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AN INTEGRATED MODEL FOR THE IMPLEMENTATION OF COMPUTER TECHNOLOGY

by

TERRENCE A. BRUCHAL 

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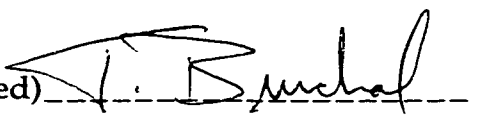
(signed) 

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DATE: March 12, 2001

UNIVERSITY OF ALBERTA
FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled An Integrated Model For The Implementation Of Computer Technology submitted by Terrence A. Bruchal in partial fulfillment of the requirements for the degree of Doctor of Philosophy, in Educational Administration and Leadership.

Dr. Don Richards (Committee Chair)

Dr. T. Craig Mongomerie (Supervisor)

Dr. Eugene Romaniuk

Dr. Frank Peters

Dr. Don Richards

Dr. Thomas P. Keenan
(External Examiner)

DATE: March 12, 2001

ABSTRACT

The purpose of this study was to describe the various change models that were used to guide implementation of computer technology in a large high school over the duration of the study (1987 to 1995), to confirm that successful change was achieved, and to develop an integrated approach for using various models during the implementation of computer technology.

The study site was an inner city high school of approximately 1400 students and 75 staff members. These numbers gradually decreased to approximately 1100 students and 65 staff by 1995. The school was a composite high school and, in addition to academic programs, offered the following wide range of programs: Career and Technology Studies including Vocational Studies, English as a Second Language, Industrial Occupations, Learning Resource Program, Native Studies, Romance Languages, and Food Preparation.

In September 1987, only a handful of teachers were interested in using computer technology. During that year, a model of change was chosen to guide the development of a technology plan, and implementation began. Over the following eight years an increasing number of teachers became involved in the project. Teachers initially used computers only as productivity tools. Gradually the teachers began using computers for automation, then instruction, and finally the use of computers became integrated into everyday instructional use.

A record was kept from 1987 to 1995 of anything that affected or was affected by technology in the school. The documentation included

implementation plans, yearly event timelines, school reviews, and an evaluation of the computer implementation program including interviews, and a survey. From observations and these data, a case study was developed and analyzed using the Concerns Based Adoption Model (CBAM) as the analytical model. From the beginning of the implementation of the project to the end of data collection, implementation strategies evolved, partially to accommodate new conditions and occasionally to rectify ineffective strategies.

It was concluded that change, involving the use of four different change models, had occurred successfully at the study site. In general, there was a movement from singular processes with deliberate outcomes to pluralistic processes with emergent outcomes as implementation progressed. Throughout the progression of change there was a movement from lower to higher levels of innovation configuration, stages of concern, levels of use (diagnostic tools of the CBAM), and diversity among users of computer technology.

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CHAPTER I

THE PROBLEM

Introduction

Schools are experiencing enormous pressure to adopt and promote technological innovations which are occurring in the larger society. As society becomes inundated with the rapid introduction of information technology, schools are expected implement it (Hope, 1996). Green (1996) reported that the use of some form of information technology in college courses increased by at least one-half and in some cases nearly doubled over the period 1994 and 1995. Technology in various forms is becoming commonplace in classrooms, however, there is "no widely recognized standard procedure, format, blueprint, or model, demonstrating how to proceed through the process of initiation, implementation, and institutionalization of technology in a school" (Hope, 1996, p. 54). While educators planning for the implementation of computer technology have many models available to them from the literature, choosing one can be confusing to the school practitioner without some standard or guideline. Some technology planning models have been developed on the basis of actual experiences while others are purely theoretical, and no single model or set of rules can adequately prescribe a formula that will successfully implement innovations in every circumstance (Herriott & Gross, 1979).

Early models of change assumed that a particular model could be universally applied across varied contexts to invoke successful change. Current models or views of the change process promote the notion that a particular model for change should be selected with consideration to the context of the change site. Therefore, many models of change are required to facilitate different contexts, and a single, appropriately chosen model might be sufficient to facilitate successful change at a particular site. However, if a model is selected with respect to the context and conditions of context change over time, therefore changing the context, does not successful change require the use of several models throughout the process?

"Technological change in schools and school systems involves many complex, diverse, and uncertain organizational processes" (Riffel & Levin, 1997, p. 51). However, we can hopefully learn from the experience of other implementation sites. Technology is an area in which implementation is already occurring as teachers and schools make efforts in various directions. Riffel and Levin asserted that we have the ability to learn from all that experience, but that capacity is sadly lacking because most technological implementation projects are not documented or circulated.

This study examined a particular change site over an extended period (1987 to 1995) in an attempt to derive some insight and guidance for educators and administrators contemplating, or struggling with, the implementation of information technology.

Background

Since 1987, the planning for and coordinating of implementation of computer technologies occurred at a particular school site. This study focuses on implementation at that particular site. This site is referred to as the site or the school. Data were analyzed to determine if the implementation was successful, and an integrated approach for using various models during implementation of computer technology was developed.

The Site

In 1987, the study site was an inner city high school of approximately 1400 students and 75 staff members. These numbers gradually decreased to approximately 1100 students and 65 staff by 1995. The staff varied in age from their early twenties to early sixties with a bulge in the mid-forties to mid-fifties. The student body was highly diversified with representation from 56 nations. The students possessed academic abilities ranging from far below to well above average, and they came from all parts of a large western Canadian city. A significant number of these students were recent immigrants to Canada and most came from a low to middle class socio-economic background.

The school was a composite high school and, in addition to academic programs, offered the following wide range of programs: Career and Technology Studies including Vocational Studies, English as a Second Language, Industrial Occupations, Learning Resource Program, Native Studies, Romance Languages, and Food Preparation.

The school had a floor area of 320,000 square feet, was built in five sections between 1931 and 1967, stood four stories tall, and was situated on a busy street in the center of the city.

The Researcher

I was a 35 year old academic teacher when the initiative to introduce computer technology began in 1987. I was in the midst of completing requirements for a Masters Degree in Education and was charged with the responsibility of implementing computer technology in the school.

Overview

In September 1987, some staff at the school had begun to think about ways to implement computer technologies into their teaching. The school administration appointed me to develop and implement a plan to use computers in the school. At that time, only a handful of teachers were interested in discussing the implications of such an undertaking. During that year, a model of change was chosen to guide the development of a technology implementation plan, and implementation began.

Over the following eight years an increasing number of teachers became involved in the project. Resource centers, computer labs, networks (both administrative and instructional), information centers, an on-line communications center, a support center, and a repair center were introduced into the school. All were operated, maintained, and staffed by teachers. Teachers used computers both as productivity and instructional tools.

This undertaking was a study in planned change and implementation strategies evolved to accommodate new conditions and to rectify ineffective strategies for using technology. The choice of strategies was a result of the explicit use of change models. Four models

were utilized throughout the course of the change process. A record was kept (from 1987 to 1995) of anything that affected or was affected by technology in the school.

Purpose of the Study

The purpose of this study was to describe the various change models that were used to used to guide implementation of computer technology over the duration of the study (1987 to 1995), to determine whether successful change was achieved, and to develop an integrated approach for using various models during the implementation of computer technology.

The Study

Significance of the study

Most classical change models found in the literature describe stages of change. It is often assumed that the change process can be described by these stages, and that change can be facilitated by using a single model.

The significance of this study is that (a) the change process was implemented over a period of eight years, from 1987 to the end 1995, (b) the implementation of technology was observed from its infancy, and (c) four models of change were used during the implementation period observed.

If change strategies varied in response to emerging factors affecting the change as change proceeded, reflecting a shift from one model to the next, then perhaps successful change can be better achieved through the use of various models, utilizing a particular model at a particular time throughout the change process.

Structure of this Document

Chapter II presents a literature review of classical change models and strategic planning models. These are compared on a typology. There is a discussion on developing strategies followed by a synopsis of recent trends in the literature on technological change.

Chapter III describes the methodology of this study and Chapter IV presents the case study, followed by the case study analysis in Chapter V.

The last chapter, Chapter VI, presents a summary of this study and the conclusions, implications, and recommendations.

CHAPTER II

REVIEW OF THE LITERATURE

Preamble

There is an overwhelming amount of literature that pertains to innovation and change. Havelock has written extensively on the topic of innovation and change. Havelock (1968) included approximately 4000 relevant sources; Van Meter and Scollay (1985) included 900 references. The vast amount of literature on the subject necessitated that some restriction be placed on the material that was reviewed and included in the literature review. Although change and innovation can be described from many different conceptual orientations, a decision was made to review only literature which was based on change and innovation at the organizational level.

A survey of the literature revealed that at least two distinct branches of change theory exist, and from these roots various models evolved over decades. One branch of change theory is concerned with the identification and labeling of the process of change. Arising predominately out of an era in which classical management was prevalent, models of this branch emphasize the predictable nature of change through the use of identifiable and sequential stages. In the remainder of this document, these models will be referred to as classical models.

The second branch of change theory is concerned with planning rather than stages of change. Having its roots in the military, strategic planning can be traced back as far as the ancient Greeks. Like the classical models, strategic planning was popularized in an era of classical management, and therefore models evolving from this branch descend from classical thought of strategic planning. In strategic planning, the models are generally referred to as schools of thought.

Both branches resulted in various models or schools that evolved from a classical beginning, however, since they are fundamentally different each branch will be considered separately. Models from both branches will then be compared on a common typology reflecting trends from the 1960's through the 1990's.

Overview

Classical models are reviewed first. This section starts with a discussion of the different orientations from which stages in the most popular classical models have emerged. Then classical models are reviewed, compared, and summarized in Table 2.

Next, strategic planning is discussed, starting with an attempt to define what constitutes a strategy. The schools of strategic planning are reviewed and then summarized in Table 4.

Next, classical models and strategic schools of thought are compared on a common typology which was derived from Whittington's (1993) general perspectives of change that span trends of the 1960's through to the 1990's.

Finally, the application of strategies to organizational change, and trends in technological change are discussed. A pictorial overview of the structure of the literature review is presented in Figure 1.

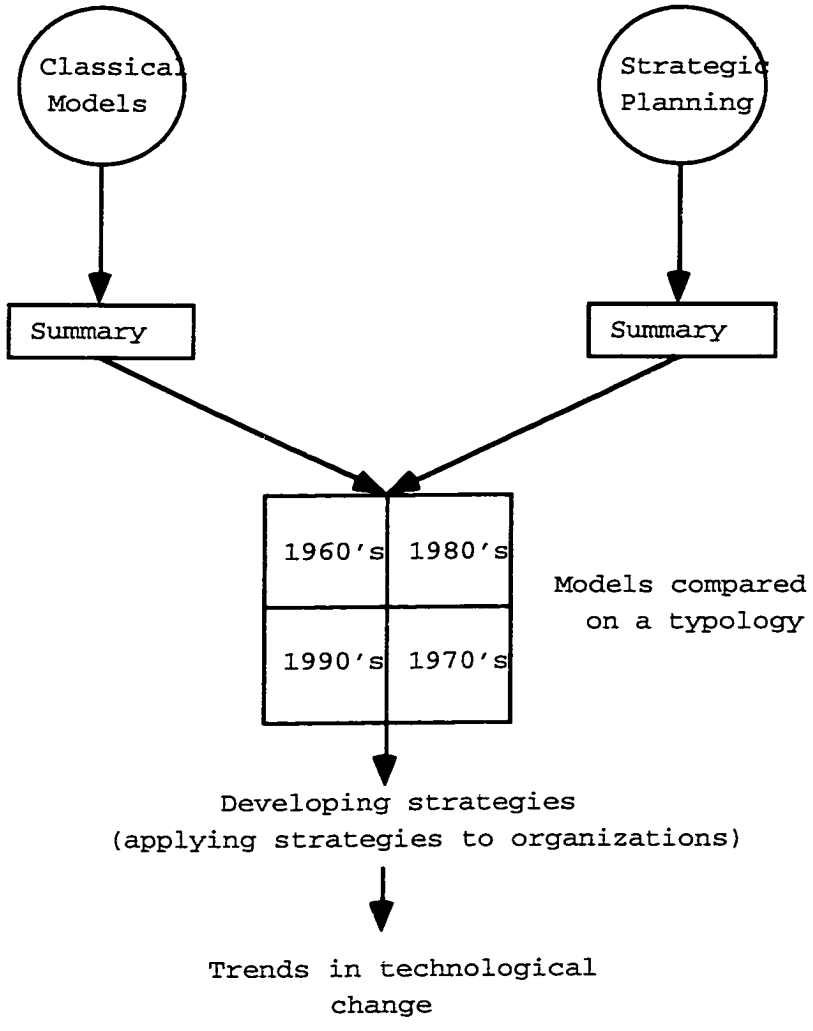


Figure 1. Structure of the Literature Review

Classical Change Models

Orientations of Change Models

The models of innovation and change represent theoretical efforts that attempt to impose structure and order on the change process. Lozier and Covert (1982) wrote of the change process in relation to social structures. They stated that social structures result from the balance between the natural tendency to preserve a high degree of stability and the equally natural pressure toward change. They suggested that models of

change provide strategies for dealing with the resistance to change and innovation. Brown and Eisenhardt (1998) insisted that the challenge in change is in managing it, and that early models provided a means of planning, commanding, and controlling change.

According to Lozier and Covert, many of the models are based on a model of change developed by Lewin (1947). Morrish (1976) identified the three stages of Lewin's model as "unfreezing," "moving," and "re-freezing." Lozier and Covert explained that models of this type view change as a series of stages. The unfreezing stage includes awareness of the need for change, development of problem awareness, and reduction of dependence on existing organizational structures and ideas. The second stage involves the identification and acquisition of information and actions that may be integrated into an effective solution for the perceived problem. During the re-freezing stage the solution is generalized and stabilized within the organizational structure. Models based on Lewin's approach assume that organizational structure is normally stable and unchanging, and that the change process can be represented in a lock-step fashion.

Change models vary on a number of aspects. Rosenblum and Louis (1981) described change in terms of the rational and non-rational aspects of an organization. They suggested that organizations fall into two categories of organizational change: rational systems and natural systems. In the rational systems approach, the process of change in an organization is the result of deliberate, rational decision making, based on need, facts, and insight. On the other hand, in the natural systems approach, the change process involves both non-rational and rational aspects of the organization. Butler (1998) noted that terms such as economic rationality and bounded rationality also refer, respectively, to the rational and non-rational attributes of an organization. Non-rational aspects of an organization include factors such as practices, beliefs, and existing organizational structures. Like Rosenblum and Louis, Van Meter and Scollay (1985) also used the rational/non-rational view of organizations to categorize change processes. They proposed that organizations fall into two categories with respect to change: rational organizations and

organizations of 'limited rationality.' These categories are equivalent to the rational and natural systems categories that were proposed by Rosenblum and Louis (1981). Van Meter and Scollay proposed that schools are organizations of limited rationality since culture, values, and existing structures of society and of the organization must be considered as factors in the change process.

Shears (1987) described the process of change in another manner. Shears categorized change according to authoritative and democratic decision making processes. In an authoritative approach, the decision to innovate is made by one individual or a few selected elite individuals. Essentially, the power center makes a decision and change filters, top-down, through the levels of the organization. In the democratic approach, change comes about by consensus and negotiation throughout levels of the organizational structure. Shears stated that consideration should be given to the structure of the organization, the management style, the nature of change, and the individuals involved when choosing the most satisfactory approach to change. The authoritative/democratic view of change was also held by Balistreri (1987). He labeled the first approach as "coercion" and the second approach as "philosophical agreement."

Hansen (1979) described yet another approach to the study of change processes. Hansen identified three types of change that were based on the rate at which the innovation is implemented into an organization: planned change, evolutionary change, and spontaneous change. Planned change is deliberate and directed organizational change. The remaining two types of change are regarded as unplanned. Evolutionary change occurs slowly and is the result of cumulative alterations that occur while adjusting to conditions that are internal and external to the organization, rather than the result of a deliberate, managed change. Johnson (1987) referred to this process as incremental change, in which the organization feels or muddles its way through change. Spontaneous change tends to occur quickly and is a response to natural circumstances and random occurrences.

Rogers and Shoemaker (1971) presented another basis for categorizing change. Their view was that change is based on where the

innovation had originated and on where the recognition for the necessity of change had originated. These factors may either originate from within the organization (internally) or outside the organization (externally). When the innovation is developed internally, the change process is referred to as 'immanent change' and the need for change is usually internally recognized. When the innovation is externally developed, the change process is referred to as 'contact change.' In 'contact change,' the need for change can be internally or externally recognized. Rogers and Shoemaker described the types of contact change in this manner:

> Selective contact change results when members of a social system are exposed to external influences and adopt or reject a new idea from that source on the basis of their needs. Directed contact change, or planned change, is caused by outsiders who, on their own or as representatives of change agencies, intentionally seek to introduce new ideas in order to achieve goals they have defined. Much change that occurs today is directed, and.... (p. 38)

Other classifications of the types of change can be found in the literature. However, these classifications appear to overlap and become unclear as distinct orientations; some appear to be permutations of others. Bennis (1966) described eight classifications of change: planned change, indoctrination, coercive change, technocratic change, interactional change, socialization change, emulative change, and natural change. Each of these categories employ some of the characteristics of the previously mentioned orientations. Peters (1986) described the classification developed by Bennis (1966) as "a somewhat involved classification of change" (p. 27).

In summary, various orientations support different beliefs about organizations and the nature of change. The orientations discussed in this section are listed in Table 1.

Table 1

Summary of Orientations of Classical Models

Concept	Essence
stability vs. pressure to change	opposing forces, natural
unfreezing, moving, freezing	tendency to not change
rational vs. non-rational change	organizational dynamics
authoritative vs. democratic change	decision making
planned vs. evolutionary vs. spontaneous change	rate of change
immanent vs. contact change	origin of the innovation (internal or external)

The adoption of an innovation can be described from the perspective of stages of change, predictability of behavior, factors that influence change, such as the adopters, the culture and the innovation (Gbomita, 1997). Depending on the particular perspective, different aspects of the change process become salient and result in the development of a classical model with a particular orientation.

Popular Classical Change Models

Ten models are considered in this section. These models are abundantly described in the literature and represent unique positions. In general, the change models presented here focus on planned change as opposed to evolutionary change, and are primarily rooted in the rational view of organizations rather than the natural systems approach. All of the models describe the change process with the use of stages of change except two of the most recent classical models, Elmore's (1978) model which is a composite of several models, and Bigelow's (1982) model which describes change from the opposing forces orientation (stability vs. pressure to change).

It is not possible to evaluate all models on exactly the same basis because each model advances some unique aspects of change. Therefore

each model is considered separately and important aspects of the model are described and related to the other models.

1. Research, Development, Diffusion, And Adoption Model

The RDDA (Research, Development, Diffusion, and Adoption) model and the RDD (Research, Development, Diffusion) model differ only in that the later does not include the adoption stage (Havelock, 1971). This model places emphasis on product development and the developer. According to Havelock, conceptualization of the RDD model was evolved by Brickell (1961) and further developed into the RDDA model by Clark and Guba (1965). Clark and Guba described four phases of the RDDA model, that they further subdivided into eight stages:

1. Research
2. Development
   a. Invention
   b. Design
3. Diffusion
   a. Dissemination
   b. Demonstration
4. Adoption
   a. Trial
   b. Installation
   c. Institutionalization

The research and development phases are involved with product, process, or idea development in order to solve a particular problem. Diffusion describes the flow of information from experts and product developers to the users (the people experiencing the problem). The adoption phase has three stages. The first stage is the trial of the innovation in the context of a particular situation. In the second stage, the innovation is installed for use in a particular organization. The final stage establishes (institutionalizes) the

permanency of the innovation in the organization. Morrish (1976) presented a similar interpretation of research and development models but renamed the general phases as invention, development, production, and dissemination. Essentially, Morrish retained the stages of the RDDA model but eliminated the substages.

In research and development models, communication is uni-directional, from the external group to the internal group; that is from the developer of the innovation to the users. The internal group, or organization accepting the innovation, is considered rational and passive while being dominated by the external group, or experts. The innovation is developed externally and is seldom modified since communication is only one way. The product developers act as the change agents during implementation of the innovation.

2. Social Interaction Model

The Social Interaction (SI) model places emphasis on communication within an organization. In particular, it assumes that members of the organization belong to a network of social relations and that diffusion of information pertaining to an innovation passes through the network. In this way, members of the organization are exposed to new ideas or innovations, and the level of acceptance is influenced by their position in the network and the position of the informer. Havelock (1973) stated that the individual user's place in the network (centrality, peripherality, or isolation) is a good predictor of the user's rate of acceptance of new ideas. A centrally located individual is one who has more associations within the sphere of the social network. This individual is more likely to accept new ideas, diffuse the innovation to others, and exert influence upon the acceptance of others.

The SI model was developed by Rogers (1962) and was later refined by Rogers and Shoemaker (1971). The SI model is referred

to by Morrish (1976) as the 'rural sociology' model, since it emerged from research on the diffusion of agricultural innovations.

This model assumes that the innovation has already been developed. Therefore, it does not include research and development phases. However, it includes the awareness and interest phases to account for the initiation of change in an organization. The five stages of this model are:

1. Awareness - of problem.
2. Interest - pertaining to problem.
3. Evaluation - of its appropriateness.
4. Trial
5. Adoption - for permanent use.

Like the RDDA model, in the SI model the innovation is developed externally and communication is uni-directional from the 'experts' to the users, allowing little modification of the innovation. Members of an organization that adopt an innovation early during implementation were referred to as 'innovators' by Rogers (1962). Therefore, the change agent primarily consists of the innovation developers, who are external to the organization, and the early adopters of the innovation who are internal to the organization. As in the RDDA model, the members of an organization or social network form the internal group, and they are considered to be rational and passive. While the RDDA model emphasizes the research and development of the innovation in the change process, the SI model stresses communication within the social network, and is concerned with the problem awareness phase and the interest phase of change.

