-.10323388E-01	.7371470						
FCONC11	.60842138E-02	-.14811808E-01	1.014187					
FCONC12	.81230898E-01	-.20132898E-01	-.38279218E-02	.8874127				
FCONC13	.3137387	-.14687818E-01	-.81830128E-01	.88880368E-01	1.017721			
FCONC14	.32237208E-01	.82838768E-01	.43401078E-02	.10401818E-02	.88678838E-01	1.164203		
RWFACT1	.47884108E-01	-.85287788E-01	.78768888E-01	.88736168E-01	-.1876040	-.45835748E-01	.8078880	
RWFACT2	.53471018E-01	.1347390	-.87424448E-01	.68187788E-01	-.86172878E-03	.26763008E-01	-.87784278E-01	.7810808
RWFACT3	-.47874868E-01	.1147386	-.10414418E-01	.84811108E-01	.11362838E-01	.1840483	-.27794278E-01	.1736160
RWFACT4	-.18202438E-01	-.84472808E-02	.33018188E-01	-.88470488E-01	-.1044414	-.3833888	.2064298	-.24823878E-01
RWFACT5	-.1663336	[illegible]	[illegible]	.1113880	-.1681281	[illegible]	[illegible]	-.87833748E-01
RWFACT6	.1087280	[illegible]	[illegible]	.1318849	.4182373[illegible]	[illegible]	[illegible]	[illegible]

	FCONC09	FCONC10	FCONC11	FCONC12	FCONC13	FCONC14	RWFACT1	RWFACT2
RWFACT8	.2030486	-.1073886	.30787418E-01	.1180830	.1803603	-.1064087	-.1136441	.86868038E-01
RWFACT9	-.26306332E-01	.1562015	-.1116851	.48828808E-01	-.1731078	.2266781	.1030146	.33680031E-01

	RWFACT3	RWFACT4	RWFACT5	RWFACT6	RWFACT7	RWFACT8	RWFACT9
RWFACT3	1.037468						
RWFACT4	.40838108E-01	.8104278					
RWFACT5	-.77801118E-01	-.14068118E-01	1.273078				
RWFACT6	-.32641848E-01	-.84037308E-01	.1148883	.7367447			
RWFACT7	-.33138078E-01	.83002838E-01	-.16032838E-01	-.74714808E-01	1.182104		
RWFACT8	-.16430778E-01	-.88670838E-01	.88408088E-01	.2282388	.1044678	.8460818	
RWFACT9	.1061882	-.1208388	.1880871	-.80763008E-01	-.87368128E-02	-.31882848E-01	1.078107

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	FCONC01	FCONC02	FCONC03	FCONC04	FCONC05	FCONC06	FCONC07	FCONC08
FCONC01	1.102844							
FCONC02	.89321418E-02	1.002068						
FCONC03	.32178318E-01	-.38008868E-01	1.110214					
FCONC04	.11610808E-01	-.16333688E-01	.88028878E-01	.8180478				
FCONC05	-.38304128E-01	.63613668E-01	-.80488348E-01	.38348818E-02	1.100842			
FCONC06	.31160828E-01	-.1107887	-.88348018E-01	.68831268E-01	.74003028E-01	1.063880		
FCONC07	-.13886388E-01	-.1008380	-.23820008E-01	.1383804	-.18584328E-01	.80734248E-01	1.134784	
FCONC08	-.78133378E-01	.47713308E-01	.38830388E-01	-.87607418E-01	-.44828468E-01	.30211688E-01	.1073872	1.060870
FCONC09	.68884308E-02	-.33861008E-01	.17640608E-02	.1104723	.42188368E-02	-.33740408E-01	.20374308E-01	-.88148478E-01
FCONC10	-.38882238E-02	.42410868E-02	-.66868848E-01	.84804378E-01	.38018128E-01	-.23858228E-01	-.70816218E-02	-.38208148E-01
FCONC11	.30787408E-02	-.33268808E-01	-.37134878E-01	.1163818	-.1186138	-.31701328E-01	-.1000851	-.80680608E-01
FCONC12	-.70301308E-01	-.78284708E-01	.18803808E-02	.1282833	-.33084408E-01	-.82338088E-01	-.83821328E-01	.81274568E-01
FCONC13	.13263868E-01	.81047718E-02	.21881438E-01	-.38741788E-01	.10080138E-01	.83183088E-01	-.18836428E-01	.38587708E-01
FCONC14	-.81344338E-01	-.43273888E-01	.30883088E-01	-.18137278E-01	.18840378E-02	-.31107418E-01	.40768768E-02	-.78208328E-02
RWFACT1	-.83811808E-02	-.88223488E-01	.3088101	-.1384800	-.88646318E-02	-.88782148E-01	.88884248E-01	.83681668E-01
RWFACT2	.1301188	.1007882	.73482008E-01	.18871238E-01	-.1703188	-.1742860	.17240878E-01	.1018164
RWFACT3	.33803808E-01	.83888568E-01	.18878868E-01	-.84838318E-01	.48832688E-02	.2864118	.1738330	.1383188
RWFACT4	.1331808	-.74708408E-01	-.30184318E-01	.30188468E-01	-.86808838E-01	.47208308E-01	-.38804118E-01	.1684188
RWFACT5	-.83488388E-01	-.78860488E-01	-.38111108E-01	-.88834418E-01	-.83877338E-01	-.87033038E-02	.38138288E-02	.82188478E-01
RWFACT6	-.83848318E-01	.83883868E-01	-.1861761	-.88801768E-01	.88870808E-01	-.1786883	.44238838E-02	.1080032
RWFACT7	.48731768E-01	.1223487	.40184878E-01	-.11440428E-01	.41083888E-01	.88768888E-02	.34863808E-01	.1418108
RWFACT8	.78480308E-01	-.34803438E-01	.81880108E-02	.88808888E-01	.38888848E-01	.11023188E-01	.1321722	-.17734188E-01
RWFACT9	-.44468808E-01	.1480030	-.88060388E-01	-.31102448E-01	.81808308E-01	-.38323808E-01	-.14307228E-01	.1607068

	FCONC09	FCONC10	FCONC11	FCONC12	FCONC13	FCONC14	RWFACT1	RWFACT2
FCONC09	.8368821							
FCONC10	-.71176603E-01	1.320085						
FCONC11	-.42184208E-01	-.10210732E-01	1.078013					
FCONC12	-.88658212E-01	-.61868818E-01	-.14227768E-01	1.224686				
FCONC13	-.2082839	.24781689E-01	.88418298E-01	-.29083186E-01	.8780223			
FCONC14	.10048863E-01	-.61828866E-01	-.16562347E-01	.82084486E-01	-.30304618E-01	.8207671		
RWFACT1	-.28008632E-02	.68066886E-01	.22050800E-02	.86770888E-01	.14452468E-01	.31117636E-01	1.171841	
RWFACT2	.80085236E-01	-.78677668E-01	-.33771288E-01	.86762876E-01	-.68061668E-01	.1801301	-.64483888E-01	1.164730
RWFACT3	.12102318E-02	.33363876E-01	-.78637728E-01	.30482618E-01	-.1018688	-.80774468E-02	.16867428E-01	-.1148838
RWFACT4	.63638236E-01	.10821638E-01	-.33801018E-01	-.34308838E-01	-.84483088E-01	-.77788388E-01	.33284318E-01	.88101348E-01
RWFACT5	.1843121	.1107831	-.28892128E-01	-.28841018E-01	-.86200788E-01	-.33206888E-01	-.98811788E-01	.87418078E-01
RWFACT6	.84360208E-01	-.87218418E-01	-.82871878E-01	-.68684288E-01	.20808658E-01	.1010424	.12188688E-01	.81181428E-01
RWFACT7	-.38027348E-01	.88808468E-01	.11878808E-01	-.78882688E-01	.81888808E-01	.1128222	-.77728268E-01	.84478888E-01
RWFACT8	.86366236E-01	.74086852E-01	-.1364481	-.44006878E-01	-.43348308E-01	.42681888E-01	.87381118E-01	-.67043618E-01
RWFACT9	.84814798E-01	.88026208E-01	-.80378036E-02	.32730798E-01	.1447881	-.12814408E-01	-.16630788E-01	.68836888E-01