Zaltman, Duncan, and Holbeck (1973) proposed a model similar to the SI model. Their model, however, consists of two stages, the initiation and implementation stages. The stages and substages are as follows:

I. Initiation stage
   1. Knowledge-awareness substage
   2. Formation of attitudes toward the innovation substage
   3. Decision substage

II. Implementation stage
   1. Initial implementation substage
   2. Continued-sustained implementation substage

Like the SI model, this model is characterized by an already developed innovation, 'top-down' one-way communication, and a rational, passive internal group. The internal group has some influence on the modification of the innovation, but most of the direction comes from the external group, or change agent. This model stresses feedback as an important factor during implementation of an innovation. The feedback is used predominantly for evaluation of the implementation process and not as a mechanism for guiding the change process.

3. Problem Solving Model

The Problem Solving (PS) model is unlike the RDDA and SI models because the PS model does not revolve around a completed innovation. Instead, the innovation is developed through collaborative efforts between the internal and external groups. The PS model places emphasis on the internal group (users), and upon developing an innovation that is satisfactory to the internal group.

Roberts (1978) stated that the PS model was developed by Lippit, Watson, and Westley in 1958, and that the model was influenced by work related to T-group sessions conducted at the National Training Laboratories. Morrish (1976, p. 112) identified six stages of the PS model:

1. Translation - of need to problem
2. Diagnosis - of problem
3. Search and Retrieval - of information
4. Adaptation - of innovation
5. Trial
6. Evaluation - of trial in terms of need satisfaction.

Havelock (1970) depicted the stages of the PS model as a cycle that repeats until an innovation has evolved that satisfactorily resolves the problem.

The PS model is different from the RDDA and SI models in many respects. In the PS model, the user (internal group) is of major concern and actively participates in the development or adaptation of the innovation and in the change process. The internal group is also considered to be rational and cooperative. The model is characterized by two-way communication between the internal group (users) and the external group (change agent). Therefore, the change agent acts as a consultant and is related with the internal group in a collaborative fashion. In the RDDA and SI models, the change agent plays a directive role, the internal group is passive, and communication occurs in one direction (from the external to the internal group).

4. Linkage Model

The linkage model is based on the concept that a problem is best solved by the user (internal group), and that an individual or agency should assist in the search for and retrieval of pertinent information, in the selection of an innovation, and in the implementation. In this model, a resource person or agency acts as a link to information and expert resources that are relevant to the problem faced by the internal group. This resource person (linker) must have a good understanding of the nature of the users' problem and, reciprocally, the user must be aware of any resource

limitations. Havelock (1973) explained the relationship in this manner:

> Technically speaking, the resource person needs to develop a good "model" of the user system in order to "link" to him effectively.... At the same time, the user must have an adequate appreciation of how the resource system operates. (p. 165)

The Linkage model follows the same stages as the PS model, but uses slightly different names:

1. Identification - of need
2. Diagnosis - of problem
3. Problem Statement
4. Search and Retrieval
5. Selection - of innovation
6. Implementation

As in the PS model, the stages of the Linkage model will cycle until a solution which is satisfactory to the internal group is found. However, these two models are different in the roles assigned to the internal and external groups. In the Linkage model, it is essential that communication is two-way and that a true understanding is developed of the other's needs, requirements, and limitations. Only then can the relationship between the user and the linker be collaborative in the development of the innovation.

The linker is a person or agency that acts as the change agent. The task of the linker is to provide information and resources to the internal group from experts (external groups) that are relevant to the problem. The innovation can be externally or internally developed and it can be modified to suit the requirements of the internal group. As in the PS model, emphasis is placed on satisfying the needs of the internal group. In both the PS and Linkage models, the internal group is rational and actively

participates in the development or modification of the innovation and in the change process.

5. Local Process Of Change Model

The Local Process Of Change (LPC) model places importance on the implementation of the innovation during the change process. It differs from previously mentioned models because it is derived from a political orientation and it doesn't assume rationality of the internal group. The LPC model recognizes that the incentives, constraints, opportunities, and conflicts of members of the internal group have an effect on the change process.

According to Roberts (1978), the LPC model evolved during a study of federal programs and educational change, conducted in the United States by Rand Corporation (Berman, McLaughlin, Pauley, Greenwood, Mann, & Pincul, 1974, 1975, 1977). Roberts stated that during the Rand study it was "argued that the traditional concepts of rational practitioner behavior, invariant transfer of innovations, and internal desire for change were unrealistic" (p. 27). Roberts described the stages of the LPC model as:

1. Mobilization
   a. Problem definition
   b. Solution Seeking
   c. Solution Selection
   d. Generation of support
   e. Decision-making and strategies
2. Implementation - mutual adaptation of project and organization
3. Institutionalization - assimilation by school and teachers

The sequence of this model resembles the SI model, but the change process has been reduced to three stages.

The innovation may be externally or internally developed, and both the innovation and the organization are modified to meet the needs of the organization. A change agent (external group), is not always required, but, if present, will act as a consultant or linker. The internal group is adaptive and cooperative, and although communication between internal and external groups is two-way, the internal group is far more influential. The influence of the internal group during the change process in the LPC model is similar to the influence of the internal group in the Linkage and PS models. However, the LPC model differs from other models in that the development of implementation strategies in the form of planning, support, and training, is a dominant factor in the change process. Also, the LPC model differs from some other models because it assumes the internal group to be non-rational and the external group may or may not be active in the change process.

In works by Mirvis (1983), that related to the assessment of implementation and adoption of an innovation, a model of change that resembles the LPC model was presented as a basis for assessing the success of the change process. Although the stages of the LPC and Mirvis models are named differently, the sequence of the change process, the rationale, and the emphasis, are similar. Mirvis (1983, p. 428) described the stages of implementation and adoption as follows:

1. Need for Change - perceived performance gap
2. Openness and Potential for Change - disposition to innovate
3. Views of Innovation - knowledge, attitude, and support
4. Trial Adoption
5. Sustained Adoption

The first three stages of the Mirvis (1983) model are encompassed in the mobilization stage of the LPC model. The implementation and institutionalization stages of the LPC model correspond to the trial adoption and sustained adoption stages of Mirvis' model respectively.

6. Organizational Development Model

This model is quite different from the previously mentioned models. Roberts (1978) stated that the Organizational Development (OD) model was built upon concepts taken from a number of disciplines, including economics, general systems theory, anthropology, sociology, and psychology, and behavioral science. Roberts indicated that the OD model "evolved from time and motion studies conducted in industrial settings" (p. 24), and was influenced by T-group and Y-group theory, and the problem solving approach to change. The stages of the model, as described by Alderfer and Brown (1975) are:

1. Entry and Contract Setting
2. Data Collection
3. Diagnosis - of organization
4. Action Interventions

According to the OD model, organizational change occurs through self-assessment and behavioral change of the internal group, and the innovation is the process which results in organizational changes. The group sessions emphasize affective rather than intellective aspects. Friedlander and Brown (1975) indicated that the OD model does not emphasize stages, but rather personal values, change technologies, and change processes. These are identified during small group sessions which promote self-analysis and identification of organizational needs.

The premise of the OD model is that organizational effectiveness and efficiency are dependent on the quality of

interpersonal relations in work groups (McGregor, 1967). Agreement on goals, open communication, mutual trust and support, full utilization of member skills, and effective management of conflict are characteristics of effective work groups (McGregor, 1967).

The innovation in the OD model is the process which causes changes in the organization that initiates and maintains effective work groups. The changes occur both in the individual members of the internal group and in the organizational structure. During the small group sessions, the individuals are encouraged to increase openness and to diagnose the needs of the organization. Communication is an essential aspect of the process and the effectiveness of this technique increases as inter-group and intra-group communication increases. The change agent acts as a consultant or a human relations expert, and designs action interventions that include changes in socio-technical systems, job design and enlargement, and job enrichment (Friedlander & Brown, 1974). Members of the internal group are considered to be trustworthy, capable of growth, and capable of demonstrating initiative. The relationship between the internal group and the change agent is cooperative and adaptive. The innovation results in organizational changes that improve communication and productivity.

The OD model is similar to the Linkage and PS models in that the internal group is cooperative, influential, and dominates the innovation and change process. This model is unique in its methodology and emphasis of openness and group communication, and in the view that the innovation is a process.

7. Elaborated Leadership Obstacle Course Model

The Elaborated Leadership Obstacle Course (ELOC) model is focused on leadership during the change process. Peters (1986) noted the importance of this aspect of the model when he stated, "The behavior of the key individuals involved in the change

process, which is the central focus of the ELOC model, has been identified frequently in the literature as a major contributor to, or detractor from, the successful implementation of a particular innovation" (p. 33).

The ELOC model leans toward a political approach to change and was developed by Herriott and Gross (1979) and evolved from the earlier Leadership Obstacle Course (LOC) model proposed by Gross, Giacquinta, and Berstein (1971). The theoretical basis of the LOC model comes from Argyle's (1967) Overcoming Resistance to Change (ORC) model. The stages of the ELOC model, as given by Herriott and Gross (1979, p. 360) are:

1. Exploration
2. Strategic Planning
3. Initiation
4. Attempted Implementation
5. Incorporation/Rejection

Management, or leadership, is a key factor in each stage of the model. In the exploration stage, management provides leadership in identifying problems and selecting innovative strategies. Leadership in identifying internal and external obstacles to the innovation is required in the second stage, and guidance in overcoming problems is needed in the third stage. In the fourth stage, management is involved in overcoming previously identified emergent obstacles. Finally, management provides leadership to ensure that the innovation remains a viable part of the organization, or conversely that the innovation is rejected. The model cycles from any stage to a previous stage, or from the last stage to the first, until the change process is satisfactorily completed.

An underlying concept of the ELOC model is the resistance to innovation. The resistance surfaces as obstacles. According to Peters (1986), obstacles include the organizational members, ignorance of the innovation, skill deficiencies of organization

members, inadequate materials and equipment, lack of motivation of organization members, and existing organizational structure. It is the primary function of management, or the school administrator, to develop strategies to overcome these obstacles at each stage of the change process. In this way, the manager provides leadership during the implementation and adoption/rejection stages of the innovation.

The ELOC model considers members of the organization to be rational and active in the change process. Two-way communication exists, and modification and adaptation of the innovation, mediated by the manager, occurs during implementation. The model shows similarity to the PS, Linkage, and LPC models in that communication is two-way, the innovation is adapted, and the internal group is active and has influence on the change process. The model is different from other models in that management acts as the change agent, providing leadership and strategies to facilitate the implementation and adoption of the innovation.

8. Cusp Catastrophe Model

Each model of change provides a different perspective of the change process. The Cusp Catastrophe (CC) model is concerned with the rate of change and the variables affecting the rate of change. The CC model, mathematically developed by John Bigelow, evolved from the catastrophe theory of Thom (Bigelow, 1982). The basic premise of the model is that the change process is a function of the pressure and resistance to an innovation, and that the rapidity and success of change is dependent on the relative presence of these factors.

The CC model does not provide stages of the change process, but it does address the dynamics of the rates of change. Bigelow (1982) explained the importance of this factor to the change process of organizations:

> An organization in immediate and drastic difficulties may require rapid change in order to survive. Rapid change, however, is not without risk....Effective adaptation, then, can be a function of change rate as well as change content. (p. 27)

The rate of change that is most effective for an organization at a particular instance is dependent on the circumstances creating the need for change. Bigelow (1982) stated that two factors, the pressure to change and the resistance to change, develop within an organization and govern the rate of change. Resistance and pressure are functions of perceptions of members of an organization about the consequences of choosing or rejecting the innovation. Bigelow (1982) explained that members of an organization will choose to resist an innovation if they perceive that the change may have negative consequences for them personally. The support of the existing state creates resistance to change, and hence represses the rate of change.

According to Bigelow (1982), the rate of change can be altered by manipulating the variables that control the pressure and resistance functions. If resistance to change is high and the pressure to change is low, change will not occur. However, if resistance is low and pressure is high, change will be rapid and drastic. A continuum lies between these two extremes. Bigelow (1982) suggested that pressure for change may be altered by modifying either (1) the actual or perceived outcomes of changing existing organizational structure, (2) the valued outcomes of actors, through hiring and firing or 'learned needs' training, or (3) the relative influence of organization members on a particular dimension of the innovation or change. Bigelow also suggested that resistance to change may be altered by acting on either the costs of a current practice, the costs of changing to a new practice, the norms stabilizing the existing organizational structure or practice, or the

level of trust with which organization members receive change proposals.

The CC model is similar to the OD model and the LPC model in that the internal group is not necessarily rational and has influence on the change process. The CC model is different from other models because the change agents or decision-makers manipulate resistance or pressure toward change rather than designing change strategies, or acting as a linker for the internal group.

9. Adaptive Development Model

The Adaptive Development (AD) is a non-stage model of change developed by Lindquist (1978). Lozier and Covert (1982) explained the AD model as a synthesis of four different theories of change strategy. They stated that the AD model combines aspects of the rational planning, the social interaction, the human problem-solving, and the political approaches to planned change. The model is non-prescriptive, since all organizational changes have unique qualities, but it does suggest five important factors to consider when planning strategies for change.

Lindquist (1978) gave his model the name 'adaptive development' since "planned change is a local development of external innovations rather than the invention of new ones" (p. 223). The basis of the model is that planned change occurs by the implementation and modification of an externally developed innovation, influenced by both the change agent and the internal group. Communication is two-way between internal and external groups (change agent), and the change agent initiates change strategies, supports the internal group, and links the internal group to resources and information.

Linkage, openness, leadership, ownership, and rewards are the five critical factors in the AD model (Lozier and Covert, 1982). These factors are emphasized separately in previously mentioned models, but no other model encompasses all five of these aspects.

Linkage is also viewed as an important aspect of the change process in the Linkage model and also in the LPC model when a linker is present. In these models the linker seeks and retrieves information relevant to the problem and provides "linkage to new information, new perspectives, new ideas and concern" (Lindquist, 1978, p240). According to Lozier and Covert (1982), the responsibilities of the linker in the AD model are extended to include establishing contact and communication between groups concerned with the change, including internal and external groups. This contact and communication is similar to aspects of the SI and OD models.

Openness, the second factor of the AD model, is also emphasized in the OD model. Openness is promoted through group sessions in the OD model and through small group and individual discussion in the AD model.

The third factor, ownership, is the feeling of being part of the change process. This factor is present in the OD, PS, and the LPC models, as well as the AD model. Ownership is likely to develop when the internal group participates in the development or modification of the innovation, and in the change process. Involvement is the key element.

Rewards are another important factor in the change process of the AD model. "Organizational leaders, and the larger group of professionals themselves, must learn how to recognize the efforts of innovators in terms of status and esteem, along with such tangible rewards as salary increases" (Lozier & Covert, 1982, p. 201). This aspect is important political orientation models, such as the LPC model.

The last important factor in the AD model is leadership, which is required to initiate and support change strategies, and to provide linkage of the internal group to ideas, people, and money. Leadership is the aspect of change that is emphasized in the ELOC model.

The adaptive development model provides a distinctive approach to change because it does not prescribe stages of change

and it combines rational planning, social interaction, human problem solving, and political orientations to guide the change process. Therefore, this model is more closely aligned than the previous models with the thesis that more than one model is required to successfully achieve change.

10. Elmore: Four Distinct Models Of Organizational Change

Elmore (1978) provided a different approach. He synthesized four different orientations and combined them into one change model. He stated that "No single model adequately captures the full complexity of the implementation process" (p. 189). His position, although more limited in scope, is consistent with the thesis of this study.

According to Elmore (1978), the basis of understanding an implementation of an innovation is the comprehension of the structure and function of an organization. "Only by understanding how organizations work can we understand how policies are shaped in the process of implementation" (Elmore, 1978, p187). He further stated that since there was no single coherent body of organizational theory that could serve as the basis for analysis of all organizational structures, models based on four views (orientations) of organizational structure were needed to describe implementation of an innovation. Elmore's four views are:

1. Systems Management
2. Bureaucratic Process
3. Organizational Development
4. Conflict and Bargaining

Two approaches, the Systems Management and the Bureaucratic Process models, assume authoritative organizations with the 'top down' style of policy implementation. The other two models, Organizational Development and Conflict and Bargaining, are based on democratic decision making within the organizations.

In the Systems Management model, members are considered to be rational and "Organizations are thought of as problem-solving 'systems' - functionally integrated collection of parts that are capable of concerted action around a common purpose" (Elmore, 1978, p. 191). Decisions are made by a selected few at the top of the hierarchy, and management controls are used to induce adoption of an innovation within the organization. The RDDA and SI models are founded on similar premises.

The Bureaucratic Process model is based on the view that 'power' within an organization is "fragmented and dispersed among small units exercising relatively strong control over specific tasks within their sphere of authority" (Elmore, 1978, p. 199). Elmore defined discretion as the day-to-day decisions made by individuals of an organization, and defined routine as the developed operating routines that maintain the individual's position in the organization. Implementation strategies in this type of organization must consider where discretion, or power, is concentrated and must ensure that routines are devised that conform to the new policy (innovation). Organizational units are induced to replace old routines with new ones. This model has many similarities with the RDDA and SI models but also incorporates some aspects of the ELOC model.

The proposition of the Organizational Development model is that organizations should function to satisfy the basic psychological and social needs of individuals within the organization so that members will develop commitment to the purposes of the organization (Elmore, 1978). Elmore stated that, in this view of implementation of an innovation, individuals must have some autonomy and control over their own work and be allowed to participate in decisions affecting them. Communication and small group discussion are essential factors in this model. Implementation involves the process of consensus-building and accommodation between policy-makers and implementors. This model is philosophically aligned with the OD model.

According to Elmore, the Conflict and Bargaining model assumes that organizations are arenas of conflict in which individuals and groups compete for relative advantage in the exercise of power and the allocation of scarce resources. Competition is driven by differences in specific interests between groups or individuals. Because of perpetual competition within an organization, the power distribution is never stable and bargaining does not result in total agreement among members of an organization. "Implementation consists of a complex series of bargained decisions reflecting the preferences and resources of participants" (Elmore, 1978, p. 218). This model resembles the ELOC model in that resistance is fundamental in the change process.

In summary, Elmore (1978) described four different methods of implementing an innovation. Elmore (1978) did not believe that the use of a single model could adequately accommodate the change process. Therefore, he created a model that consists of four change models. Each model is intended to be applied to the same set of events in a organization. "In fact, every implementing agency probably has a set of management controls, a firmly entrenched collection of operating routines, some process for eliciting the involvement of implementors, and a set of internal and external bargaining relationships" (Elmore, 1978, p. 227). The application of each of the four models to a particular instance ensures that many perspectives of organizations are considered during the development of implementation strategies.

Summary of Classical Models

A comparative summary of various aspects of the models is provided in Table 2.

Table 2: Summary of Aspects of the Classical Models of Change

MODEL	EMPHASIS	CYCLICAL	EXPLANATORY REMARKS	RELATED MODELS
Research, Development, Diffusion and Adoption RDDA	Product development and the developer.	no	The internal group plays no role in the development of the innovation or the change process.	
Social Interaction SI	Communication and the organization	no	Acceptance influenced by position in network of recepient and informer. Centrality, peripherality, and isolation are predictors.	Zaltman, Duncan, Holbeck; but internal group has influence.
Cusp Catastrophe CC	Rate of change.	??	Change is a function of pressure to change and resistance. The external group manipulates resistance and pressure to change.	
Elaborated Leadership Obstacle Course ELOC	Management or leadership, resistance. Individuals are factors for successful change	??	Focus on obstacles or resistance to change. The leader or manager develops strategies to overcome obstacles.	
Problem Solving PS	Internal group.	yes	The external group or change agent acts in a consulting role; the relationship with the internal group is collaborative.	
Linkage L	Internal group.	yes	The linker is a resource person or expert for the internal group. Both internal and external groups must understand the others needs.	
Local Process of Change LPC	Implementation of the innovation.	Can be.	The external group acts as a consultant or a linker. Both the organization and the innovation are adapted.	Mirvis (but cyclical)
Organizational Development OD	Personal values, change technologies, change process, and openess.	Can be.	Change occurs through self-assessment and behavioral change of the internal group and change of the organizational structure.	
Adaptive Development AD	Linkage, openess, leadership, ownership, rewards.	??	The change agent or linker provides leadership, change strategies, support, and brings people together.	
Systems Management	Heirarchical control	??	Organization has common functional purpose.	
Bureaucratic Process	Routine definition	??	New routines replace old ones in work units.	
Organizational Dev.	Group consensus	??	Accomodation between control & other groups	
Conflict&Bargaining	Bargained decisions	??	Competition for power; bargaining; instability	

Summary of Aspects of the Classical Models of Change (continued)

MODEL	CONTROL	COMMUNICATION	INTERNAL GROUP	INNOVATION
Research, Development, Diffusion and Adoption RDDA	External group controls the change.	External group to internal group.	Rational and passive.	Externally developed
Social Interaction SI	External group controls the change.	External group to internal group through the social network.	Rational and passive.	Externally developed
Cusp Catastrophe CC	External group has more control than internal group.	??	Active, effects change process; not necessarily rational.	Internally or externally developed.
Elaborated Leadership Obstacle Course ELOC	Management has more control than the individual.	Bidirectional between internal and external groups.	Rational, adaptive, active.	Adapted
Problem Solving PS	External group has equal control with the internal group.	Bidirectional between internal and external groups.	Rational, active, and cooperative.	Develop through the collaborative efforts of the internal and external groups.
Linkage L	External group has less control than the internal group.	Bidirectional between internal and external groups.	Rational and active. (more than in the PS model)	Internally or externally developed and adapted.
Local Process of Change LPC	External group has less control than the internal group.	Bidirectional between internal and external groups.	Adaptive, active, cooperative, and not rational.	Internally or externally developed and modified.
Organizational Development OD	External group has less control than the internal group.	Bidirectional; inter and intra group; interpersonal relations needed.	Adaptive, active, and cooperative. External group is human relations expert.	The change process is the innovation.
Adaptive Development AD	External group has less control than the internal group.	Bidirectional between internal and external groups.	Rational, adaptive, active, cooperative.	Externally developed and modified.
Systems Management	Ext. greater than Int.	Ext. to Int. group.	Rational, active.	??
Bureaucratic Process	Fragmented into groups	??	Rational.	??
Organizational Dev.	??	Bidirectional.	Rational, active, adaptive.	??
Conflict&Bargaining	Subunits in conflict	??	??	??

Strategic Planning Models

Overview

This section reviews strategic planning, its roots and evolution. It starts with an exploration of what a strategy is and how strategic planning came about. Next the evolution of strategic planning is discussed and different schools of thought presented.

The roots of strategic planning came from classical thought. Other schools of thought evolved from the 1960's through the 1990's according to themes that were popular at the time.

The schools described in this section come from two categories: Those based in practice and those based in literature. Johnson's (1987) rationalistic, incremental, and interpretive planning models, Quinn's (1988a) logical incrementalism, and the Concerns Based Adoption Model (CBAM) are models derived from practice. Mintzberg's (1990a) comprehensive review will be presented to represent schools of thought found in the literature.

Defining Strategy

The origin of the concept of strategy goes back to the early military. Bracker (1980) traced the concept to the Greek word *strategos*, which means a general, which in turn has roots in the words army and lead. The earliest link between business and the military came when Socrates consoled Nichomachides, a Greek soldier who had lost an election for the position of general to a businessman. Socrates explained to Nichomachides that the duties of a businessman and a general were similar in that they both involve planning and the use of one's resources to meet objectives (Bracker, 1980). Wells (1998) agreed with Bracker about the source of the strategy term and noted that organizations don't have real enemies but strategies are required to contend with the ever changing landscape of possibilities and problems.

Military-diplomatic strategies existed far back into prehistoric times. In fact, one function of the early historians was to collect lore relating to successful and unsuccessful strategies in order to analyze them and to

produce a cumulative body of strategic knowledge. Quinn (1988b) noted that with the exclusion of a few exceptions brought about by modern technology, the basic principles of strategy were in place and recorded long before the Christian era.

The military origin of early strategy led to the formation of classical theories of strategic planning. Military roots are evident in classical theories. At the center of military tradition is the isolated, heroic figure of the general, who presides at top of a rigid hierarchy, and who ultimately makes the decisions. This notion, along with an intellectual inheritance from economics, form the basis of classical models of strategic planning (Whittington, 1993). Whittington explained that early influence of economics on strategy came from the ideal of the rational economic man. This concept portrays strategy development as the product of a single entrepreneurial individual, acting with perfect rationality to maximize his economic advantage.

Although the rigid boundaries of Classical thought may have been softened by the evolution of theories of strategic planning, much of the original underpinnings have persisted. In a careful analysis of key texts related to strategic planning, including those associated with the Harvard Business School, Mintzberg (1990b) identified the basic premises of Classical thought. One premise is that strategy formation is the result of a controlled, conscious process of thought, reflecting the notion of the rational economic man. Another premise that emerged reaffirmed the impact of military hierarchical rigidity, attributing the responsibility of strategy formation to the chief executive officer. The last premise is that an earlier phase that involves explicit and conscious strategy formation is followed by a distinct implementation phase. Continuing with the military analogy, only after the general has thought out the strategies can they be executed by those lower in the hierarchy of command.

Since its inception Classical thought has evolved into many strategic planning models. Hax and Majluf (1984) have identified four models that developed between the 1930's and the 1980's: long-range planning, business strategic planning, corporate strategic planning, and strategic management. While the central theme of these strategic

planning models remains typically Classical in nature, their perspectives on what strategy is about varies. The focus of these strategies and the era in which the strategic planning model evolved are listed in Table 3.

Table 3
Strategic Planning Models of Classical Thought
(Hax & Majluf, 1984)

Strategic Planning model	Era	Focus of Strategies
Long-range planning	early thirties to mid-fifties	Prediction and extrapolation of trends in the market place
Business strategic planning	mid-fifties to present	Create the future through the identification of strengths, weaknesses, opportunities, and threats (SWOT)
Corporate strategic planning		Implementation, evaluation, and control in a process that involves the entire organization and its stakeholders
Strategic management		Strategic planning process and the management functions that support the process

A current understanding of strategic planning involves two areas: A strategic planning process and a managerial process. The planning process typically encompasses (Pfeiffer, 1991b): 1) mission and goal formulation, 2) strategy formulation, 3) strategy evaluation, 4) strategy implementation, 5) strategic control and evaluation. The managerial process governs the formulation and implementation of strategies. Overall, it is the general management that participates in the strategic management processes of the organization (Hofer, Murray, Charan & Pitts,

1985). Furthermore, the substance of the strategy cannot be separated from the process of strategy making (Hax & Majluf, 1996) The cognitive processes of individuals, social and organizational processes, and political process contribute to the strategy outcome.

It appears that even in many current strategic planning models a strategy is the result of a conscious, rational and deliberate effort, and that the process is most likely controlled by management. This evolved approach is not tremendously different than the original concept of the rational economic man.

Has the Classical school stopped evolving? No. Pfeiffer (1991b) explained that recent trends in Classical thought have moved toward more emphasis on implementation, which in turn involved greater participation of line managers in order to gain acceptance for the strategies to enhance the success of implementation. This represents a softening of the Classical stance. Is this the final word on strategy? No, there are many concepts of strategy beyond that of Classical thought. The very notion of deliberate development and execution of strategies is in question. "Does the company do what it set out to do as a result of careful strategic planning, or is some part of the actual outcome the result of learning on the way, or responding to opportunities as they arise?" (Luffman, Lea, Sanderson & Kenny, 1996, p. 8). Other views of strategy development, such as positioning, have gained prominence. In this realm of thought the organization develops strategies to dynamically position itself in competitive advantage with other companies, balancing the various forces (economic, political, social, and technological) and players (customers, competitors, suppliers, etc.) in the external environment (Wells, 1998). Mintzberg (1996a) explained that a position is a niche that is occupied to avoid competition.

While Classical thought is the school from which strategic planning and strategy formulation was born, it is not the last word on the subject. A broader perspective of strategy and strategic planning is required. We must go beyond the origins of strategic planning and examine other schools of thought that have emerged.

Various Schools of Strategic Planning

The earliest theme of strategic planning models was derived from Classical thought, as described in the previous section. These models are rational and analytical and have steps or phases that are comparable to many of the Classical models described earlier in this document: (1) awareness of the problem, (2) exploration of the problem, (3) deciding what to do, (4) taking action to implement the decision, (5) examination and feedback of results (Luffman et al., 1996).

Much has happened in the field of strategy since those early days. The number of books and articles is so great that it is impossible to read them all, and the subject itself has gone through several changes of name (Hussey, 1998): Long range planning to corporate planning to strategic planning to strategic management.

Whittington (1993) described the emergence of various themes in the field of strategy. The Classical theme was prevalent up to the end of the 1960's. In the 70's a political theme emerged, followed by evolutionary themes in the 80's, and cultural themes in the 90's. The result of the evolution of these themes is a multitude of strategic planning models.

There at least two ways to survey the various models. One is to examine research from actual sites where strategic planning occurs to identify what themes emerge. The other is to study the literature on theoretical planning models. This literature review will include both and will compare the findings of these two methods.

Schools of Strategic Planning Based In Practice

Johnson (1987) conducted a ten year study at a particular site (Foster Brothers) in which he observed the way managers actually do strategic planning. His concern was that existing approaches to strategy formation found in the management literature were rather limited in scope, and were based on a view of managers as essentially scientific in their approach to strategy formulation. His study was an attempt to assess how managers develop problem solving strategies within the social, political, and cultural milieu of a functioning organization.

Johnson categorized the way in which managers develop strategies into three themes which he established as models.

1. Rationalistic model

   Strategy is formed through the analysis of an uncertain environment and the evaluation of the extent to which organizational resources can be utilized to take advantage of environmental opportunities. Uncertainty and complexity can be reduced through analysis which will provide explanations. Clear, quantifiable objectives can be established. Implementation occurs only after top management has made strategic decisions.

2. Incremental model

   Strategy is the outcome of the action of corporate life. It is the product of social and political activity, and the routines of the organization. Strategy typically develops through small, serial steps resulting in an evolutionary, possibly intermittent, pattern. Organizations, in effect, feel or muddle their way through the uncertainty of their environments. Typically, problem identification and definition takes place at the level of functional/operational management, and the diagnosis of problems is informal and verbal, iterative and characterized by solicitation and bargaining. Objectives are likely to be unclear or absent, or rationalized after-the-fact. Senior management is more likely to be involved in selecting or authorizing strategies than to be formulating them, and strategies can be viewed as compromises designed to accommodate conflicting power groups competing for organizational resources. Implementation may be ongoing and does not necessarily follow the formal adoption of a strategy. Incrementalism may be seen as purposive, experimental and logical, involving active environmental scanning, with decisions arising from the politics and day-to-day operation of organizational life.

3. Interpretative model

> Strategy is the product of the ideologies of individuals or groups in the organization, but is not separate from, and may be part of the ideology and culture. Ideologies are preserved in the symbols, rituals and myths of organizational culture, and managers posses scripts or casual maps arising from these ideologies which they use to make sense of situations and guide strategy formulation. Decision-making occurs in environments which are enacted, a function of management cognition, and organizational action is consistent with the meaning relevant to the organization.

Johnson's (1987) models are represented in Figure 2.

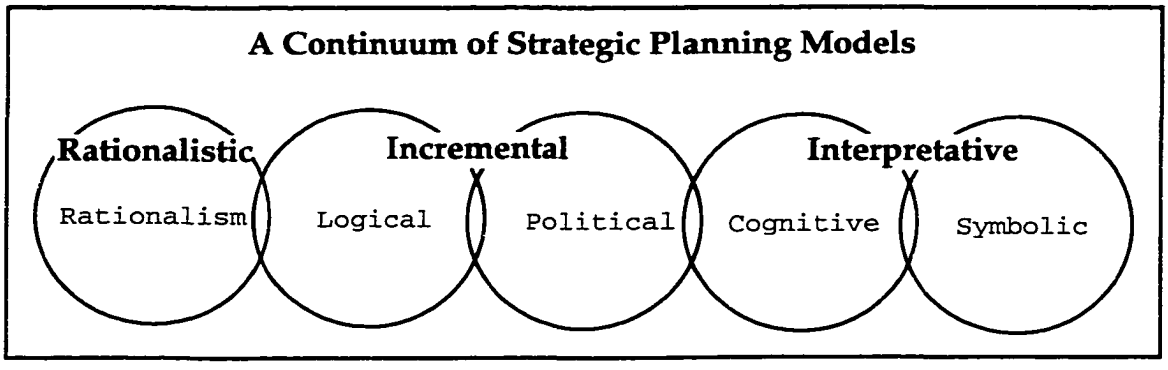


Figure 2. Johnson's Categories of Strategic Planning Models

According to Luffman (1996) Johnson's notion of a cultural web is important to understanding strategy development. The cultural web of an organization is the managers' paradigm that results from the integration of organizational structure, routines, power structures, symbols, ritual and myths, and control systems. The cultural web creates a perceptual framework which focuses senior managers' views of the environment and the organization and can act as a constraint on strategic action (Luffman et al., 1996).

Quinn (1988a) also observed organizations. He studied ten major companies and determined that "When well-managed major organizations make significant changes in strategy, the approaches they use frequently bear little resemblance to the rational-analytical systems so

often touted in the planning literature" (Quinn, 1988a, p. 94). He proposed that while classical strategic planning models offer an excellent approach for some purposes, they tend to focus on measurable quantitative factors and under-emphasize qualitative, organizational, and power-behavior factors. Power-behavior factors in an organization include multiple goal structures, the politics of strategic positions, executive bargaining and negotiation, satisficing (as opposed to maximizing) in decision making, the role of coalitions in strategic management, and the practice of muddling through. He noted that neither the power-behavioral nor the formal systems planning approach adequately characterizes the way successful strategic processes operate. Real strategy tends to evolve as internal decisions and external events flow together, forming a continuous stream of events. They tend to emerge from a series of strategic subsystems, each of which attacks a specific class of strategic issue (acquisitions, divestitures, reorganization, etc.) in a disciplined way, but which is blended incrementally and opportunistically into a cohesive pattern that becomes the organization's strategy.

Quinn called the process logical incrementalism. It is a purposeful, effective, proactive management technique for improving and integrating both analytical and behavioral aspects of strategy formulation. It is not "muddling" through, nor does it necessitate that strategy must first be decided and then implemented. It is choice through action (Johnson, 1987). Pondy (1983) stated that incrementalism is the unity of rational and intuitive models of strategy-making, and that incrementalism is unfolding rationality.

Quinn and Voyer (1996a) noted that strategy deals with the unknowable and that there are so many forces that one cannot predict events. He explained that logical incrementalism allows executives to proceed flexibly and experimentally and to blend analysis, organizational politics, and individual needs into a cohesive new direction.

Rogers (1995), after three decades of observation, proposed another approach. He suggested that change is a process he called diffusion. Diffusion is a process by which an innovation is communicated through channels over time. Diffusion is the spread of the innovation, and

communication is the sharing of ideas and information. Communication occurs through channels, such as mass media or interpersonal channels. The main elements of diffusion are: (1) an innovation, (2) which is communicated through certain channels, (3) over time, (4) among members of a social system.

While Johnson (1987) emphasized how managers develop problem solving strategies, and Quinn (1988a) emphasized the incremental nature of strategic planning, Rogers proposed that the diffusion of innovations involve the development of technologies and a design for instrumental action in order to reduce uncertainty about the innovation.

The last model to be discussed in this section is also based in practice. The Concerns-Based Adoption Model (CBAM) is essentially descriptive and predictive and not prescriptive of attitudes and behaviors during implementation of an innovation (Anderson, 1997). The model was developed in the early 1970's (Hall, 1979) and much of the early development was conducted by researchers at the Research and Development Center for Teacher Education (R&DCTE), at the University of Texas at Austin (Hall & Loucks, 1981). Development of the model stopped in the mid 80's and the most in depth explanation of CBAM is provided by Hall and Hord (1987), two of the original researchers (Anderson, 1997). They (Hall & Hord, 1987) have verified a number of assumptions about change that are the basis of the model. Central to the CBAM is the change facilitator (CF) (Hord et al., 1987). People and the change facilitator's understanding of the point of view of the participants are the most important factors in the change process of this model (Hope, 1996). The CF, a person or persons, delivers actions on the basis of the needs of individuals or groups involved in the change. Facilitators have a resource system available to them as well as various interventions. Which resources to use and when to deploy them, and what interventions to use and when to use them, is based on concerns-based diagnosis. For the diagnosis, the CF uses various techniques for probing the change environment and the people involved. Stages of concern of the people involved in the change, levels of use of the innovation, and the way in which the innovation is employed (innovations configurations), are

evaluation tools that the CF may use to diagnose the condition of the change process. The strategy used by the CF to facilitate change may be any combination of interventions and resource usage, depending on the results and interpretation of the concerns-based diagnosis. The CBAM is represented in Figure 3.

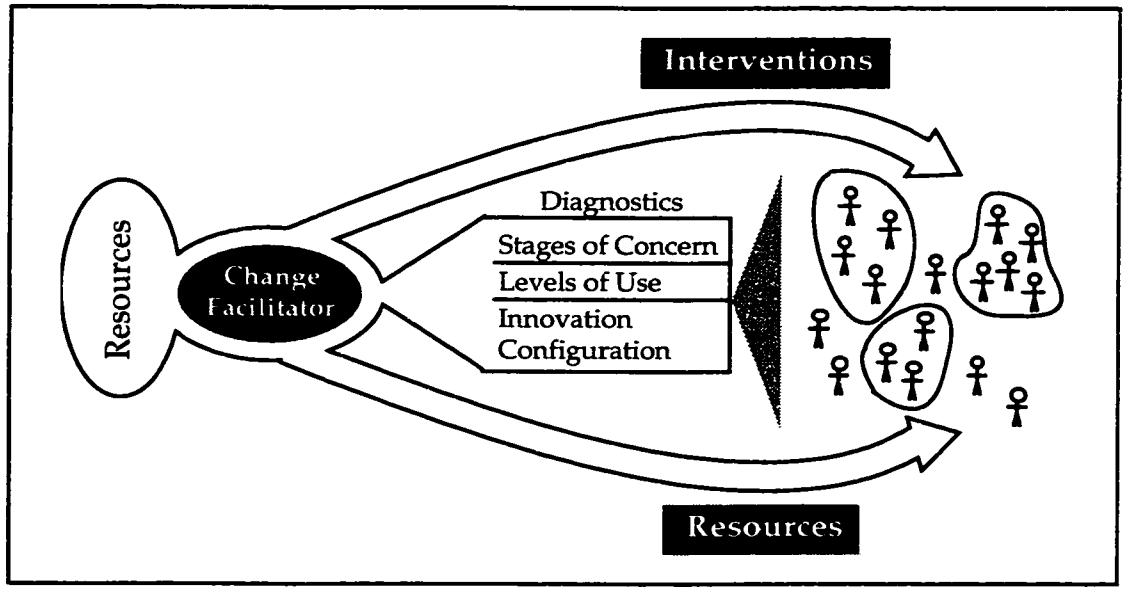


Figure 3. The CBAM based on Hord et al. (1987)

A configuration is the form a process or product takes on during actual use (Hall & Loucks, 1981). Therefore, innovation configurations describe variations in what an innovation looks like in practice for different teachers (Anderson, 1997). It is a description of the operational forms of the innovation

A key dimension of the CBAM is the concept of stages of concern (Hall & Loucks, 1978). The stages of concern focus on the individuals of the organization and are identified by the CBAM. As implementation of the innovation takes place individuals move through different stages of concern (Hall, 1979). Initially an individual is engulfed in self-concern about how the innovation will personally effect them, including their perceptions about the innovation. As progression through the stages occurs the individual becomes focused on the task of using the

innovation, and lastly about the change and the impact of the innovation. Concern about change includes active participation in determining the various ways the innovation can be used, and participation in the change process. The stages of concern are listed in Table 4.

Table 4

Stages of Concern for the CBAM

(from Hord et al. (1987))

Stages	Description
0 Awareness	I am not concerned about it (innovation)
1 Informational	I would like to know more about it
2 Personal	How will using it affect me?
3 Management	I seem to be spending all my time getting material ready
4 Consequence	How is my use affecting students?
5 Collaboration	I am concerned about relating what I am doing with what other instructors are doing
6 Refocusing	I have some ideas about something that would work even better

The levels of use are used by the CF to identify those individuals who are still experimenting and those who have not started. The LU describe behaviors of the innovation users and does not include attitudinal or motivational aspects of the individual (Hall, Loucks, Rutherford & Newlove, 1975). It focuses on general pattern of teacher behavior (Anderson, 1997). The individual becomes familiar with and increasingly knowledgeable about the innovation before use actually begins. The levels of use progress from orientation about the innovation, to managing the innovation, and lastly to integrating the innovation (Table 5).

Table 5

Levels of Use of the CBAM

(adapted from Hord et al. (1987))

Levels	Description
0 non use	State in which the individual has little or no knowledge of the innovation, no involvement with it, and is doing nothing toward becoming involved.
1 Orientation	State in which the individual has acquired or is acquiring information about the innovation and/or has explored its value.
2 Preparation	State in which the user is preparing for the first use of the innovation
3 Mechanical Use	State in which the user focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes are made more to meet the user needs than the needs of students. The user is primarily engaged in an attempt to master tasks required to use the innovation.
4 Routine and Refinement	State in which use of the innovation is stabilized. Few if any changes are being made in ongoing use. In the refinement portion of this level the user varies the use of the innovation to increase the impact on clients.
5 Integration	State in which the user is combining own efforts to use the innovation with related activities of colleagues to achieve a collective impact on clients.
6 Renewal	State in which the user reevaluates the quality of use of the innovation, seeks major modifications of, or alternatives to, present innovation to achieve increased impact on clients, examines new developments in the field, and explores new goals for self and the organization.

After applying the IC, SC, and LU diagnostics to the change context, the CF will decide which resources should be utilized or which interventions are appropriate for the change conditions. The CBAM does not predict what interventions work best in resolving a particular circumstance, however, it does provide a framework that describes interventions (Anderson, 1997). Hord et al. (1987) identified interventions for CF's (Table 6).

Table 6

Interventions of the CBAM

(adapted from Hord et al. (1987))

Interventions	Description
1 Developing supportive organizational arrangements	making decisions, planning, preparing, scheduling, restructuring roles, staffing, providing space, acquiring funds, providing equipment
2 Training	developing positive attitudes, increasing knowledge, teaching innovation related skills, holding workshops, reviewing information, modeling/demonstrating innovation use, clarifying innovation misconceptions

3 Consultation and Reinforcement	encouraging people on a one-to-one basis, promoting innovation among small groups, assisting individuals in solving problems, coaching small groups in innovation use, sharing tips informally, providing personalized technical assistance, holding brief conversations and applauding progress, facilitating small groups in problem solving, reinforcing individuals' attempts to change, providing practical assistance, celebrating small successes
4 Monitoring	gathering information, collecting data, assess innovation knowledge or skills informally, assessing innovation use, analyzing/processing data, interpreting information, reporting/sharing data outcomes, providing feedback on information collected
5 External communication	describing what the innovation is, informing others, reporting to the board of education and parent groups, making presentations, developing a public relations campaign, gaining support of constituent groups
6 Dissemination	encouraging others (outside implementation site), broadcasting innovation information, mailing descriptive materials, training innovation representatives, marketing the innovation

Schools of Strategic Planning Based In Literature

Mintzberg (1990a) completed an extensive literature review, involving 1,495 bibliography items, from which he deduced that there existed ten distinct schools of thought in the discipline of strategic planning. Mintzberg divided the schools of thought into three groups. The first group is prescriptive in nature because it is concerned with how strategies should be formed rather than how they actually do form. This group contains the first three schools: Design, planning, and positioning. The next six schools are descriptive in nature since they are concerned with how strategies actually form. The entrepreneurial, cognitive, learning, political, cultural, and environmental schools are members of this group. The last category is named contextual and it contains only the configurational school, which combines all the others into a single perspective.

Prescriptive schools:

1. Design School

   Strategy formation is a conceptual process in this school, a process of informal design. This school was the earliest to evolve and is rooted in Classic thought. Strategy formation is the function of top management and often employs concepts such as SWOT (strengths, weakness, opportunities, and threats) during the process.

   The premise of the design school is that strategies are the result of a controlled, conscious process of thought, which is the responsibility of the chief executive officer (the strategist or architect). From the process, strategies emerge as explicit, articulated, full-blown objectives. Only after strategy formulation can implementation begin.

2. Planning School

   In this school strategy formation is a formal process, a systematic process of formal planning.

   While the planning school is similar to the design school, in this school there is an emphasis on decomposition of organizational functions (budgets, objectives, strategies, and

programs) into small steps or sequences that can be scheduled and programmed using checklists and specified techniques.