	RWFACT3	RWFACT4	RWFACT5	RWFACT6	RWFACT7	RWFACT8	RWFACT9
RWFACT3	.8887730						
RWFACT4	-.10806448E-01	.7168737					
RWFACT5	.18777268E-01	.70210688E-01	1.030381				
RWFACT6	.22884878E-01	-.88888888E-02	-.76888188E-01	1.308821			
RWFACT7	-.47328868E-01	-.88433848E-01	-.1134688	.68668178E-01	.8730846		
RWFACT8	-.78188888E-01	.88438888E-01	-.70333588E-01	-.1173808	-.1100271	1.187708	
RWFACT9	-.24032888E-01	.60721288E-01	-.71468868E-01	-.13008368E-01	-.82838378E-02	.60031828E-01	.8777478

- D I S C R I M I N A N T   A N A L Y S I S -

ON GROUPS DEFINED BY PER

ANALYSIS NUMBER 1

STEPWISE VARIABLE SELECTION

SELECTION RULE: MAXIMIZE RAO'S V
MAXIMUM NUMBER OF STEPS.................... 46
MINIMUM TOLERANCE LEVEL.................... .00100
MINIMUM F TO ENTER......................... 3.0000
MAXIMUM F TO REMOVE........................ 1.0000
MINIMUM INCREASE IN RAO'S V................ 0.

CANONICAL DISCRIMINANT FUNCTIONS

MAXIMUM NUMBER OF FUNCTIONS................ 3
MINIMUM CUMULATIVE PERCENT OF VARIANCE.... 100.00
MAXIMUM SIGNIFICANCE OF WILKS' LAMBDA..... 1.0000

PRIOR PROBABILITY FOR EACH GROUP IS .33333

---------------- VARIABLES IN THE ANALYSIS AFTER STEP 8 ----------------

VARIABLE	TOLERANCE	F TO REMOVE	RAO'S V
VCONC07	.0670100	14.648	
VCONC10	.0780013	6.4303	
RWFACT1	.0722000	16.807	
RWFACT2	.0013073	7.3473	
RWFACT4	.0648901	20.018	
RWFACT5	.0036006	6.0070	
RWFACT7	.0010028	7.3160	
RWFACT8	.0036402	8.0661	

------------------- VARIABLES NOT IN THE ANALYSIS AFTER STEP 8 -------------------

VARIABLE	TOLERANCE	MINIMUM TOLERANCE	F TO ENTER	RAO'S V
FCONC01	.8744023	.8611806	.23717	
FCONC02	.8152807	.8152807	.26220	
FCONC03	.8600240	.8603808	.38043E-01	
FCONC04	.8418800	.8267872	.70443	
FCONC05	.8657263	.8631673	2.7843	
FCONC06	.8857006	.8648302	.48806	
FCONC08	.8384812	.8370881	.73882	
FCONC09	.8906405	.8620962	.89948	
FCONC11	.8823443	.8834430	.38732	
FCONC12	.8761486	.8887804	.37748	
FCONC13	.8657807	.8842218	.72618E-01	
FCONC14	.8568784	.8540086	1.8470	
RWFAC13	.8802807	.8837408	1.0883	
RWFAC16	.8887438	.8642878	.87841E-01	
RWFAC18	.8778184	.8470858	.10728	

F LEVEL OR TOLERANCE OR VIN INSUFFICIENT FOR FURTHER COMPUTATION.

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CONCORDIA UNIVEVERSITY COMP CT CYBER 180/830D NOS 2.4.3

SUMMARY TABLE

STEP	ACTION ENTERED	ACTION REMOVED	VARS IN	WILKS' LAMBDA	SIG.	RAO'S V	SIG.	CHANGE IN V	SIG.	LABEL
1	RWFACT4		1	.863858	.0000	84.32	.0000	84.33	.0000	REGR FACTOR SCORE 4 FOR ANALYSIS 1
2	RWFACT1		2	.785589	.0000	109.2	.0000	44.84	.0000	REGR FACTOR SCORE 1 FOR ANALYSIS 1
3	FCONC07		3	.735818	.0000	140.8	.0000	31.83	.0000	REGR FACTOR SCORE 7 FOR ANALYSIS 1
4	RWFACT2		4	.711287	.0000	158.8	.0000	17.85	.0001	REGR FACTOR SCORE 2 FOR ANALYSIS 1
5	RWFACT8		5	.687268	.0000	177.7	.0000	18.85	.0001	REGR FACTOR SCORE 8 FOR ANALYSIS 1
6	RWFACT7		6	.668677	.0000	196.1	.0000	17.40	.0002	REGR FACTOR SCORE 7 FOR ANALYSIS 1
7	FCONC10		7	.648331	.0000	208.0	.0000	13.88	.0010	REGR FACTOR SCORE 10 FOR ANALYSIS 1
8	RWFACT5		8	.627886	.0000	223.8	.0000	14.88	.0006	REGR FACTOR SCORE 5 FOR ANALYSIS 1

CLASSIFICATION FUNCTION COEFFICIENTS
(FISHER'S LINEAR DISCRIMINANT FUNCTIONS)

PER =	1 68-74	2 75-81	3 82-88
FCONC07	-.2847432	-.3035468	-.3264124
FCONC10	-.1380304	-.2325406	.1017334
RWFACT1	-.5109919	-.2172192	.2249420
RWFACT2	-.2646600	-.2076220	.2273688
RWFACT4	.0613264	.2679434E-01	-.3601816
RWFACT5	-.2007588	.2043824	-.8202373E-01
RWFACT7	.1856673	.2566862	-.2248223
RWFACT8	.2762816	.2212433	-.2400088
(CONSTANT)	-1.622487	-1.205402	-1.210221

CANONICAL DISCRIMINANT FUNCTIONS

FUNCTION	EIGENVALUE	PERCENT OF VARIANCE	CUMULATIVE PERCENT	CANONICAL CORRELATION	:	AFTER FUNCTION	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFICANCE
					:	0	.6278854	186.60	16	.0000
1*	.47087	84.97	84.97	.5658411	:	1	.9231148	32.041	7	.0000
2*	.08329	15.03	100.00	.2772818	:					

* MARKS THE 2 CANONICAL DISCRIMINANT FUNCTION(S) TO BE USED IN THE REMAINING ANALYSIS.

STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	FUNC 1	FUNC 2
FCONC07	.43081	.38782
FCONC10	.26358	.28893
RWFACT1	.48486	-.08528
RWFACT2	.32953	.11125
RWFACT4	-.84898	[illegible]
RWFACT8	-.07470	[illegible]
RWFACT7	.31184	-.28823

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STRUCTURE MATRIX:

POOLED WITHIN-GROUPS CORRELATIONS BETWEEN CANONICAL DISCRIMINANT FUNCTIONS AND DISCRIMINATING VARIABLES
VARIABLES ARE ORDERED BY THE FUNCTION WITH LARGEST CORRELATION AND THE MAGNITUDE OF THAT CORRELATION.

	FUNC 1	FUNC 2
FCONC07	.48330*	.25626
RWFACT1	.43683*	-.00815
RWFACT2	.35026*	.13066
RWFACT9	-.33803*	-.11182
FCONC10	.18940*	.10407
FCONC08	-.10823*	.06238
FCONC12	.08328*	-.01115
RWFACT3	.08760*	.06315
FCONC06	-.08232*	-.03743
FCONC03	.08430*	-.00808
FCONC09	-.06072*	-.02211
RWFACT5	-.04347	-.60168*
RWFACT4	-.52408	.50882*
RWFACT7	-.18693	-.21862*
FCONC04	-.10327	.20207*
FCONC02	-.07994	-.13873*
FCONC14	.04785	-.08121*
FCONC11	.00781	-.06607*
FCONC05	.02735	-.06324*
RWFACT8	.06017	.06663*
FCONC13	-.01677	-.05561*
FCONC01	-.02426	.03123*
RWFACT6	-.03147	-.03718*

VARIMAX ROTATION TRANSFORMATION MATRIX

	FUNC 1	FUNC 2
VARIANCE	68.38	31.62
FUNC 1	.87341	.48690
FUNC 2	.48690	-.87341

ROTATED CORRELATIONS BETWEEN CANONICAL DISCRIMINANT FUNCTIONS AND DISCRIMINATING VARIABLES
VARIABLES ARE ORDERED BY THE FUNCTION WITH LARGEST CORRELATION AND THE MAGNITUDE OF THAT CORRELATION.