Strategy formation should be a controlled, conscious, formal process, decomposed into distinct steps. Responsibility for the process rests with the chief executive officer and execution rests with the staff planners. Strategies are explicit and full blown and implementation follows strategy formulation.

3. Positioning School

Unlike the previous two schools, this school is more concerned with the content of the strategy than the process of strategy formation. It is referred to as the positioning school because it focuses on the selection of strategic positions but it does not radically depart from the premises of the design and planning schools. Strategy formulation emerges out of calculation, quantitative analysis, from which a pre-defined position in the market place can be selected.

Strategies are generic, specifically common, tangible positions in an economic and competitive marketplace. The strategy formation process is analytical, based on calculations of an analyst(s), from which managers, including the chief executive officer, select generic market positions (an organizational posture). Strategies emerge from the process as full blown and articulated. Implementation follows strategy formation.

Descriptive schools

4. Entrepreneurial School

Strategy formation is associated with the personalized vision of the leader. This school allocates strategy formation exclusively to a single leader, and stresses the intuition, judgment, wisdom, experience, and insight this visionary individual.

The process of strategy formation is semiconscious, rooted in the experience and intuition of the leader. Strategy exists as a perspective, as a sense of a long-term direction, and specifically as the leader's vision of the organization's future. The strategic vision

is malleable, as is the organization. The leader maintains close personal control over implementation and the organization is responsive to his or her directives.

5. Cognitive School

In this school strategy formation is a mental process, a process of concept attainment in a single mind. The focus is on what strategy formation means in the sphere of human cognition.

At least four aspects of cognitive psychology can be identified as relevant to strategy formation: 1) perception, 2) concept attainment, 3) reconception, 4) cognitive style. Perception is how the strategist becomes informed, through information gathering. Concept attainment is how the strategy forms as a vision or fundamental sense. Psychologists use terms such as cognitive map, frame, or schema. Reconception (sometimes called reframing) refers to the changing of strategies (visions, map, or schema). The cognitive style of the strategist causes differences in strategic styles, for example, opportunistic, incremental, and political approaches to strategy making. These four aspects of cognitive psychology indicate that, in this school, an emphasis is placed on the distortions and biases in the mind of the strategist.

Strategy formation is a cognitive process that takes place in the mind of the strategist and results in the formulation of perspectives or concepts, which are strategies for negotiating a complex environment, and which are less than optimal at best. If the world of strategy formation is as complex as proposed by proponents of the cognitive school, then the design, planning, and positioning schools have dangerously oversimplified the process, and overstated their ability to establish successful strategies.

6. Learning School

To the followers of this school, the world is too complex to allow strategies to be developed all at once as clear plans or visions; hence strategies must emerge in small steps, as the organization adapts or learns. Emergent strategies are followed by retrospection which facilitates organizational learning, which is the basis for

further strategy development. Therefore strategy formation is an emergent process.

The premise of this school is that the complex and dynamic nature of the organization's environment precludes the development of deliberate preconceived strategies, and that action must be taken before learning can occur, individually and collectively (organization's collective mind). Incrementalism is basis of the learning school. Quinn (1988a) introduced the notion of logical incrementalism, where strategy tends to evolve as internal decisions and external events flow together to create a new shared consensus for action. A central actor directs the process of strategic learning toward a final strategy, and implementation and strategy formulation may be carried out concurrently.

Strategies appear first as patterns out of the past and later become plans for the future, and they continuously undergo change and improvement.

7. Political School

Strategy formation is a process of exploiting power, whether by groups in a conflictive process within an organization or between organizations with regard to their external environments.

In this school there in no dominant actor but rather a number actors or coalitions who use power and political means (rather than authority, expertise, or ideology) to achieve a desired outcome. The process is one of bargaining and negotiation, that produces a series of outcomes. The outcomes, whether deliberate or emergent, become the strategy, and impose a pattern on the stream of subsequent actions.

8. Cultural School

Strategy formation is an ideological process. The process is rooted in the culture of the organization and it is fundamentally collective and cooperative. The culture is collective cognition and it represents the organization's mind. It represents a set of shared beliefs that are reflected in stories, symbols, and credos.

Strategy takes the form of a perspective rather than a position or ploy, and it is reflected in the patterns of the organization's behavior. Therefore, strategy is deliberate although not necessarily explicit. Strategy formation is fundamentally a process of collective behavior, controlled and coordinated by the norms of the organization which are based on the shared beliefs of its members.

9. Environmental School

Proponents of this school focus their attention on the power and the nature of environments that surround organizations. Accordingly, strategy formation is a passive process and power over it rests not in the organization but in its external environment.

As we progress through the various schools, the power of the central strategist is diminishing. In this school, the leadership and the organization has become passive and the environment becomes the central actor. The environment consists of a set of vague forces that create conditions that force organizations into strategies (market niches). Organizations that do not adapt to their environment by fitting into their market niche are "selected out."

Strategies are positions (niches) where organizations are sustained until a shift in environmental conditions forces the organization to adapt to another niche. Since a set of abstract environmental forces dictates the strategy an organization will adopt, there is no real internal strategist or strategy-making process, and no leadership.

Contextual School:

10. Configurational School

Strategists of this school are integrative, and this school focuses on typologies and episodes. The elements and behaviors of organizations, such as strategy-making processes, content of strategies, and structures and/or contexts, are clustered at distinct stages or episodes in their histories.

Strategy formation in this school is described as episodic, in which a particular type and form of organization, matched to a

particular type of environment, engages in a particular process, for a certain period of time. Accordingly, the process can be one of conceptual design, formal planning, systematic analysis, or vision. It can involve an individual, or collective learning, or politics, and it can be driven by personalized leadership, organizational culture, or the external environment. The resulting strategies can be plans, patterns, ploys, positions, or perspectives, but each must exist in its own time and context.

Summary of Mintzberg's Strategic Planning Schools

A summary of Mintzberg's (1990a) schools is presented in Table 7.

Table 7 Schools of Strategic Planning (Mintzberg, 1990a)

School	Strategy	Basic Process	Central Actor
Design (conceptual)	explicit, perspective, unique	cerebral, simple and informal, judgmental, deliberate	chief executive, "architect"
Planning (formal)	explicit plan, decomposed into sub-strategies	formal, decomposed, staged, deliberate	planners
Positioning (analytical)	explicit generic positions (economic & competitive)	analytical, systematic, deliberate	analysts
Entrepreneurial (visionary)	implicit perspective (vision), personal and unique (niche)	visionary, intuitive, deliberate	leader

Cognitive (mental)	mental perspective (individual concept)	mental, overwhelming	brain
Learning (emergent)	implicit patterns, often collective	emergent, informal, messy	whoever can learn
Political (power)	ploys and positions, overt and covert	conflictive, aggressive, messy, emergent, deliberate	whoever has power
Cultural (ideological)	collective perspective, unique and usually implicit	ideological, constrained, collective, deliberate	collectivity
Environmental (passive)	specific position (niche in population ecology)	passive, emergent	environment
Configurational (episodic)	all those above, in context	all of those above, integrative, episodic, sequenced	all those above, in context

School	Organization	Leadership	Intended message
Design (conceptual)	ordered, font of strength and weaknesses	dominant, judgmental	fit
Planning (formal)	structured, decomposed	responsive to procedure	formalize

Positioning (analytical)	font of competitive advantages	responsive to analysis	analyze
Entrepreneurial (visionary)	malleable, simple	dominant, intuitive	envision
Cognitive (mental)	incidental	source of cognition	cope
Learning (emergent)	eclectic, flexible, playful	responsive to initiatives or to own learning	learn, evolve
Political (power)	conflictive, disjointed, uncontrollable, aggressive, controlling	weak, at best a player	promote
Cultural (ideological)	cohesive, normative	part of collectivity	coalesce
Environmental (passive)	acquiescent	acquiescent	react
Configurational (episodic)	any of the above, in context	any of the above, so long as categorical	integrate

School	Base Disciplines	Vocabulary
Design (conceptual)	none, architecture as a metaphor	distinctive, competence, competitive, advantage, SWOT
Planning (formal)	links to urban planning, systems theory, and cybernetics	programming, budgeting, scheduling

Positioning (analytical)	economics (industrial organization), military	generic, strategy, industry and competitive analysis
Entrepreneurial (visionary)	none	vision
Cognitive (mental)	psychology	map, frame, concept, reframe, mental set, bounded rationality, cognitive style
Learning (emergent)	none (perhaps links to learning theory in psychology)	incrementalism, emergent strategy, sense-making, revitalization, champion
Political (power)	political science	power, coalition, political games, collective strategy
Cultural (ideological)	anthropology	myth, culture, ideology
Environmental (passive)	biology	selection, environment dynamism, complexity, niche
Configurational (episodic)	history, perhaps also catastrophe theory in mathematics and equilibrium theory in biology	configuration, archetype, stage, life cycle, strategic revolution, quantum change

Comparing The Various Schools and Models

Many views about change, strategic planning, and strategy formulation have been presented. The literature review started with a comprehensive survey of various classical models of change. Then strategic planning models based on practice were discussed. Johnson's (1987) rationalistic, incremental, and interpretive planning models were introduced. Johnson's models were derived from actual studies of

organizations, as was Quinn's (1988a) and Quinn and Voyer's (1996a) logical incrementalism, Rogers' (1995) diffusion model, and the Concerns Based Adoption Model (CBAM). Mintzberg (1990a) provided us with a comprehensive survey of the various schools found in the strategic planning/strategic management literature. The relationships between these models/schools can be better understood if they are placed on a typology that compares the orientations of the various positions. After an extensive review of literature, Whittington (1993) established four general perspectives (classical, processual, evolutionary, and systemic) of strategic planning. His analysis may be useful as a typology. His perspectives are given in Figure 4.

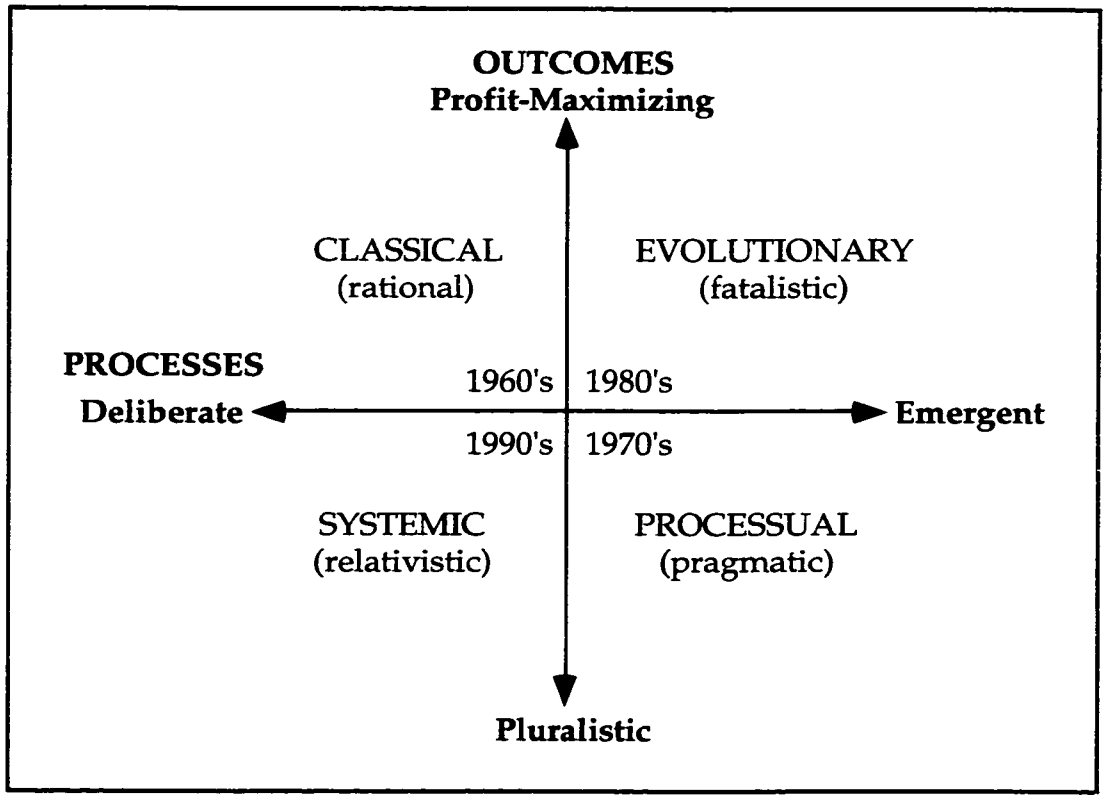


Figure 4. Whittington's (1993) Perspectives on Strategy

Whittington (1993) described the classical perspective as being the oldest and still very influential. It is based on rational planning methods dominant in textbooks. The evolutionary approach to strategy draws on

the fatalistic metaphor of biological evolution, however, the market becomes the stage instead of a natural environment and ecosystems. Processualists emphasis the sticky imperfect nature of all human life, accommodating strategy to the fallible nature of organizations, its people, and markets. Lastly, the systemic approach is relativistic. Strategy is linked to the cultures and powers of the local social system in which it takes place.

The four perspectives on strategy differ along two dimensions: Outcomes of strategy and the process by which it is developed. The vertical axis in Figure 4 represents the degree to which strategy produces profit-maximizing outcomes or allows for other outcomes. The horizontal axis depicts the deliberate as opposed to the emergent process of strategy development.

Butler (1998) categorized strategic decision making models in a similar pattern to Whittington. Instead of the axes representing outcomes and processes, Butler labeled the axes politicality and complexity, respectively. Models of strategy making comprise five categories along the axes of Butler's typology: Centralization (Whittington's classical), computation (Whittington's classical), negotiation (Whittington's processual), inspiration (Whittington's processual), and expertise (Whittington's systemic). The similarity of Butlers' and Whittington's classification schemes affirm a common theme for use as a typology for relating the Classical models and strategies presented in the literature review.

This study will use a typology based on Whittington's perspectives, however, singular outcomes will replace profit-maximizing outcomes. Figure 5 illustrates the typological positioning of the Classical models of change on Whittington's perspectives.

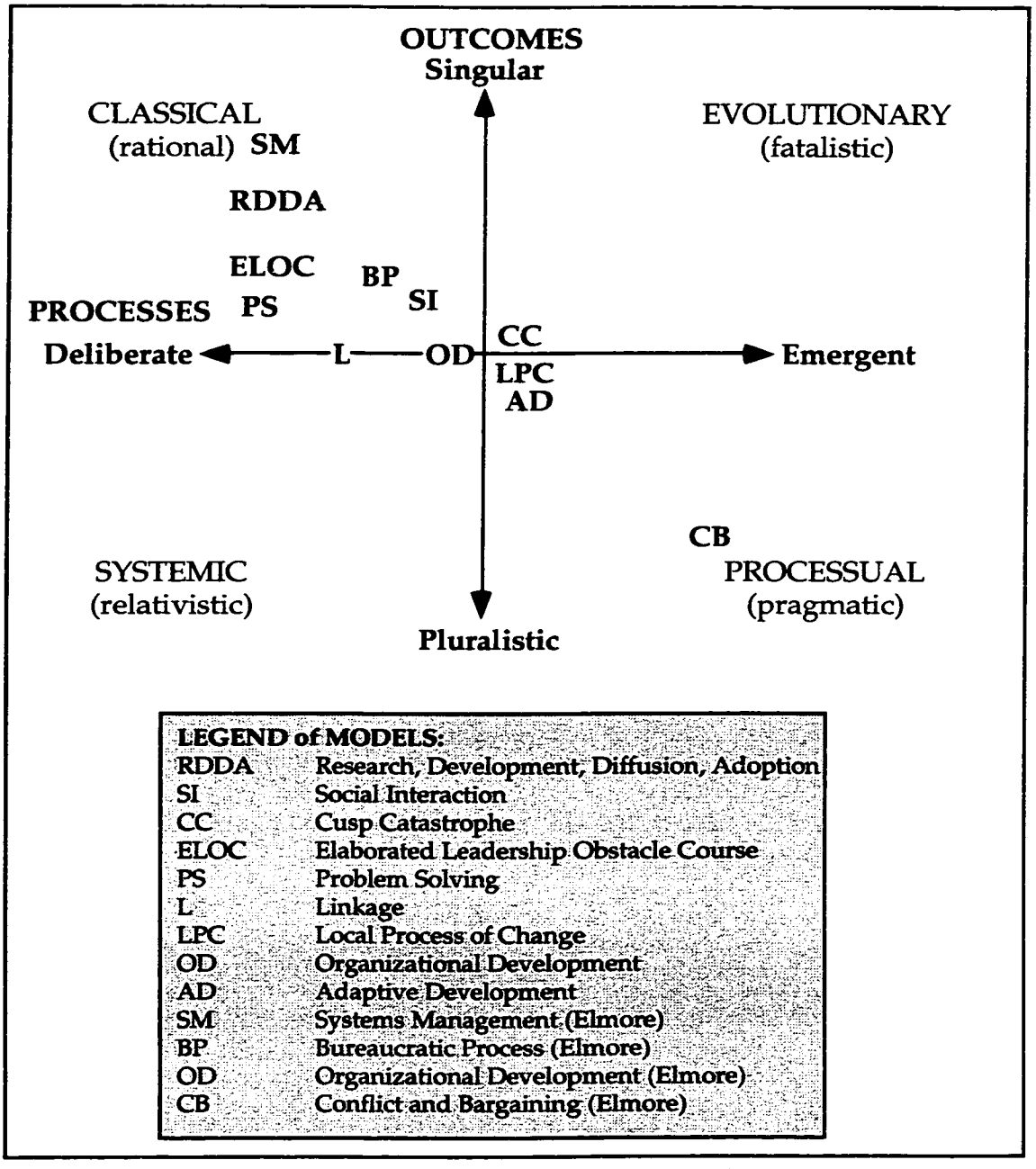


Figure 5. Classical Models of Change and Typology based on Whittington's (1993) Perspectives

Not surprisingly, most of the models of change lie in the classical quadrant. Classical approaches evolved first and most of the models of change were developed on this view of organizations. The linkage,

adaptive development, and organizational development models are leaning toward the systemic approach but still cling to classical roots. The conflict and bargaining model, a political model, and the local process of change model, being slightly political, lie in the processual quadrant.

Figure 6 represents the positioning of Johnson's (1987) categories of strategic planning models and Quinn's (1988a) logical incrementalism on the typology.

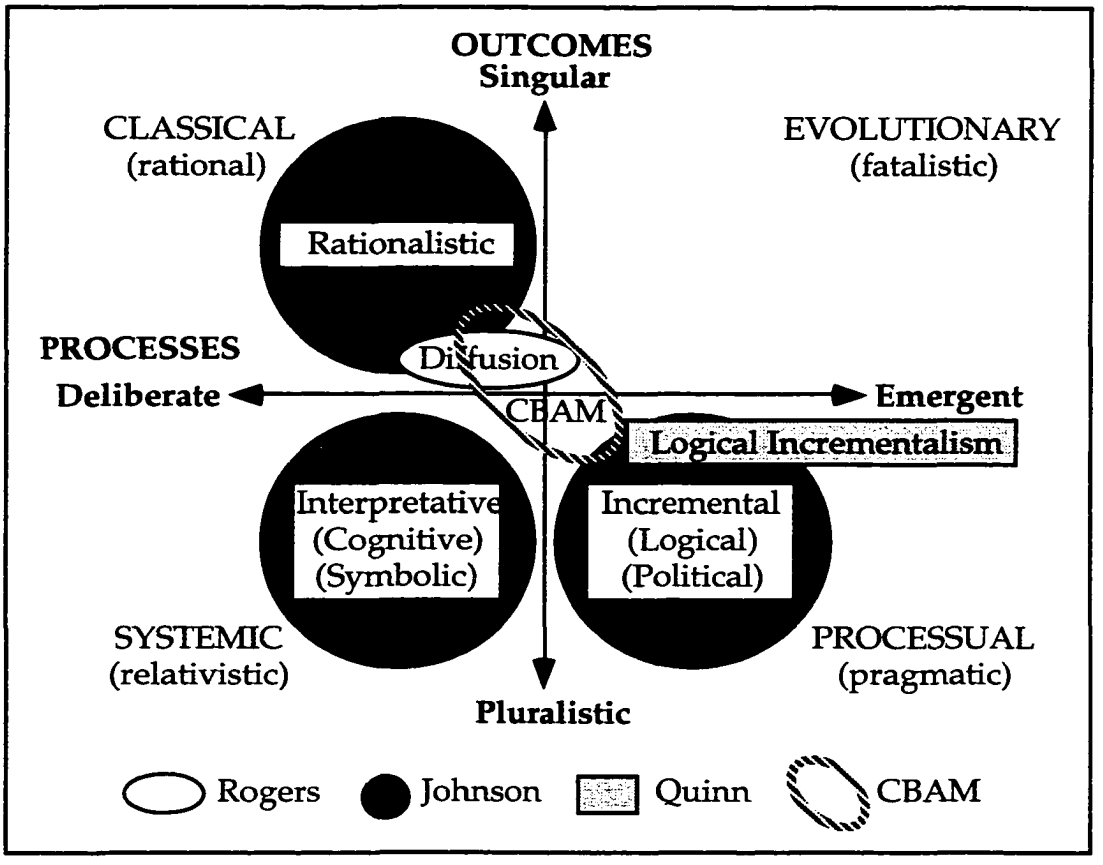


Figure 6. Johnson's (1987) Planning Models, Quinn's (1988a) Incrementalism, Rogers' (1995) Diffusion model, CBAM and Typology based on Whittington's (1993) Perspectives

Johnson's categories are conspicuously missing from the evolutionary perspective, probably because the strategies formed in this quadrant are more reactionary than purposive.

Finally, Mintzberg's (1990a) schools of strategy formation are compared with Whittington's perspectives in Figure 7.

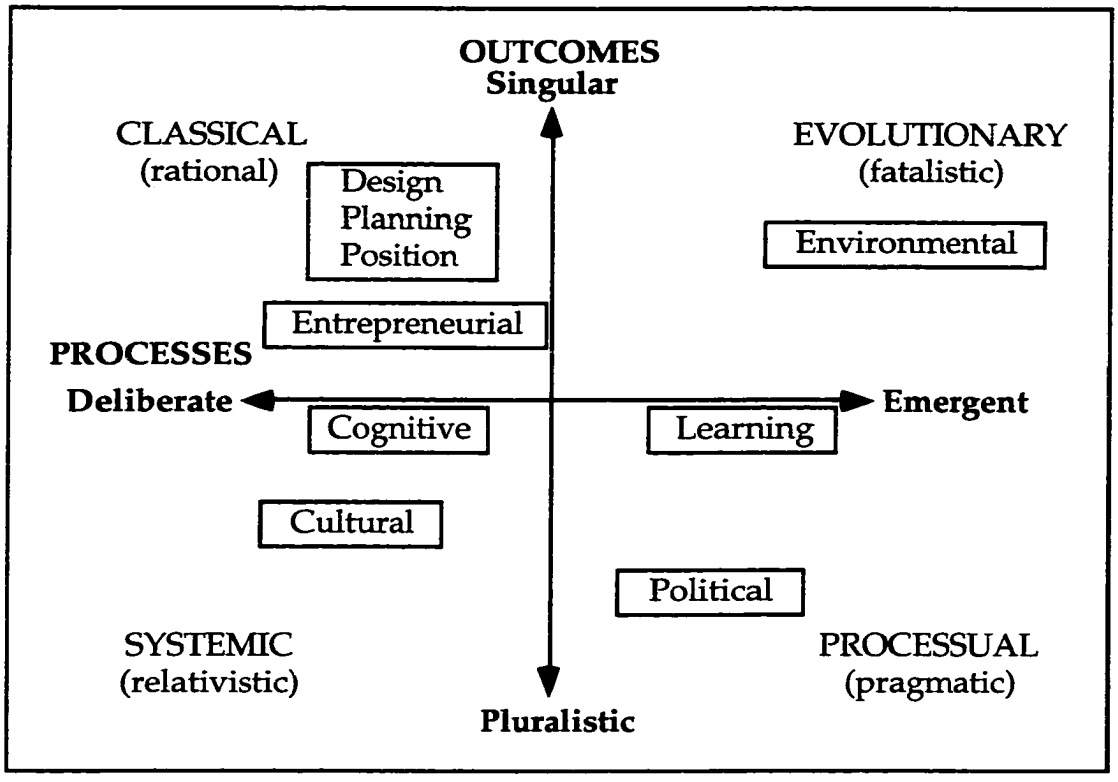


Figure 7. Mintzberg's (1990) Schools and Typology based on Whittington's (1993) Perspectives

Not unexpectedly, the prescriptive models (design, planning, and position) presented by Mintzberg fall into Whittington's classical quadrant. The entrepreneurial model, although less singular in the focus of strategies, is still very much a derivative of the classical school. Strategy development occurs before implementation and is based upon the vision of an individual at the top of the hierarchy. Strategy development in the environmental school is passive and emergent and, therefore, is placed in the evolutionary quadrant. Emergent strategies are characteristic of the learning and political schools, and in both schools strategy development involves many organizational members. Quinn's logical incrementalism also exhibits these traits (Figure 6). These schools are situated in the

processual quadrant. Finally, the cultural and cognitive schools fall into the systemic quadrant. Both involve deliberate strategy development, however, the cognitive school depends more on the mind of one individual for strategy development. Mintzberg's configurational school has no particular place on Whittington's classification since it may be aligned with any one of the quadrants, depending on the context.

Whittington's four approaches to strategy development differ widely in their advice to management, consequently, so do the schools within them. Although each of the schools has its own particular set of characteristics, their placement on the typology allows the examination of general similarities.

The classical approaches flourished in the 1960s. The classical schools prescribe hierarchical control, confidence, rationality, and a sequential approach. They view internal and external factors of the organization as measurable and predictable, and therefore strategies are explicit, unambiguous, and have clear objectives with predictable results.

The evolutionists, a popular school in the 1980s, don't view the world with the same controllable, predictable vigor. They are reactionary instead of proactive. The environment is changing too fast and it is too unpredictable to anticipate and to develop pre-emptive strategies. Evolutionists focus on a day-to-day assessment of the environment and develop strategies based on current variability. The focus is to keep the organization viable. Like the classical school, they believe that markets work with ruthless efficiency, but they differ in their belief that strategies are emergent and that implementation may occur concurrently.

The Processual perspective arose out of the 1970s. This group finds economic irrationality, and does not ascribe to the belief of efficiency of the markets. Therefore, they incline towards patient strategies of incremental adjustment. Strategies emerge from a process involving political bargaining and coalition building. Therefore, strategies are vague, goals are unclear, and often any logic of the strategy emerges retrospectively.

The Systemic perspective is the most recent, finding popularity in the 1990s. Like the Processualists, they don't believe in the economic rationality that Classical and Evolutionary perspectives purport. Instead,

economic rationality is vague so they search for other rationalities, finding them internally or as part of a social system. Both the ends and the means of strategy development is dependent on the prevailing social system. Therefore, the systemic perspective is relativistic.

A last observation about schools of the various perspectives is that Processualist and Systemic strategists are inward-looking while Classical and Evolutionist strategists are outward-looking.

A Final Word On The Strategic Approach to Change

So What Is Strategy?

Strategy was previously defined within the scope of Classical thought. A number of other schools have since been examined and their orientations were discussed with respect to Whittington's (1993) classification scheme (Classical, Evolutionary, Processual, and Systemic). It is now necessary to revisit the definition of strategy.

Given the complexity and ambiguity of organizational situations, managers need a pattern of beliefs through which to interpret the meaning of situations and to guide decision making (Johnson, 1987). Strategies are a way in which managers try to simplify and order a world that is too chaotic and complex for them to comprehend (Whittington, 1993). However, there is no single, universally accepted definition of what strategy is (Quinn, 1996b), and no single definition takes precedence over others (Mintzberg, 1996a). In fact, to do nothing is a strategic decision (Luffman et al., 1996). Therefore, no simple explanatory model of strategic planning can sufficiently describe the complexity of organizations, that is, the level of complexity with which we are concerned cannot be reduced to one model (Johnson, 1987). Mintzberg (1990a) reaffirms the need for an eclectic strategic planning approach with the use of an analogy based on a poem written by John Godfrey (1816-1887), titled The Blind Men and the Elephant. In the poem, six blind men individually approach an elephant, feeling a particular portion of the animal, such as the trunk, tail, ear, leg, etc., in an attempt to describe what the elephant was like. Various opinions arose from the exploration. One man said the elephant was like a snake, another compared it to a tree, still another associated it with a fan.

Six varied descriptions of the elephant emerged. All were insufficient in their description of the elephant but each was correct in their description of a particular elephant part, the unique particular portion of the elephant's anatomy that each blind man had explored. Mintzberg related the moral of the poem to strategic planning by noting that "An elephant may not be a trunk, but it certainly has a trunk, and it would be difficult to understand elephants without reference to trunks" (Mintzberg, 1990a, p. 107). The blindness of the men imposed a certain concentration that was insightful. None of the schools of strategic planning captures all of strategy formation but each, in its limited perspective, adds something of a caricature or critique to understanding aspects of organizations and strategic planning.

Mintzberg (1988b) suggested that strategy cannot be neatly described by one definition and that the definition should be widened from the Classical position. He proposed that strategy may be a plan, a ploy, a pattern, a position, or a perspective (Mintzberg, 1996a). Quinn (1988b) further expanded the parameters of what constitutes a strategy when he suggested that "Strategies may be looked at as either a priori statements to guide action or a posteriori results of actual decision behavior" (p. 4). A strategy, then, is the result of what was planned and what actually occurred. For Mintzberg (1996b), crafting strategy is a continuous and adaptive process, with formation and implementation inextricably entangled. It consists of both reaction and anticipation to changing conditions (Brown & Eisenhardt, 1998). Whether it is consciously set forth or a widely held understanding resulting from a stream of decisions, the emergent pattern becomes the strategy.

The sequence of strategic planning may also be unlike that proposed by the Classical planning school. The Classical sequence of formulation first, implementation second, may be reversed and therefore, strategy is discovered in action (Whittington, 1993). This concept is consistent with Fullan's (1991) notion of ready, fire, aim, in which action precedes planning as much as follows it. Fullan (1991) explained the process by using an analogy of aiming at a target. After each firing, strategies are evaluated and revised on the basis of their ability to bring the organization

closer to the target. Wells (1998) described the cyclical nature of strategic thinking as not just a one-time choice of strategy but as an ongoing shaping of it.

In summary, a strategy is a pattern in action, the result of deliberate and emergent strategies, explicit and implicit action, and intended and unintended effects.

Developing Strategies

Now that strategy has been defined, how do we develop them? Butler (1998) noted that there has been a shift from 'what is the best strategy? toward 'how are effective strategies made?' Naturally, strategy development may be based upon the particular school or orientation that has been embraced by the organization. Whittington (1993) explained that for the Classical approach, strategy development arises from deliberate formal analysis based upon rational profit-oriented endeavors developed from a powerful array of financial and planning techniques. Evolutionists have similar views to the Classical orientation. However, strategies are developed for the short-term since external environmental influences quickly shift, requiring a new set of coping strategies. The Processualists do not agree that successful strategy development can be so rational. They believe that strategies emerge out of a pattern of events. Strategies form out of a mixture of analysis and instinct, routine and spontaneity, and top and bottom management. It is a continuous incremental process habituated with coaching, bargaining, and maneuvering; and planning can have unintended spin-offs. Systemic theorists are also skeptical about formal analysis. However, planning and financial processes are useful rituals which professional groups and cultural norms demand, although strategies actually emerge from social processes.

Quinn and Voyer (1996a) identified two methods of strategy development. The formal systems planning approach includes analyzing, projecting, analyzing external environments, goal establishment, etc. Devout Classical theorists would include a performance audit, gap analysis (between what is realistic, feasible, and attainable), and SWOT (strengths, weaknesses, opportunities, and threats) analysis (Pfeiffer, 1991a). A second

method, the power-behavioral approach, includes multiple goal structures, politics of strategic decisions, bargaining and negotiation, satisficing (as opposed to maximizing), and the practice of "muddling." Quinn concluded that neither of these approaches adequately characterizes the way successful strategic processes operate. Strategies emerge incrementally from strategic subsystems (e.g. acquisitions, divestitures, or major reorganizations) forming a cohesive pattern.

Mintzberg (1988a) provided three strategy-making modes: Entrepreneurial, adaptive, and planning. The entrepreneurial mode involves risk-taking, an active search for opportunities, centralized power, and dramatic leaps forward in the face of uncertainty. Growth is the dominant goal of the organization. Characteristics of the adaptive mode include a division of power among members of a complex coalition, strategy-making as a reactive rather than proactive process, and an adaptive and incremental process which may involve bargaining and negotiation. Finally, the planning mode, is consistent with strategy development of the Classical orientation. Mintzberg has represented the three modes of strategy-making graphically. These are illustrated in Figure 8.

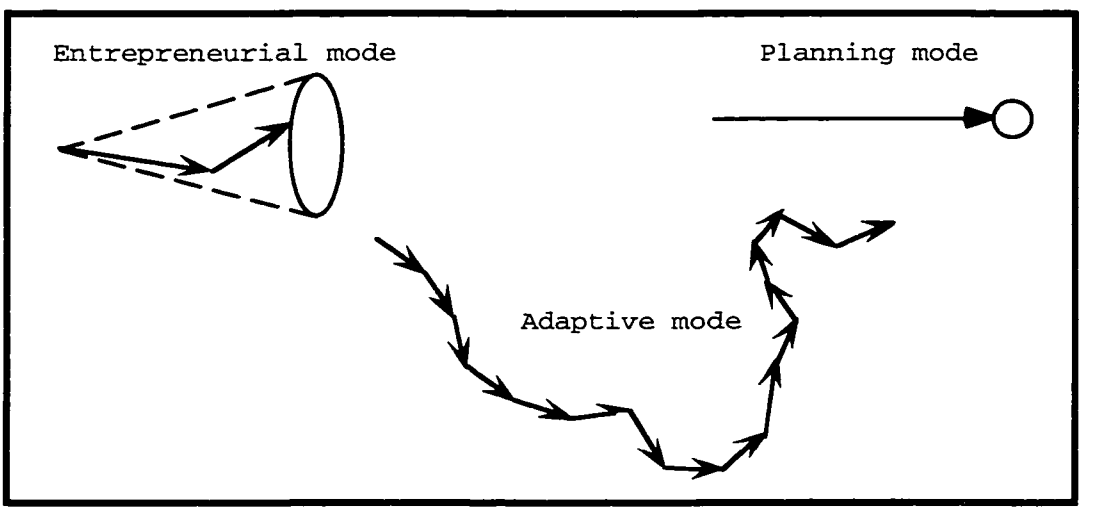


Figure 8. Mintzberg's Modes of Strategy-Making

Mintzberg warns that all too often only one mode of strategy development is applied in every organizational situation and that "we should recognize that the mode used must fit the situation" (p. 88).

Quinn (1988a), Quinn and Voyer (1996a), and Mintzberg (1988a, 1996a) have cautioned strategy-makers about exclusively using one method. The need for a eclectic approach to planning is commonly stated in the literature. Peters (1986) stated that the use of various models of change facilitates different perspectives of the organization, and he noted that Elmore (1978) emphasized the value of an eclectic approach.

Another common theme in the literature is that strategy development is an adaptive, iterative process as part of a learning organization (Brown & Eisenhardt, 1998; Luffman et al., 1996; Wells, 1998). Beckhard and Pritchard (1992) explained that in the past organizations operated under the assumptions that they could control their own destinies and that they operated in a relatively stable and predictable environment. Those assumptions led to result oriented strategy development. In a rapidly changing external environment, where organizations cope with instability and unpredictability, an organization must be learning oriented. Quinn (1988a), Quinn and Voyer (1996a), and Guskey (1990) indicated that incrementalism is an important aspect of a learning organization. Fullan (1991) wrote of the learning organization and the iterative process. He recommends that organizations start small and think big. Johnson (1987) declared the need for organizations to move from single-loop learning, where they are making responses from within a particular cognitive framework, to double-loop learning in which many perspectives may be valid. The double-loop learning requires the reevaluation and validation of our understanding of the world, then strategies may be assessed and adapted, or eliminated. Mintzberg (1996b) described the process as action driving thinking.

The notion of learning and adaptive organizations is associated with the concept that emerging and evolving conditions (external and internal), combined with management decisions, produce patterns that may be used as basis for developing strategies. Thompson and Strickland (1990) described strategy-making as an ongoing process that is always

evolving, partly to respond to a constantly changing external environment, partly from the proactive efforts of managers to create opportunities, and partly from fresh ideas about how to make existing strategies work better. In describing the process, they emphasized that "Everything cannot be planned out in advance, and even the best-laid plans must be responsive to changing conditions. Strategy-making thus proceeds on two fronts--one proactively thought through in advance, the other conceived in response to new developments..."(p. 9). Similar views are commonly found in the literature but the most prolific writer on the subject is Mintzberg. Mintzberg (1972, 1987, 1988a, 1988b, 1990a, 1990b, 1996a) differentiates emergent from deliberate strategy: Deliberate being realized intended strategy and emergent arising out of new developments. He (1988b) described strategy as a plan and a pattern. However, the two are independent: Plans may go unrealized while patterns may emerge without a preconceived plan. That is, some of the intended strategies may be unrealized while some emergent strategies, possibly unintended, become realized. Thus strategy is the result of the combination of both deliberate and emergent strategies. Mintzberg's model is illustrated in Figure 9.

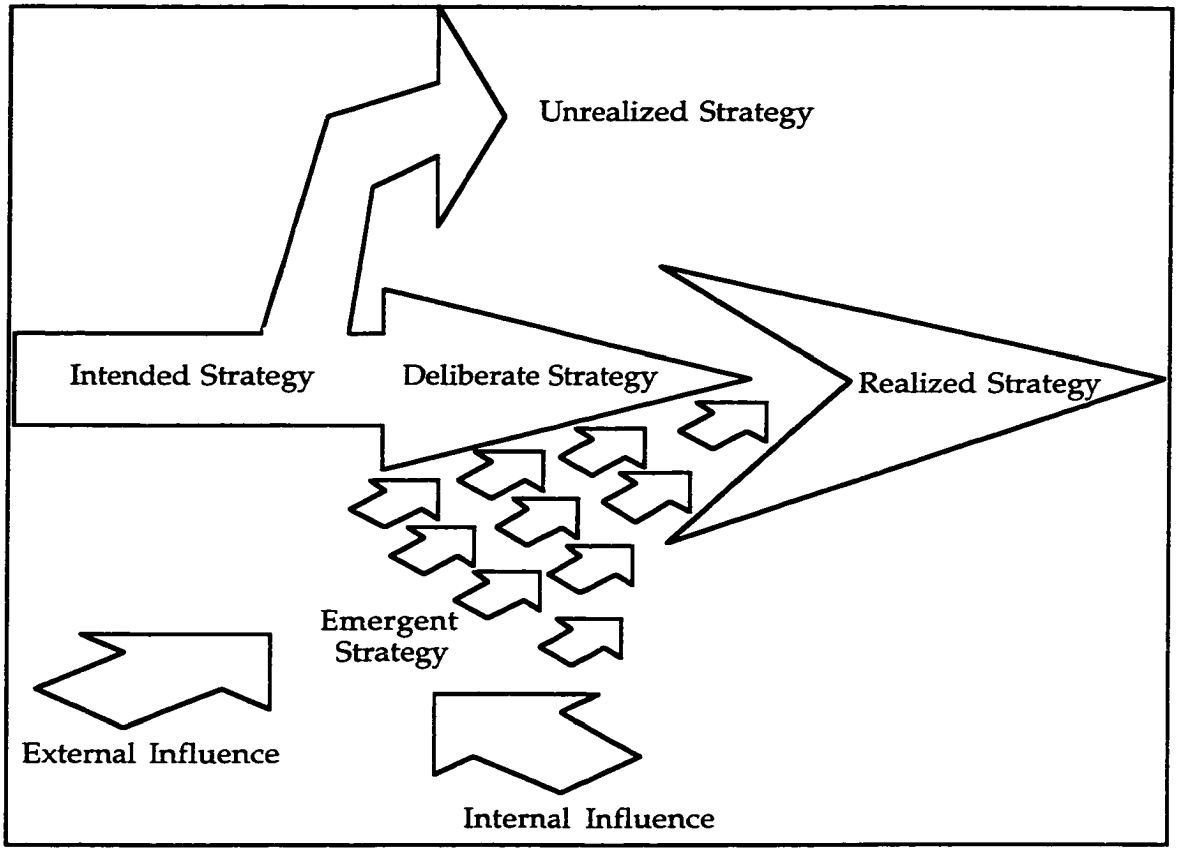


Figure 9. Based on Mintzberg's Theory of Strategy Development

Essentially, Mintzberg (1996a) and Thompson (1990) have advanced the notion that strategies can emerge from action as well as from planning, and therefore, the organizational process of strategy development is one of learning. Quinn and Voyer (1996a) noted that effective strategies tend to emerge incrementally and opportunistically as the organization learns. Learning is not possible without acting (Weick, 1979). Fullan (1991) emphasized the importance of this concept during his discussion of educational change. He summarized the process as ready, fire, aim. That is, plan, execute (implement), review, and repeat the cycle.

In summary, strategy development can be as prescriptive as that embraced by the Classical schools, where quantifiable factors are analyzed, strategies developed, and then implemented. This form of strategy development is deliberate. Conversely, strategy development can be emergent, being guided only by a broad vision or perspective called an

"umbrella strategy" (Mintzberg, 1990a). The two extremes form a continuum, and "probably most (strategies) sit on the continuum that exists between the two, reflecting deliberate as well as emergent aspects" (Mintzberg, 1988b, p. 15). Papadakis and Barwise (1998) agreed with Mintzberg declaring that realized strategy is a combination of deliberate and emergent aspects.

A strategy can be any pattern that the organization develops. It can be crafted from thought or action, control or learning, stability or change (Mintzberg, 1996b). It can be explicit or implicit or arise from formal analytical or power-behavioral processes, past actions or a forward looking plan, or from deliberate or emergent strategy (Hax & Majluf, 1996).

Trends In Technological Change

A review of the articles and books that related experiences regarding technological change revealed some dominant themes that are consistent with trends in the change/planning models.

Themes

1. Emphasis On People

   Bancroft (1992, p.15) stated that people "will sabotage the best laid plans unless their real needs and feelings are considered." Bancroft described several cases in which technological innovation was unsuccessful because the technology was the sole focus of the implementation plan. "Organizations do not make changes; people do" (Farmer, 1990, p. 9). Keyes (1993), in Infotrends, explained how to techno-strategize a corporation for technological change. She labeled the people component of a organization as peopleware, and emphasized the significance of including strategies to manage peopleware in the implementation plan. But the elevation of the importance of people in determining successful technological change cannot be more strongly reinforced than by the inclusion of a people component in technology education. Wright (1994) acknowledged this inclusion and noted that

assessing the impact of technology on people is a necessary component of technological change.

"There is only one constant factor in successful change processes--people" (Mariotti, 1997, p. 170). Furthermore, Luffman et al. (1996) wrote that organizations make strategic responses to a changing environment through people, either individually or collectively. This realization has led to a proliferation in the technological change literature of terminology that relates to the people aspect of the organization: culture, climate, values, beliefs, shared goals, communication, participative or collaborative leadership, support, training, and champions or early adopters.

Support and training for successful technological change is imperative: "Technical assistance, and user support--are critical catalysts for innovation and the integration of technology" (Green, 1996, p. 26), "has led many authors to recommend training as an essential part of introducing computers" (Faseyitan, Libii & Hirschbuhl, 1996, p. 225), "stresses the need for staff development and provisions for technical assistance" (Hope, 1996, p. 48), and "we have to pay much more attention to systematic and continuous training and to support functions" (Cartwright, 1996, p. 58).

When an investment is made in technology without an investment in the people of the organization, effective adoption of technology often fails (Deden & Carter, 1996). However, the investment is not just in support and training. Early adopters or champions play key roles in recognizing the potential of an innovation and exploiting it (Afuah, 1998), in influencing and training others (Armstrong, 1996), and in transforming technological innovations into classroom implementations (Riffel & Levin, 1997).