	FUNC 1	FUNC 2
FCONC07	.59982*	.01184
RWFACT1	.36836*	.21686
RWFACT2	.28221*	.00778
RWFACT7	-.27847*	.08808
RWFACT9	-.26323*	-.01874
FCONC10	.24878*	-.03861
RWFACT3	.10722*	-.01249
FCONC05	-.08828*	-.01614
FCONC12	.07817*	.06468
RWFACT8	.07081*	-.02416
FCONC06	-.06866*	-.00483
FCONC03	.04361*	.03347
FCONC13	-.04172*	.04040
RWFACT6	-.03188*	.01328
RWFACT4	-.18810	-.77822*
RWFACT5	-.33088	.80434*
FCONC04	.00831	-.33678*
FCONC09	-.06902	-.10787*
FCONC02	-.08772	.08780*
FCONC14	.00228	.08423*
FCONC08	-.00681	.06858*
FCONC11	-.02826	.06186*
FCONC01	-.00588	-.03808*

ROTATED STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

	FUNC 1	FUNC 2
FCONC07	.85816	-.12883
FCONC10	.38841	-.08828
RWFACT1	.38067	.31847
RWFACT2	.34122	.06288
RWFACT4	-.18311	-.84203
RWFACT5	-.27924	.82876
RWFACT7	-.38786	.07382
RWFACT9	-.38310	-.06103

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UNSTANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	FUNC 1	FUNC 2
FCONC07	.5864074	-.1358307
FCONC10	.3581542	-.9905404E-01
RWFACT1	.4060878	.3270163
RWFACT2	.3486000	.6368808E-01
RWFACT4	-.1066638	-.8043508
RWFACT6	-.3841281	.8336662
RWFACT7	-.4012647	.7446718E-01
RWFACT9	-.3672312	-.8172607E-01
(CONSTANT)	-.3107870E-15	.3361788E-15

CANONICAL DISCRIMINANT FUNCTIONS EVALUATED AT GROUP MEANS (GROUP CENTROIDS)

GROUP	FUNC 1	FUNC 2
1	-.61463	-.01876
2	-.62016	.10528
3	.60887	.26888

TEST OF EQUALITY OF GROUP COVARIANCE MATRICES USING BOX'S M

THE RANKS AND NATURAL LOGARITHMS OF DETERMINANTS PRINTED ARE THOSE OF THE GROUP COVARIANCE MATRICES.

GROUP LABEL	RANK	LOG DETERMINANT
1 68-74	8	-3.338348
2 75-81	8	-1.388886
3 82-88	8	.031108
POOLED WITHIN-GROUPS COVARIANCE MATRIX	8	-.812208

BOX'S M	APPROXIMATE F	DEGREES OF FREEDOM		SIGNIFICANCE
333.30	2.0888	72,	208164.1	.0000

$p < .05$ therefore the following prediction is <u>not</u> robust.

GROUP COVARIANCE MATRICES OF THE CANONICAL DISCRIMINANT FUNCTIONS

NOTE FOR COMPARISON THAT THE POOLED WITHIN-GROUPS COVARIANCE MATRIX OF THE CANONICAL DISCRIMINANT FUNCTIONS IS AN IDENTITY MATRIX.

GROUP 1, 68-74

	FUNC 1	FUNC 2
FUNC 1	.64224	
FUNC 2	.07878	1.21456

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GROUP        2. 75-81

                  FUNC  1        FUNC  2

 FUNC  1          .01618
 FUNC  2         -.11381         .08880

GROUP        3. 82-88

                  FUNC  1        FUNC  2

 FUNC  1         1.24030
 FUNC  2          .03611         .01728

TEST OF EQUALITY OF COVARIANCE OF THE CANONICAL DISCRIMINANT FUNCTIONS

  THE RANKS AND NATURAL LOGS OF DETERMINANTS PRINTED ARE THOSE OF THE GROUP
  COVARIANCE MATRICES OF THE CANONICAL DISCRIMINANT FUNCTIONS.

   GROUP LABEL                          RANK    LOG DETERMINANT

       1 68-74                            2         -.256403
       2 75-81                            2         -.223431
       3 82-88                            2          .128130
   POOLED WITHIN-GROUPS COVARIANCE
   MATRIX (AN IDENTITY MATRIX)            2          .000000

   BOX'S M       APPROXIMATE F  DEGREES OF FREEDOM  SIGNIFICANCE
    18.780         2.2706         6.     778880.6      .0032

CLASSIFICATION RESULTS -

                          NO. OF    PREDICTED GROUP MEMBERSHIP
    ACTUAL GROUP          CASES         1         2         3
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GROUP        1              82         45        30         7
68-74                                54.9P     36.6P      8.5P

GROUP        2             120         20        76        24
75-81                                16.7P     63.3P     20.0P

GROUP        3             208         26        46       136
82-88                                12.2P     22.0P     65.9P

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED:  62.00P
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