Cooley (1997) summarized the importance of people in the process of technological change with these words,

"Successful implementation of technology is not about equipment, but the empowerment of people" (p. 74).

2. Culture

The willingness of an individual to adopt an innovation depends on the individuals' characteristics and the nature of the social system in which the individual is a member (Rogers, 1995). Therefore, the culture and climate of an organization can effect the success of implementation efforts (Gbomita, 1997).

Bancroft (1992) promoted the notion of employing socio-technical thinking to technological change. It is the recognition of the way that technology and culture of an organization affect each other. "Technological change does not happen in isolation, but in a cultural and organizational context" (Kiesler & Sproull, 1987, p. 226). "People influence the behavior of an organization through their actions, which express the organization's culture" (Farmer, 1990, p. 9).

Many innovations effect the culture of the organization. "When an innovation moves from plan to implementation, it has a destabilizing effect on a school" (Hope, 1996). The culture of the organization changes and its members experience disequilibrium. However, the success of implementation is related the extent of the compatibility of the organizations' existing culture and the innovation (Eran-Jona & Cohen, 1998). To implement an innovation that is fundamentally inconsistent with the perspective of the organization requires changing the beliefs, values, and knowledge of the organization as well as the rules, roles, and relationships (McAdams, 1997). Afuah (1998) termed major change as radical change, where the technological knowledge needed to exploit the innovation is very different from existing knowledge. He labeled the implementation of subtle technological changes as incremental change.

If the culture of the organization and the nature of the technological change are dipolar, then there will be resistance to change. Bishop-Clark and Grant (1991) categorized resistance as

being of three types: People-determined, environment-determined, and technology-determined. People-determined resistance may be caused by disregarding the needs and feelings of individuals in the organization with respect to change. Environment-determined resistance can be traced to characteristics of the environment, such as corporate culture. Lastly, technology-determined resistance stems from poor quality of technology or a mismatch of technology to the organization. Resistance can be caused by one or more categories, and all resistance is an impediment to successful change.

It is evident that successful technological change will not occur without managing multiple facets of the organization to avoid insurmountable resistance. Bancroft (1992) suggested that managing change demands consciousness of three levels of human response: The individual, the group, and the social context (culture). She suggested that a cultural assessment be performed to evaluate the degree to which the technological innovation and the culture of the organization match. If they are closely aligned, resistance will not likely occur. However, if they are too disparate, steps should be taken to develop a closer match by modifying the technology, changing the implementation phase, promoting a cultural change, or modifying any combination of these aspects of the organization. She stressed the importance of developing a common understanding of an idea, plan, or design, through the use of communication. It is the job of leadership to discuss strategies, to encourage and empower organizational members, and to reinforce shared values (Cooley, 1997).

Other authors suggested a similar approach for successful change. Fullan (1991) described the notion of common understanding as shared meaning, and determining the match between the innovation and culture as organizational readiness. Like Bancroft (1992), he also emphasized the importance of these

concepts for successful change. Farmer (1990) reminded us that premature action has been one principle source of failure, and that successful planned change requires careful preparation to achieve a state in the organization that is receptive to the innovation. It is imperative for leadership to create a positive climate (Wolfson, 1997) and to prepare the organizational members for the innovation (Cooley, 1997). It is also essential for management to demonstrate commitment (Adkins, 1998) and clear priorities (Riffel & Levin, 1997) during the change process.

3. Unintended or second order effects

An emerging theme reported in the literature describing the implementation of technology is the occurrence of unplanned and unintended effects. Bancroft (1992) reported that the installation of new systems by Information Systems departments often inspired second-order change which required the attention of the Organizational Development people. First order effects are the deliberate result of the planned change, whereas, second order effects where unintentional and emergent.

Probably one of the most studied organizations with respect to technological change is Carnegie Mellon University (CMU). CMU is a small University with extensive computing. Starting in 1980, they began to implement computer technology and by 1985 University owned 2800 computers, and the faculty and students have personally purchase hundreds more. More importantly, CMU had struck a committee of researchers to study intended and unintended effects from the beginning. Kiesler (1987) noted that planned and unplanned changes occur simultaneously, and that unplanned changes are not necessarily deleterious, they are simply unintended effects the change.

March (1987), in the same study, further categorized unintended effects. He divided the effects of change into intended and emergent. Emergent, or unintended effects,

consist of those that are temporary and those that are longer lasting. He called these effects transient and second order respectively. In his study he also noted reactions to these effects and reported that the impact of intended effects were exaggerated, the significance of transient effects were exaggerated, and that the impact of secondary effects were underestimated.

Knowing of unintended effects does not help the strategic planner in the development of the initial plan since emergent effects are highly variable and hard to foresee (Kiesler, 1987). The planner can only be prepared to modify and review strategies as change proceeds. Mintzberg (1996a) referred to the actions taken by planners in reaction to unintended or unforeseen factors as emergent strategies. Emergent strategies comprise a series of unplanned strategic decisions in response to unforeseen threats and opportunities (Papadakis & Barwise, 1998).

The concept of emergent strategy does not preclude the importance of deliberate strategy. However, the future is too uncertain for totally predictable (deliberate) planning (Brown & Eisenhardt, 1998). Therefore, emergent strategy is about making some moves and observing what happens and learning what works (Hax & Majluf, 1996).

4. Incremental change

Quinn and Voyer (1996a) had observed that actual strategies evolved as companies overextended, consolidated, made errors, and rebalanced various thrusts over time, a process he called logical incrementalism. If the concept of unintended effects and unforeseen circumstances is embraced, then logical incrementalism is a worthy concept.

Farmer (1990), a change agent at King's College, indicated that incremental change is less threatening than global change because breaking a large change into a series of discrete smaller steps that occur sequentially is a powerful strategy for reducing

resistance to innovation. According to Farmer, incremental change is the most appropriate method of introducing change.

Although there are many references to incremental change in the literature, they are not all in agreement as to the necessity of employing incrementalism. Bancroft (1992) agreed with (Farmer, 1990). However Bishop-Clark and Grant (1991) were not as convinced. They studied many schools in the Cincinnati, Ohio, area through the Center for Educational Technologies. The Center was involved with the introduction of computer technologies into many schools. They concluded that whether or not incremental change is the best approach depends on the situation. In cases where there are few technical specialists, less enthusiastic teachers, vague goals and little pressure to change, the incremental approach is more likely to assure successful change. Conversely, when technical expertise and outside pressures are high, user involvement is participative, and there is a clear plan, the innovation will take less time to implement, and therefore, approaches other than incremental change may be more appropriate.

Another study came to similar conclusions as Bishop-Clark and Grant (1991). Ferrante, Hayman, Carlson, and Phillips (1988) conducted a study that surveyed institutions of higher education in the United States. Their findings reveal that institutions use several methods to implement computer technology ranging from "muddling through" to long-range strategic planning with environmental scanning. In some cases, various planning processes may be occurring concurrently. They concluded that in instances of the most successful change, institutions had analyzed opportunities, anticipated changes in the external environment, and had been open and willing to modify strategies accordingly. Although they did not apply this label, their suggested approach to change reflects some characteristics of incremental change.

The success of the step-by-step approach was refuted by Guskey (1990). He studied the implementation of various programs, including technology, into schools and concluded that incremental change rarely brought about lasting change. He proposed that the reason for this was that strategies changed from year to year. Teachers perceived the undulating strategies as fads, and were unwilling to permanently embrace them. Perhaps the reason for unsuccessful change in the schools Guskey studied is more related to poor planning than to incremental change.

The instances of acceptance of the incremental approach as a reliable process for change are plentiful in recent literature. When writing on planning for academic computing Cartwright (1996) insisted that incremental change be included in the plan for implementing computer technology. Incremental change allows iterative, experiential learning and will yield better curricular outcomes when using technology to enhance learning (Deden & Carter, 1996). Another study about implementing technology and incremental change demonstrated that "If technology is presented properly, individuals will grow more comfortable and proficient with it and more innovative in applying it to self-directed learning" (Saye, 1997, p. 7). McAdams (1997) reported similar observations but added that teachers and school officials are inclined to adopt an incremental rather than radical approach for change.

Summary Of The Literature Review

The literature review started with an introduction to orientations from which Classical change models have emerged. The essence of these orientations (Table 1) included opposing forces, tendency not to change, organizational dynamics, decision making, rate of change, and origin of the innovation. Then ten classical change models where presented (Table

2): RDDA, SI, PS, L, LPC, OD, ELOC, CC, AD, and Elmore's (1978) SM, BP, OD, and CB models.

Strategic planning models where introduced with a discussion about defining strategy. While a definition of strategy was easily achieved from the perspective of Classical thought, the root of strategic planning models, defining strategy from the perspective of theories that have evolved from Classical thought was less obvious, and resulted in many explanations of what strategy might be. Based on this diversity many strategic planning models have evolved.

Strategic planning models where surveyed from two groups: models that were the result of direct observation of how organizations change, and theoretical models found in the literature. Models based in practice were presented first. Johnson's (1987) rationalistic, incremental, and interpretative categories of strategic planning models (Figure 2) were developed after ten years of observing organizational behavior. Quinn's (1988a) logical incrementalism was also based on direct observation, as well as Roger's (1995) diffusion model and the CBAM (Figure 3). Next, models based in literature where surveyed. Mintzberg (1990a) classified models found in the literature into ten schools: design, planning, positioning, entrepreneurial, cognitive, learning, political, cultural, environmental, and configurational.

Because of the large number of models presented in the literature review, it was necessary to provide a structure to compare the models. Whittington's perspectives (classical, processual, evolutionary, and systemic) of strategic planning were introduced as the basis for a typology to compare the various Classical change models and the strategic planning models (Figures 5, 6, and 7).

Once again, the definition of strategy was examined. The literature reviewed did not provide a definitive explanation of what strategy is. Mintzberg (1988b) suggested that strategy cannot be neatly described by one definition. He concluded that strategy is a pattern in action, the result of deliberate and emergent strategies, explicit and implicit action, and intended and unintended effects.

The next section of the literature review examined how strategies are developed. Strategy can be developed from thought or action, control or learning, stability or change. It can be the result of behavior or explicit formal analytical processes and can be deliberate or emergent.

Finally, trends in technological change were presented and four themes that emerged in the literature were described. These were the emphasis on people, organizational culture, unintended or second order effects, and incremental change.

CHAPTER III

METHODOLOGY

Research Design

The challenge of this study was to select a research design that would allow the research to acknowledge the various data sources, including observation, while preserving the strength of the study.

Rather than employing a quantitative, positivistic, experimental orientation, a qualitative case study approach was selected for this study. Qualitative studies are holistic in that they seek to understand phenomena in their entirety rather than isolate defined variables, they are inductive because they begin with specific observations and move toward the development of general patterns, and they are naturalistic in that phenomena are observed in their naturally occurring states. Descriptive (non experimental) research is often undertaken when description and explanation rather than prediction based on cause and effect are sought. "The decision to focus on qualitative case studies stems from the fact that this design is chosen precisely because researchers are interested in insight, discovery, and interpretation rather than hypothesis testing" (Merriam, 1988, p. 10). Case studies are also advantageous because they are strong in reality and they provide attention to the subtlety and complexity of the situation (Adelman, Jenkins & Kemmis, 1980).

Herriott and Gross (1979) placed much emphasis on the use of case studies to examine complex dynamics of educational change. In particular, among other benefits, is that case studies provide the type of information needed to ascertain whether important stages of the change process were ignored, and to determine the impact of decisions made during the different stages of the process on the fate of the innovation.

The Researcher

The researcher was a participant observer throughout the duration of the study, from September, 1987, to the June, 1995. During the study, I participated in the selection of change models and the development of

implementation strategies. Strategies evolved throughout the change process, and I noted that several models of change had been used to guide the implementation over the study period.

My observations came from the rational, interpretive perspective.

The Data

The period of data collection extended from September, 1987, to June of 1995. The sources of the data were quite extensive, ranging from observations, personal notes and a daily log, to official school documents such as evaluations and reviews, to records and invoices obtained from the Business Office at the school. An event list of proceedings and significant events was kept and updated on a yearly basis. Data sources included:

- personal observations
- my daily log
- my personal notes
- Principals' notes
- Principals' scheduler
- memos and directives
- school invoices
- business office database file
- business office records
- computer lab booking sheets (some digital)
- school documents (Appendix E)
    - Olympic Data Technology Project: Evaluation Report
    - Office Equipment Modernization Proposal
    - Network Implementation Schedule (MacProject PERT)
    - Training Schedule for Linkers
    - School Review
    - Vision 2000 Development Plan (MacProject PERT)
    - Vision 2000
    - Evaluation Report: Computer Technologies Implementation Program

    - CTS Equipment Funding Proposal
    - Revised CTS Equipment Funding Proposal
- school project records
    - Olympic Data Technology Project
    - Statistics Canada CANSIM Project
    - SchoolNet Project
- interviews from 1992 (Appendix C)
- questionnaires from 1992 (Appendix C) and 1993 (Appendix D)
- school event list (Appendix F)

These documents were maintained at the study site. Participant observation, interviews, surveys, and document analysis are standard forms of data collection (Gold & Miles, 1981).

All of the data combined together becomes the case record (Merriam, 1988) from which the case study is written.

The Case

The case study is presented chronologically, organized by themes based on the use of computer technology. The themes were identified using survey results from 1992 (Appendix C) and 1993 (Appendix D), and the levels of use and innovation configurations of the CBAM. The levels of use provide a framework to identify "different types of behaviors and patterns of innovation use" (Hall et al., 1975). Starting at non use a user may progress through other levels of use (orientation, preparation, mechanical use, routine, refinement, integration, and renewal). Many innovation users never reach the refinement level (Hall et al., 1975). Innovation configurations focuses on description of the operational forms of an innovation. "A configuration is the form a process or product takes on during actual use" (Hall & Loucks, 1981). Innovation configurations and different levels of use emerged during the study. These formulate the basis of the themes. For example, the acceptance of technology, or the use of computers for personal productivity are themes that are comprised of different levels of use and different innovation configurations. Several

themes emerged throughout the study period. These themes and their descriptions are provided in Table 8.

Table 8

Themes and Descriptions

Theme	Description
acceptance of computer technology	awareness, presence tolerated, some use of computers
productivity and automation	personal use of computers for word processing, database and spreadsheet applications, graphics, etc. use of computers for automating tasks (making exams and worksheets, mark keeping programs, CD ROM encyclopedia, library systems, etc.
instruction	use of classroom computer labs for word processing, teaching accounting, drill and practice, or classroom use of other non tutorial software using computer software to teach concepts
integration	use of various software tools, which may include some development tools, for the purpose of instruction, integrated to achieve a specific instructional desired outcome

Users "demonstrate a wide variation in the type and degree of their use of an innovation" (Hall et al., 1975) and consequently these themes overlap the various periods of the study and are not exclusive to a

particular period. However, a theme may be new or dominant in a particular period, providing a suitable division point for presenting the case study.

Case Analysis

The CBAM (Concerns-based Adoption Model) is used as the basis for analysis of the case. There are many studies where CBAM was applied to specific projects such as the implementation of microcomputers in schools (Anderson, 1997), and it can be used in planning change, monitoring implementation, and assessing institutionalization (Hall & Loucks, 1981). Anderson (1997) reminded us, "In practice, CBAM has been used as much to monitor implementation as to plan assistance" (p. 346).

The diagnostic tools of CBAM (Stages of concern, Levels of use, and Innovation configuration) are used to evaluate the success of implementation, and to develop an integrated approach for using various models. There is a developmental progression as typical non users of an innovation become sophisticated users (Hall, 1979). An upward shift in SC, LU, and IC, indicates a progression in the implementation of the innovation. As implementation proceeds a shift in strategies may follow. "Different kinds of leadership and assistance are needed at different points in the process" (Loucks-Horsley & Hergert, 1985, p. 54).

Reliability and Validity

Every study must contend with the issues of reliability and validity. At the time when this study was authorized, the project (the implementation of computer technology) was already underway. That is, data collection and the process of planned change had already begun. It was the opinion of the candidacy committee that there was value in the continuation of monitoring the project, and that data collection for the development of a case constituted a valid study.

Reliability is the extent to which one's finding could be replicated. Validity is the extent to which the findings match reality (internal) and the extent to which the findings are generalizable to other situations

(Merriam, 1988). However, qualitative data is different than quantitative in that qualitative data deals with the meaningfulness of human actions in specific situations or contexts (McMillan & Schumacher, 1989). Because qualitative research is based on different assumptions about reality, a different worldview, the conceptualizations of reliability and validity should also be different (Kirk & Miller, 1986). Guba and Lincoln (1981) proposed that auditability, credibility, and fittingness be used as terms to replace reliability, internal validity, and external validity, respectively. They later proposed other terms (Lincoln & Guba, 1985): consistency, truth value, and transferability.

Merriam (1988) stated that internal validity is a strength of qualitative research, and that the qualitative researcher is interested in perspectives and is obligated to present a holistic interpretation of what is happening. Goetz and LeCompte (1984) argued that the participant observer in natural settings is more likely to reflect the reality and life experiences of participants than a researcher in contrived or laboratory settings. Nevertheless, there are six basic strategies that an investigator can use to ensure internal validity (Merriam, 1988):

- triangulation - multiple sources of data
- member checks - taking data and interpretations back to the people from whom they were derived and asking them if the results are plausible
- long-term observation at the research site
- peer examination - asking colleagues to comment on the findings as they emerge
- participatory modes of research - involving participants in all phases of the research
- researchers biases - clarifying the researchers assumptions and worldview

In this study the researcher attempted to ensure internal validity through conducting a long-term study in which multiple sources of data were used, interpretations were shared and discussed with teachers and the principal at the school, and peer examination was continuous.

Reliability (auditability or consistency) ensures that the findings are repeatable in the same context. However, reliability and internal validity are inextricably linked (Merriam, 1988), and it is impossible to have internal validity without reliability (Guba & Lincoln, 1981). Guba and Lincoln (1981) argued that when internal validity is demonstrated there is a simultaneous demonstration of reliability.

The determining the extent of external validity (fittingness or transferability) is difficult with findings of qualitative studies. "Generalizations to other subjects and situations are always modest and mindful of the context" (Rudestam & Newton, 1992, p. 39). The applicability of the findings of qualitative studies to other settings has beset case study investigators for some time, and it is likely that the findings can only be generalized to other highly controlled situations (Merriam, 1988). Merriam (1988) argued that the usefulness of the findings of a qualitative study should be left to those who wish to apply them, and that the generalizability is related to what the reader wants to learn from the case. The transferability of the findings to another instance is a continuum of usefulness stretching from where the study was conducted to totally dissimilar settings (Wilson, 1979).

Assumptions, Limitations, and Delimitations

Assumption

An assumption was made that various models of change were used at the site as change proceeded.

Delimitation

This is a case study of change in a single school over the period 1987 to 1995.

Limitations

There are two major limitations of the study:

1. The model extracted from the study site is not generalizable to other sites of computer implementation. That is, the usefulness of the model is contingent upon conditions at each change site.
2. The findings, conclusions, and recommendations are posited only as they relate to this study.
3. The survey, one of the instruments used to collect data, consisted of a self-reporting questionnaire. The accuracy of the reporting is dependent on the judgment of the individual doing the reporting.
4. The study was time bound by the period between September, 1987, to June, 1995.

Ethical Considerations

As prescribed by the University of Alberta Research Ethics Review Policies and Procedures, the following ethical considerations will be followed in this study:

1. The teachers and administrators at the study site were fully informed of the nature of the study and its purpose.
2. All prospective participants were made aware that their participation in the study was voluntary.
3. An information sheet was attached to the questionnaire, restating the voluntary nature of each individual's participation.
4. Participants were not required to place their name on the questionnaire.
5. Data were analyzed as group responses as opposed to individual responses.
6. Anonymity and confidentiality was preserved throughout the study.
7. Anonymity of the study site was preserved.

CHAPTER IV

CASE STUDY

Overview

The study site is described in the *Background* section in Chapter I of this document. In brief, this study focused on the implementation of computer technology in a large inner city high school from September, 1987, to June, 1995. The school offered a wide range of courses, from academic studies to the more practical Career and Technology Studies, and provided services for a diverse racial and socioeconomic student population.

I was the researcher and a participant observer throughout the duration of the study, and my task was to implement computer technology at the study site. Several models of change, rather than a single model, were used to guide the implementation over the study period. The first and second models were explicitly selected and the remaining models were implicitly chosen. While a number of different data types were sources in this study, the dominant perspective in the description of the case is that of the researcher. For that reason, the case is written in first person singular. Data or observations from others will be explicitly identified.

The case is presented chronologically, broken into periods based on themes. The themes are the acceptance of computer technology, the use of computer for productivity and automation, the use of computers for instruction, and integration of computer software. The periods and their respective themes are presented in Table 9.

Table 9

Periods of the Case Study and Respective Themes

Period	Prevalent Theme
1987	• acceptance of computer technology
1988 1989	• productivity and automation

1990 1991 1992	• increased productivity and automation • introduction of instructional use
1993 1994	• instructional use
1995	• increased instructional use • introduction of integration

At the beginning of each period of the case study, the reader is presented with a pictorial representation that is intended to provide insight about computer activity in the period. A circle is used to illustrate the approximate proportion of the teacher group that were computer users and non users. A computer user is a teacher that used a computer at least once per month. The themes (productivity and automation, instruction, and integration) represent the manner in which computers were used in the school. Horizontal bars are used to depict the relative amount of a particular activity (productivity, instruction, integration) that computer users were engaged in. The theme bars are intended to give the reader a sense of whether activity had increased for a particular theme (i.e. instructional use of computers) from a previous period.

There are no values on these pictorial representations and the amount of use is estimated from linker's notes, computer lab bookings, resource area sign-up sheets, my daily log, my notes, the school Evaluation Report, and interviews and surveys from 1992 (Appendix C) and 1993 (Appendix D). The Amount of use is reported with low precision and is not intended to be quantitative data but they are still useful in this qualitative study. These pictorial representations are helpful to the reader in that they help to understand the progression throughout the case study.

The Case

1987: Acceptance

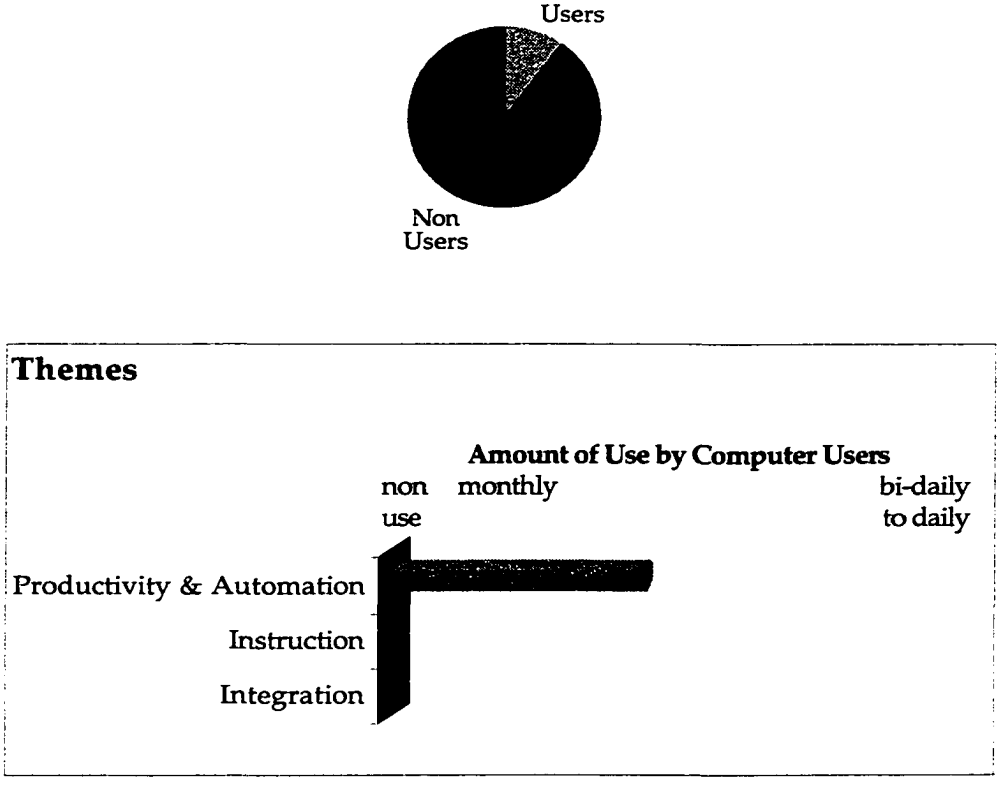


Figure 10. Computer Users and Themes for 1987 Period

Although we did not consciously choose a change model at the beginning, by the middle of this period we selected the Elaborated Leadership Obstacle Course model (ELOC). Data for this period was collected over four months.

In September 1987 I had just returned from 14 months of studying toward a Master Degree. Prior to taking leave to study for my Masters of Education, I had been employed at the school for six years, the last year of which I was technology coordinator. Before I left the school, conditions of change were in the early stages. The status of change resembled the early stages of unfreezing in Lewin's (1947) model. The school had one

computer lab of IBM 8088 computers and one Apple IIe lab. There was one file server and it ran a small Janet™ network of 15 computers. The teachers had received initial training on Appleworks™ using Apple IIe computers. While I was away studying, the school added another Apple IIe lab and upgraded the Business Education lab from IBM 8088 to IBM AT computers. My notes indicate that in 1987 the school had 68 computers and the school had 1400 students and 75 staff members (School Review, 1990). By present standards that number of computers would be inadequate for the number of staff, however, at the time, it was ample because, generally, many of the computers were idle.

The Principal intended to introduce computer technology into the school on a larger scale. However, at the time there only existed small pockets of early adopters (4 people) in the English and Business Education Departments. Other departments had no teachers that embraced computer technology, and the staff generally opposed the purchase and introduction of computers. I noted that I often heard remarks such as, 'Why are we buying computers when I need more books for my department?' or 'I need more lab equipment so why are we buying computers when they are used by only a few teachers?' My observations were that a few teachers were extremely vocal about their views but most were simply indifferent. The implementation of computers did not effect them, and they ignored their presence. In my personal notes I wrote that teachers often expressed the view that computers offered an alternative way of doing things that was more difficult than the current method, and that these alternative methods were only for the technically minded. I heard remarks such as, 'It can't do anything for me that I can't already do,' 'computers are not necessary,' and 'how can students learn to use these things if I find it difficult?'

The Principal's scheduler showed that in September, 1987, he met with me to discuss the state of the school concerning computer technology. He asked if I was interested in facilitating the implementation of computers. I replied affirmatively and the task began. I was asked to keep a daily log and report to him frequently.

The Principals' scheduler showed that discussions for technology planning began. Initial decisions involved issues such as which staff members might be interested, what platform should be purchased, and how do we start implementation? We had to resolve these issues but it was difficult to engage staff members in dialogue regarding computers.

The Principal decided that intervention on the part of administration was the only way to start implementation of computer technology. There were a few early adopters but massive change would require strategies. I had just finished reviewing the literature on change models for my Master's studies and I suggested that we choose a model to guide strategy development. The model would have to focus on administration as instrumental in the change process, and describe resistance as a key factor in change. The model we chose was the Elaborated Leadership Obstacle Course (ELOC) model, mostly because of its emphasis on leadership in overcoming resistance to change. We were comfortable with the model because it fit our existing beliefs. I recall our discussion about the nature of the model and the orientation of strategy development set forth by it, but it was not discussed again. The model set the framework for viewing the problem but we still had the task of developing implementation strategies.

Initiating teacher involvement with the use of computers was a persistent problem, especially in those departments that demonstrated absolutely no interest. My notes showed that some department heads refused to have a computer in their department resource areas. "What am I going to use it for?" said one department head to the Principal. Scheduled training was advertised weekly in the school bulletin without success in generating interest and only a few teachers attended the training sessions.

The Principal's scheduler registers a meeting between us in the second week of September. We decided to initiate live-in training (or modeling). I would take up residence in a particular department along with some computer equipment. I would continue with my daily responsibilities throughout the school, however that department would become my home base. We felt that is was possible that teachers might

become interested in learning if the usefulness of computers was demonstrated through my daily activities. We chose the Social Studies department as the first area for the experiment, the principal generated a memo and sent it to the department, and I relocated in middle of September. Another outcome of the meeting was that we determined that another factor in initiating teacher involvement was accessibility to computer equipment. We planned to initiate actions that would facilitate accessibility of teachers to computers so that they could familiarize themselves before they used them around students. My personal notes showed that the Principal asked me to investigate what kind of computers we should buy, how many, and how much money would it cost.

Between the beginning of September and the end of October, we made the decision to embrace the Apple™ platform based upon its software interfaces and the ease of learning to use these computers. However, the School Board did not favor nor support our choice since it only approved the DOS platform (IBM at the time). We decided to continue with our plans and invoices recorded the purchase of ten Macintosh computers at the end of October.

Upon arrival of the computers, nine Macintosh computers and printers were deployed to department resource areas and one was reserved for my use. I recorded in my daily log that two departments wanted more computers, a few didn't want any at all, and the rest accepted them because they were free to the departments. I briefed the Principal.

A group of us planned inservice training sessions for the whole staff to reduce the fear of using computers and to create an awareness of their utility. We planned to use early adopters as trainers. The Principal's directives and the school bulletin record that two sessions were delivered before December 1987, and each had marginal success in achieving our goals.

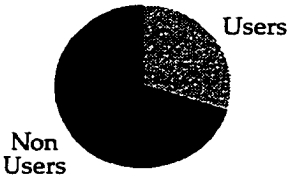
The goal for this period was to achieve the acceptance of computers in the school as a legitimate tool. For some, that meant the acknowledgment of the usefulness of computers as a tool, while for others it meant tolerating their presence. At this time, computers existed in all department resource areas, some early adopters emerged, some computer

training was occurring, and, judging by the computer usage recorded on the sign-up sheets, the live-in training had positively affected some members of the Social Studies department.

Model Usage and the Period

Throughout this period, the Principal and I realized that administration played a key role in initiating the implementation of computer technology into the school. The usefulness of the innovation (computers) was not understood nor generally accepted by the staff of the school. The goal of administration was to devise strategies that reduced resistance to the implementation of computers. The actions taken by administration and myself to initiate change in this period were guided by the Elaborated Leadership Obstacle Course (ELOC) model of change. We continued with strategies aligned with this model in the next period.

1988 and 1989: Productivity and Automation



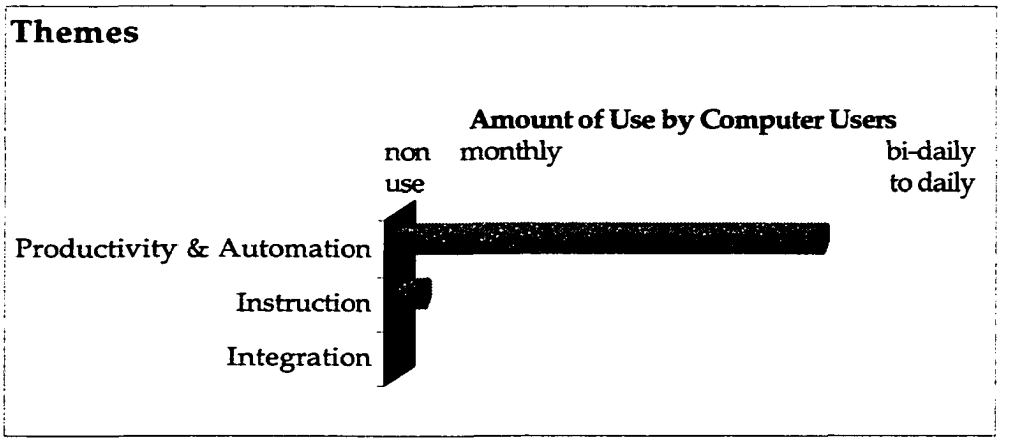


Figure 11. Computer Users and Themes for 1988 to 1989 Period

This period began with the use of the ELOC model and continued until 1989 when we replaced the model with another.

While acceptance seemed to be the theme that signified 1987, the use of computers for productivity and automation captured the focus of implementation for the next two years, 1988 and 1989.

A review of the events list (Appendix F) and invoices revealed that during this period the school experienced major equipment enhancements to facilitate productivity and to automate school functions. In 1988, we introduced a CAD lab (Macintosh Plus computers with a Macintosh SE 30 server), we added computers to the library for student use (20 Apple IIe computers), a library Information Centre using CD ROM was

established (2 Macintosh SI computers with external CD ROM players), and DOS based accounting for instruction in Business Education. We automated the Business Office as well with the introduction of New Views™ accounting software running on an IBM 286 computer. In 1989, we implemented an administrative network (6 Macintosh computers and a Laserwriter printer). This network and software automated office functions and connected the two administrative offices that were situated at opposite ends of the school.

My daily log showed that I spent two weeks working with the CAD instructor. He was a teacher with a drafting background but with little computer experience. Surprisingly, he embraced the notion of using computers for instruction, however, still required time to learn. He rarely signed on the server but managed the workstations well enough. The introduction of accounting in Business Education also went smoothly. My records show that I spent no time with that teacher. Her IBM server and workstations were initially maintained by the School Board's Information Systems department, and training was provided by the School Board's Business Education consultant. However, I did note that she too embraced the use of computers for instruction. These two teachers were certainly early adopters.

Another major enhancement for the use of computers for learning was the introduction of 20 computers in the library. These computers could be booked by teachers for their classes and they could be used by students anytime they were not in use. A review of the booking sheets revealed that while teachers infrequently booked the computers for classes, students were using them all the time for word processing and occasionally for educational software such as Where is Carmine San Diego?.

Automation enhancements were also key to this period. The business manager and I purchased and installed the New Views™ accounting package. I installed the software and he set up the accounting package. My notes showed that the Principal had approached me with the proposal after the business manager had discussed it with him. The business manager had already decided to automate so implementation

was without resistance, unlike the introduction of CD ROM based encyclopedia and periodicals in the library. I wrote in my daily log that the librarian wanted the computer and CD ROM player installed in a tiny room behind the circulation desk. In that location she could control access to the computer. However, students could not easily access the ROM's and therefore they used the traditional hard copy sources for their searches. It was months before she realized the value of CD ROM searching and it became evident that she was ready to use it when she approached me to find more CD ROM sources. I wrote in my log 'find more CD ROM titles for library' and 'see about funding'.

The biggest automation undertaking of the period was the introduction of an administrative network. The project was initiated with the Office Equipment Modernization Proposal that I wrote and submitted to the Principal in June of 1989. It included a list of reasons for the automation but one, in particular, was that the office areas should develop technologically with the other areas of the school to maintain an effective and efficient environment. I was beginning to see progress in the implementation process and saw the need for the office areas to catch up. I recommended a four phase plan with at a cost of $40,000. The Principal authorized phase 1 at a cost of $18,981.

The Network Implementation Schedule (a MacProject PERT document) depicts commencement of installation of the network in October 1989 and completion in November. The last task on the list was a 600 foot link between the North and South offices. It was described in the modernization proposal as a necessary link to provide a means of electronically transferring files between the two office areas and to facilitate of electronic messaging. The administrative network, although a wonderful success, was never used for file transfer or messaging. I made a note of a conversation I had with the head secretary regarding my dismay that these features of the network had not been used. She informed me that the secretaries enjoyed the walk between the offices when they delivered files because it provided a break from the routine.

The use of computers as productivity tools increased over the period and automation leaped ahead. However, the computer lab

bookings and the resource area sign-up sheets showed that levels of computer usage among teaching staff ranged from none to everyday. By 1988 almost all staff members acknowledged that computer technology was not going away, but pools of resistance were evident. I noted the remarks I heard from teachers: 'It would take me longer to use the word processor than it does to write by hand,' 'I will be gone (retired) before I have to use a computer,' 'Doing marks on a computer is more time consuming and complicated than doing them the way I always have,' and 'I don't have enough kids in my class to make it worth while to do marks on a computer.' When I asked one teacher to try doing class marks on a computer, he replied, 'I can do marks faster in my head!'

The group of teachers that adopted computers were not confident in their skills but they were eager to show others the work they had done. They displayed their work, or expressed to others how quickly they could change it: In my daily log I recorded comments such as, 'Look at this work sheet, watch how quickly I can change this question.' In a jovial manner, a one-up-man-ship interaction existed among the users, as each tried to excel beyond the other. Comments from this group were generally regarding assistance: 'Can you help me this afternoon?', 'Do you have a minute to show me how to...?', 'When I did that, it didn't work,' 'Can you tell me how to fix it?' One administrator said to me, 'I would like to use a computer but I don't have a use for it. I don't need to do word processing and I don't have to do marks.' I inquired about his hobbies. He possessed a collection of hundreds of classical records and needed a method of finding particular symphonies in his collection. I suggested that he try a database. He asked what it was and if I would help him make one.

Live-in training was working well in the Social Studies department. However, the Principal was approached by some teachers with a request to have me move into other departments. The Principal's notes indicate in June, 1989 we had a meeting and we decided that I would relocate to the English department in September to continue live-in training.

A pocket of resistance carried on through 1989, but a strong group of users was emerging as well. The user group shared information and skills with each other, and since they were distributed across different

departments, more interaction occurred between departments than in the pre-computer era at the school. To the chagrin of non users, discussion involving computers had a permanent and strong presence in the teachers' cafeteria, and permeated conversations between colleagues as they walked down the school corridors.

With the introduction of new equipment, software, and the increased number of users, the demand for training and assistance had grown. Time management became a problem. I found it difficult to manage routine tasks as well as accommodate the many diversified requests, such as installing and learning accounting software, installing and teaching the use of subject specific software, and resolving administrative software needs. The volume of requests entered into my daily log had increased and they were not being resolved. We needed a new approach to manage implementation.

The Principals' scheduler showed that I arranged a meeting with him in May, 1988, to discuss how to accommodate the changing demands. We discussed the situation at length and decided that the amount of maintenance and assistance required by the teachers had risen beyond the capacity of one person. I noted that the Principal, in reference to the implementation process, stated, 'but that's good.' We decided that I should probably assume the role of an instructor's instructor. We discussed models and the Linkage model appeared to be a comfortable fit for our situation. The model was appropriate for our school because many of its tenets were aligned with ours. We believed a problem was best solved by the user, that the user would require the assistance of a change facilitator in the search and retrieval of information and the selection and implementation of the innovation. The model stipulated that the resource person (linker) must have a good understanding of the user's problem and resource limitations. I would become the linker.

The linkage model helped defray some of our difficulties associated with demands of technological change, simply because it helped define the role of the change facilitator. However, being a linker wasn't quite enough to resolve the problem. Too few tasks could be delegated. It seemed apparent that for this strategy to work I would need teachers to

link with. I noted in my log that the Principal wanted a list of teachers that were computer users.

In early 1989, some teachers were demanding training beyond the use of productivity tools. They wanted to be able to help others within their departments resolve technical problems such associated with printing, installing programs, connecting external hard drives, and copying files from disk to disk. The Principal and I selected a group of ten computer users which had requested further training and named this group the linkers. Members of this group received more technical training than a typical user did. Their task was to assist other teachers in resolving computer problems. They acted as a link between the numerous staff members and myself. We had two expectations of the group: they had to commit their own time for linker training (training occurred after school), and they were expected to help others during the school day when needed. We assembled a training schedule. The Training Schedule For Linkers document showed that training commenced March 5, 1989, occurred roughly twice per week, and included topics such as Getting Started, Inside the Mac System Folder, Printing, Installing Software, Copying Between Hard Drives, and Digitizing Information.

Three other significant events occurred in this period. The first was the school's participation in the Olympic Data Technology Project. The project was the result of the joint efforts of the Olympic Organizing Committee (OCO), International Business Machines (IBM), Alberta Government Telephones (AGT), Alberta Education, Calgary Board of Education (CBE), the University of Alberta (U of A), and participating school districts. This project occurred from January to March in 1988. Our school was one of 26 participating schools from within Alberta. The project allowed participating schools to access an on-line database to obtain Winter Olympic event results from the Calgary Olympic site within 15 minutes of completion of the event, and provided on-line communication between schools participating in the project. Although the project expired in March, communication between schools was extended to June, 1988.

A document called the Olympic Data Technology Project: Evaluation Report contained, among other factors, a summary of the extent of participation of each school in the project. Approximately one-third of the teachers and students in our school regularly participated. The report stated that students and teachers particularly benefited from the project in that they had the opportunity to use a high profile current event as a means of exploring the use of technology to enhance the curriculum. The significance of this project was that the participating teachers experienced on-line communications and data retrieval for the first time, and they generally enjoyed it. The exposure to on-line communications created a desire to participate in another project, in 1994, that included e-mail and Internet access (SchoolNet Project).

A second significant event began in November 1989. It was the beginning of a review of our school that was conducted by the District and Alberta Education. The review extended to January 1990 and resulted in the development of the School Review document. The document stated that the purpose of the study was to determine the overall effectiveness of the school, to examine its role and function in the District now and in the future, and to examine in varying depths some of the major components generally common to all schools. Data collection included questionnaires and interviews with parents, students, teachers, and administrators. The significance is that it was this event that later prompted the staff and administration at the school to conduct a self-examination of its purpose and direction, which lead to the development of a guide for the school's development, called Vision 2000, in 1991.

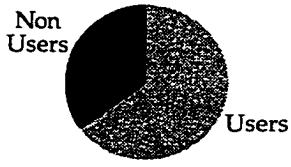
A third significant event occurred in November, 1989. At a principal's meeting for the District, our Principal was asked if our school would host an afternoon when principals could visit and get an overview of how computer technology might be used in schools. An entry in my daily log showed that the Principal met with me the next day and asked if I would conduct the seminar. We decided to call it the Technology Awareness Seminar and held the event two weeks later. The significance of the event was that the District principals had recognized our school as

having some expertise regarding the use of computer technology, and that implementation of computer technology was progressing.

Model Usage and the Period

This period started in 1988 with change strategies based on the use of the ELOC model. However, by May of 1988 the strategies derived from the model were inadequate to accommodate the changing conditions as implementation progressed in the school. We adopted the Linkage model and we developed new change strategies. In March of 1989 we established a group called the linkers and began training them. The linker group was a new approach for providing support within the school. The use of the Linkage model continued into the next period 1990 to 1992.

1990 - 1992: Increased Productivity and Automation, and Introduction of Instructional Use



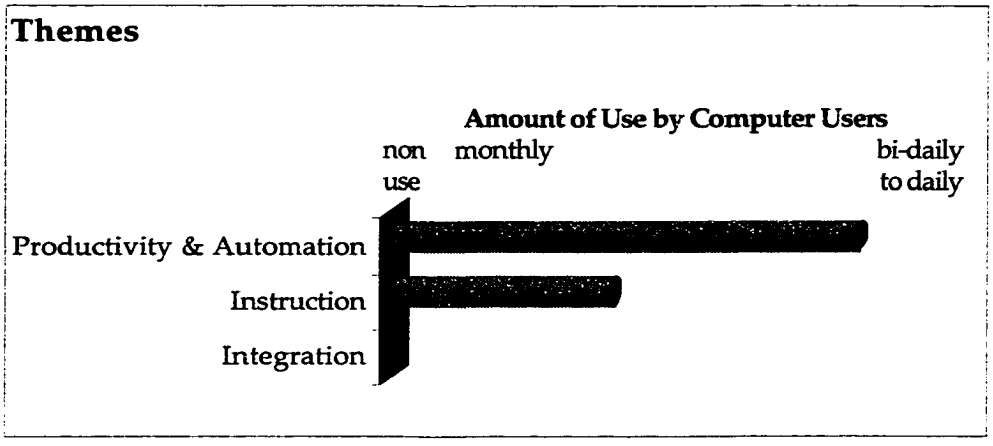


Figure 12. Computer Users and Themes for 1990 to 1992 Period

This period started with the Linkage model still in active use, however, the model was abandoned at the end of 1991.

Throughout 1990 to 1992 there was continued growth in the use of various and automation tools, and an increase in the number of teachers that were using computers. However, it was the introduction of CAI (Computer Assisted Instruction) programs that distinguished this period. In the previous period, most of the utilized software was designed for productivity (marks, and word processing) and automation (accounting, CAD, graphics). Few teachers used CAI programs. In this period, two comprehensive CAI programs were introduced: Autoskill™ to teach

English to English as a Second Language (ESL) students, and CAI math. Other important aspects of this period were the implementation of computer facilities specifically to accommodate CAI, the initiation of plans for a new delivery system (including CAI), and visitations to other educational sites that were using CAI.

To more easily comprehend the events of this period (1990 through 1992) and their significance it is beneficial to present the period in three categories: school plan, instruction, and teachers.

School Plan

In January, 1990, the School Review was completed and presented to the school. Essentially the document reported that students, parents, and teachers were pleased with the educational process at the school. Regarding the computer technology, a statement in the document reported there were "excellent facilities and equipment available to deliver the program." Other significant comments were that staff appeared to be satisfied with the administration of the school, and that the school's physical infrastructure was in need of revitalization. However, one comment prompted the Principal to take action. The authors of the School Review had concluded from the interview data that there was not a clear understanding of what the goals of the school were, and that the respondents weren't aware of an overall education plan.

The Principal's scheduler showed that in early February, 1990, we had a meeting in which we discussed formulating an overall plan for the school. The plan would focus on the future and encompass all aspects of the school including philosophy, instructional ideology, spirituality, technology, and school facilities. The Principal asked me to begin the process. In my log I entered that I must establish a plan for the process, and that possibly a suitable title would be 'Vision 2000'. I began a literature review on information pertaining school reform and restructuring, school facilities, and societal issues that would affect education.

In September 1990, the principal's notes indicated that we began a series of discussions with small and large groups of teachers at the school

regarding the vision. According to the timeline laid out in the Vision 2000 Development Plan (a Mac Project PERT document), meetings were completed in November. In January of 1991 the teaching staff at the school was asked to submit a written document describing their departments' suggestions for change by no later than February. In February, I began compiling the vision and it was completed by April 30. 1991.

The Vision 2000 document became pivotal to many of the directions in which the school would venture. The document outlined the major issues affecting education in the 90's: information age, lifelong learning, the changing nature of work, the changing social structure, and school reform and restructuring. It described the organizational plans that needed to be changed: the content of an education, the delivery, the role of teachers, the facilities, and class scheduling. The document prescribed reform strategies: a humanistic approach to educational delivery and school climate, alternate delivery methods to accommodate alternate learning styles, organizational levels of computer integration including computer facilities and computerized learning centres, flexible scheduling and individualized learning, and the school facilities required to achieve these reforms. Finally, the document offered some insights regarding the resistance to change, factors of successful implementation, and where to start the change process.

According to the Principals' notes, the Vision 2000 document was delivered to the Superintendent April 30 and was presented to the Education Council of the District in May, 1991. My notes showed that we established a facilities committee in June to examine the nature and extent of renovations that would be required to accommodate a new delivery method involving the use of computer technology, based on the Vision 2000 document, and to prescribe general facility upgrading. In March of 1992 the committee completed its work which resulted in a document called the Modernization Plan, which was forwarded to the School Board. Also in March, the School Board approved the Modernization Plan and it was sent to the provincial Department of Education for funding approval. In May, 1992, meetings were held with the Buildings Branch of the

provincial Department of Education. The plan called for a twenty million dollar renovation of the school involving infrastructure improvements (mechanical, electrical, plumbing, etc.), upgrading of instructional and CTS shop areas, and the construction of learning centres. The plan included the addition of computer centers designed for delivery of CAI and a theater.

Instruction

The use of computers for productivity and automation continued to increase in this period. The computer lab booking sheet revealed that, in 1990 the room adjacent to the library was becoming heavily used, and invoices document that in that year, we upgraded the computers from Apple IIe's to Macintosh Plus's with a SE 30 Mac server and Appleshare networking. This room was available for teacher bookings and for general student access when it was not occupied by classes.

In April of 1990, our school became a member of the Statistics Canada CANSIM Project. This project was designed to provide on-line access to the CANSIM database. Schools had to apply to participate in the Project, and 40 schools distributed across Canada were selected on the basis of their computer expertise and their ability to provide useful evaluations to Statistics Canada and their programmers. The project extended over a year and culminated in the production of a CANSIM database on CD-ROM. The social studies teachers utilized on-line database on a continuous basis with their classes. The students and teachers had to learn searching techniques and they were awe struck with the abundance of information. However, the gratification of finding current and pertinent information more than compensated for the inconvenience of learning.

My notes showed that in 1990, we were actively seeking CAI software. The Pathfinder™ software that we reviewed was a comprehensive package with mathematics, english, and social studies components. However, its initial expense combined with an annual fee led us to conclude that the cost exceeded the benefits. We continued to review software and later in the year discovered Autoskill™. This software taught the English language and grammar to ESL students, and

since we had a large ESL component in the school we purchased the program on a limited user basis. An English teacher was willing to learn and administer the program to students so we established a temporary computer lab (12 Macintosh Plus computers with a Macintosh SI server) to test the effectiveness of the software on the learner.

The Autoskill™ program was so successful with ESL students that, in 1991, invoices showed that we purchased a site license for the program, and we established a permanent lab (15 Macintosh Classic computers with an Apple Quadra server). We also introduced additional CAI software. We began beta testing CAI mathematics produced by the University of Alberta in cooperation with Alberta's Distance Learning Branch. Initially only a few interested mathematics teachers used the software because many teachers were skeptical of its value.

By 1991, lab booking sheets showed that the capacity of our computer facilities was inadequate to accommodate the rising demand. My notes indicated that teachers were complaining that computer labs were busy all the time, and that they couldn't book time for their classes. Some teachers booked full weeks of computer time months in advance, excluding others from using the facilities. Occasionally, a teacher deleted another teachers' booking replacing it with their own.

The Principal and I discussed the situation and the negative impact that the unavailability of computer lab time might have on implementation efforts. He authorized the purchase of more equipment. Invoices document the purchase of one computer lab (Macintosh LC lab with 26 networked computers) in March, and another in September (Macintosh LC lab with 24 networked computers).

Other teachers became interested in using computers for specialized needs and my daily log showed that in June of 1992, we installed a pattern assisted design (PAD) program running in conjunction with computer assisted drafting (CAD). The software ran in a computer lab that cost $20,000 and contained 5 DOS 486 computers, graphics palettes for computer input and design of clothing patterns, and a 47 inch Roland Plotter for printing patterns on paper. Clothes were cut and sewn from these

patterns. I installed and configured the software and two teachers attended courses over the summer to learn the PAD and CAD programs.

In 1992, more mathematics CAI programs were introduced into the school through Alberta's Distance Learning Branch. The mathematics teachers were no longer skeptical about the value of the software.

Teachers

In 1990 my notes showed that I had some concern about the disposition of some computer users. Teachers were becoming tired of the rapid pace of change. There was a relentless learning curve associated with the use of computer technology, a world that many of the teachers were not familiar with. The use of productivity and automation tools was one thing, but the use of computers for instruction involved learning how to use networks, and for the linkers it meant learning about servers. The user group of teachers were continuously challenged with new tasks, and there was an ever changing and expanding collection of software. The lack of time to learn was becoming a concern. My daily log showed an entry from a lunch discussion in which three computer users were expressing to me a desire to stop introducing new software. My daily log accounted that many teachers said they preferred to stop innovating for a year.

During the 1990 and 1991 interval the linker training was still progressing. However, we still had two groups in the school: Those that used computers, and those that didn't. While divergence between the two groups had been continuously growing since 1987, it was now a implementation impediment that required attention. My log showed that in 1990 we formed a discussion group to determine how to further implement computers at the school, and we also initiated small group training sessions to accommodate the divergent needs of the users and non users. The non users required entry level training while the user group was so diversified that they required specialized training that related to their particular needs.

Even though the non computer user group had diminished to about one-third of the teaching staff, the Principal's notes showed that in 1991 resistance continued, and the difference of opinions between users

and non users was problematic. Users were consuming departmental funds in printing costs and were lobbying to use departmental budgets for the purchase of computer equipment. Non users argued that departmental budgets should not be spent on computers. These issues surfaced during budget meetings. Entries in my daily log showed statements such as: 'I need books more than computers,' 'Show me how a computer can teach Shakespeare!', and 'Kids want contact with teachers not computers.'

I tried to encourage the resisting group to use computers, and I promised that they would find computers useful. In my daily log I recorded some responses I got when I asked some teachers why they didn't use computers: 'I would know computers too if I had the training that those guys (linkers) did,' 'I wasn't trained or chosen as a linker so I don't have to know,' or 'If the school wants me to know they should buy me a computer.' The Principal also encouraged teachers to use computers and he would often remark 'The train is leaving the station. Get on board or you'll be left behind.'

The user group had different concerns. In my notes I recorded having discussions with this group regarding features of new software or how to use computers for some new task, while other discussions were about the use of CAI to augment their teaching. They wanted to know how they could acquire new software, how they could secure more training and individualized help, how they could buy a computer economically, or if they could borrow a computer from the school when the it was closed for holidays.

In 1991, resource area booking sheets revealed shortages of computers in the English, Social Studies, and Science teacher resource areas. The shortages had developed because of the increased number of users, the increased number of daily tasks being performed on the computers, and novice users occupying computers for lengthy periods. Limited computer access caused teacher frustration as evidenced by comments found in my daily log: 'We need another computer but our department can't afford to buy one,' and 'I can't get my work done because the computer is busy all the time!'

It was the increased demand for computers in combination with the shortcomings of small group training that compelled the Principal and me to investigate other alternatives. The demand for more computers was surely to come from other departments as well, and funding was limited. Small group training was successful but teachers needed support on a daily basis at any time. According to the Principal's scheduler, our meeting in September of 1991 produced the concept of a Technology Support Centre. Invoices showed that we opened a Technology Support Centre at the end of September and equipped it with five computers, two printers, and a scanner. The Centre served two purposes: (1) to offset the demand for more computers in the department resource areas by providing another common work area, (2) and to provide teachers with individualized computer support at anytime from a linker, another user, or myself. The Centre was a success and it became a place where teachers were often found working.

More advanced computer users were now beginning to emerge at the school. With the introduction of English CAI (Autoskill™) in 1990 and CAI mathematics in 1991, some teachers were contemplating permanently incorporating CAI into their course delivery, while others expressed an interest to know more about it. The Principal's notes showed that in 1991 we decided it was time to expand our understanding of the use of CAI by visiting other educational facilities that where already routinely using it. In October a group of 10 teachers went to a native training facility near Rocky Mountain House where 20 networked DOS/Windows computers were administering a CAI program called BASE™ to students. It was a tutorial for junior high level mathematics, english, and science. Our second excursion occurred in December. A group of 7 teachers visited a junior high and a senior high school in Calgary. The junior high utilized english and science CAI, while the newly built senior high was entirely constructed and networked for on-line instructional delivery. Both trips were successful in providing motivation. My notes showed that some teachers stated they wanted to use CAI programs to supplement their teaching, but they required money to purchase the software. The school administration committed itself to implementing CAI and it

examined the funding issue. The Principal's notes revealed that after deliberation, administration decided to divert some funding from the library book budget to the purchase of software.

In November 1991, the Principal was asked if the school would be willing to host a Technology Initiatives evening for teachers, principals, school district board members, and parent advisory groups. The Principal called a meeting with me and I noted in my log that we had only two weeks to organize the event. We borrowed hardware and software from our suppliers to supplement our equipment. We determined which computer technologies we wanted to demonstrate and assigned teachers to operate these stations. It doesn't seem very high tech now, but to us we were on the leading edge. We demonstrated how to use accounting, desk top publishing, graphics and animation, and CAI software. Groups of 10 visitors were ushered to one of the eight sites in the school where they would receive a fifteen minute demonstration. Then they were rotated to another site. The event was well attended and in a period of about three hours, over 120 people circulated through the school. It was an opportunity for teaching staff to demonstrate the results of their endeavors to implement computer technology. However my notes showed that many of the teachers did not feel confident enough to display their skills in a public forum and they experienced significant stress before the event began. The next day the teachers were jovial, relaxed, and proud of the previous evenings' success. They felt as though they had endured the right-of-passage and were now members of a computer fraternity.

One of the most significant events recorded in my notes for 1991 occurred in December, the last day before the Christmas break at the closing staff function. One of the linkers approached me and complained bitterly that I had left all the linkers behind (in computer knowledge) because I didn't spend enough time teaching them. 'You should spend more time with us, then we would know more too!', he said. He thought that I was withholding knowledge and simultaneously asking too much of them. He remarked, 'I can't solve all those problems, I don't know how.' The next day he apologized.

I remember reflecting on the incident. In my notes I wrote that I thought there were two problems associated with the linkers. The first was that they were tired. They were tired of continually learning, especially when there appeared to be no end, and they were tired of helping others because it consumed much of their time. The second problem had nothing to do with the linkers. The user and non user groups held high expectations of the linker group because they were chosen and specially trained. In fact, some teachers held considerable animosity for the linker group because they were thought to be elite. This attitude toward the linkers was causing a divisive rather than unifying effect among teachers.

The Principal's scheduler showed that we met when school reconvened in January, 1992, and discussed the matter of the linkers. We decided to abort the linker program and abandon the Linkage model. The selection of an alternative change model was not discussed.

My role at the school changed in 1992 because in January I returned to the University of Alberta to begin doctoral studies. A fellow teacher that I trained was selected to assume my position while I was gone. The Principal decided to maintain computer technology at status quo for 1992, and we agreed that I would return to the school once per week for a half day to provide support and discuss issues. My daily log showed that we also discussed evaluating the success of our computer implementation efforts at the school.

I didn't begin the evaluation until May of 1992 and it extended to the end of June. Its purpose was to assess how well implementation had progressed, to determine what the difficulties were, and to suggest changes. The evaluation utilized interviews and a questionnaire (Appendix C) for data collection, and resulted in a 66 page document. The data were analyzed and the completed document, Evaluation Report: Computer Technologies Implementation Program was presented to the Principal September 2, 1992. There was a follow-up questionnaire administered in June, 1993.

The findings of the Evaluation Report were significant and had an effect on implementation strategies. Twenty teachers were interviewed

yielding 169 responses that were classified into these nine themes: support, applications of technology, student learning, school climate, time, teacher learning, change, training, and hardware and facilities. These themes were summarized in five areas. The five major areas, as written in the Evaluation Report, were:

1. Support and Training (52 of 169 comments)

   Support has been recognized has been one of the most useful aspects of the computer implementation program. However, the support system is complicated, having many 'layers' with different roles. Formal inservice training is useful, but equally important is the informal network of support people. This informal layer consists of linkers, individuals and departments with special areas of expertise, and the general sharing of computer knowledge among staff members. The Technology Support Center, where linkers assist each other and other staff members, is also of importance in the provision of support.

   The need to continue support, in its various forms, is recognized by most teachers. They also requested more training, preferably on a regular basis. It should be noted that large group training is no longer effective with this diversified group and that small group and one-on-one training are alternatives.

2. Applications of Technology (38 of 169 comments)

   Phase 1 of the program focused on the building of teacher competency with respect to using computer technology as personal tools. Consequently, teachers commented that the use of computers as productivity tools was the most useful aspect of the program. A much smaller number of responses indicated that using computer technologies as an instructional tool was the most useful aspect. This can be explained by the fact that only a small number of teachers were using CAI in Phase 1, and that Phase 2 (computers used for instruction) has just begun.

As for the present and the near future, teachers requested more individualized and instructional (subject specific) software, and some have even requested guidance on how to use computers in classroom instruction. For the most part, teachers were not ready to use computers for instructional purposes in Phase 1. However, many teachers now appear to be ready to move in this direction.

3. Time, Teacher Learning, and Change (33 of 169 comments)

The time required to learn hardware and software is a source of frustration. In recent years, additional responsibilities have strained an already busy schedule. The introduction of computer technology has placed further demands on the time of a teacher.

The problem of time constraints is compound by the rapidly changing industry. Changing software and hardware necessitates the continual upgrading of knowledge, in addition to exploring and learning new aspects of using computers.

4. Student Learning and School Climate (32 of 169 comments)

Teachers frequently commented on the value of the sharing of computer knowledge among the linkers, pockets of expertise, and the staff in general. As a side effect, the sharing knowledge has increased communication and interaction between departments and individuals that formerly had no need to interact. A second side effect has been a general interest in the school and increased teacher motivation.

With respect to student learning, teachers noted that there has been an increase in student motivation (those students using computers for classroom activities or special projects). Phase 1 was not intended to produce this effect since the main concern was to develop teacher computer competency. The focus of Phase 2 is the instructional use of computer technologies. However, a small number of individuals have

already started using CAI, and other instructional software, and have achieved noticeable improvements in student motivation.

The net effect of these combined factors has resulted in increased shared meaning (goals) among the teachers, and has generally positively enhanced school climate.

5. Hardware and Facilities (14 of 169 comments)

Teachers have expressed the view that more computer labs and pods, and computers in more classrooms would be useful. As teacher competency with computers has increased, so has their need for hardware and software. A trend for using computers in instruction is developing. Therefore, concern should center on the provision of sets of computers that can be used in group activities (labs, pods, classroom sets) rather than individual workstations.

The questionnaires consisted of 12 questions on a four point Likert scale. It was administered to 40 teachers. The questions were classified into six themes: effects of using computers, support and training, climate, readiness, time, and success of implementation. These themes were summarized in the Evaluation Report:

1. Support and training

The support system has many components, such as linkers, linker training, Technology Support Center, and training. Another important component of the support system is the informal transfer of computer knowledge between groups and individuals. The respondents agreed (100%) that teachers shared computer knowledge and helped each other to learn new skills. However, a fewer number of teachers agreed (81%) that they were satisfied with the support and training that they had received. Almost all of this dissatisfaction with support emerged from the non user group.

2. Success of implementation

The intent of Phase 1 of the program was to build teacher skills with respect to using computer technologies as personal tools. Teachers agreed (97%) that overall, the implementation of computer technologies has been a success, and that the use of computers as a personal tool has been helpful (100%). Fewer teachers agreed (76%) that they use computers and various types of applications frequently, and that the program has met their individual overall needs (81%). All considered, implementation of the program was successful.

3. Effects of using computers

Two effects have emerged. Firstly, teachers agreed (92%) that the program has been beneficial to their teaching. Secondly, they agreed (100%) that the use of computers in the school has been helpful to students.

4. Climate and readiness

The climate of the school is important because it is an indicator of the success of Phase 1 and it has implications for the success of the implementation of Phase 2. Teachers agreed (100%) that they share computer information and help each other to develop new skills. This is an indicator of good communication and the sharing of common goals. However, fewer agreed (81%) that they felt confident about using computers.

Overall, there is feeling that the implementation of computer technologies has been successful (97%). This could indicate the presence of good feelings with respect to change, a sense of growth and accomplishment, and a willingness to continue with further change.

The readiness of teachers refers to the extent to which teachers are prepared to enter Phase 2 of the program (use of

computers for instruction). Considering the computer skills that have been developed, the confidence of the teachers, the variety and frequency of computer applications, and the climate of the school, it appears that the school is ready for Phase 2 of the program

5. Time

   If there is one factor that could create resistance in Phase 2, it is the time demand issue. This factor continually emerges from the data as the single major negative factor of Phase 1. Only 44% of teachers agreed that they had enough time to learn the hardware and the software that they needed to know. Time pressure may cause frustration which could lead to resistance to the program. Unlike some of the other issues which appeared to be specific to the non users, this problem straddles both groups (computer users and non users).

The Evaluation Report recognized the existence of the user and non user groups and their different needs, and the need for facilities to accommodate the use of computers in instruction. In its final pages, the report provided some insight regarding the magnitude of the task at hand. It stated that real change has associated costs and that the integration of computer technologies involves fundamental changes to traditional delivery methods. It also cautioned that these changes often require policy modification and organizational restructuring, and as these changes occur the school will appear and function less like other schools and more as a unique entity.

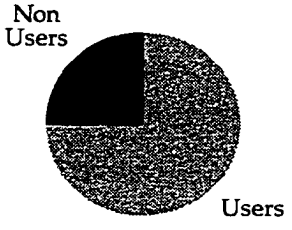
Model Usage and the Period

We used the Linkage model for two of the three years of this period (1990 and 1991). In total, the model was the basis for our change strategies from March 1989 to the end of 1991. However, strategies based on this model were losing their effectiveness in maintaining change momentum in 1991. It was an incident with a linker at the end of 1991 that prompted

us to assess the usefulness of the model at that juncture of our implementation. After abandoning the Linkage model and the linkers as a formal group, no linker training existed and a peer-to-peer exchange of information flourished. No other model was immediately selected and, in 1992, it was unclear which model of change, if any, was the basis for the schools' change strategies.

The Principal decided not to introduce new technology projects and I was absent except for one half-day per week and committee work. The intent in 1992 was to maintain status quo. No linker training existed although the peer-to-peer exchange of information flourished.

1993 and 1994: Instructional Use



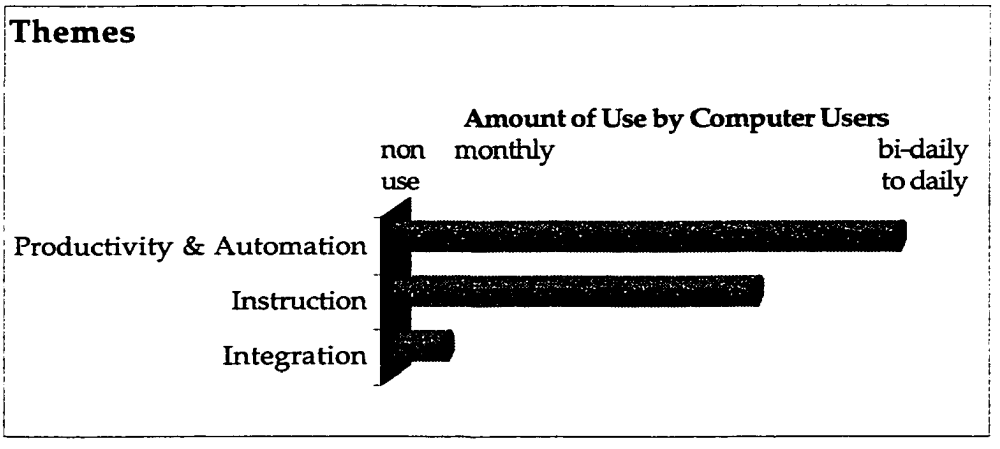


Figure 13. Computer Users and Themes for 1993 to 1994 Period

While the school did not adopt a particular model to guide the change process in 1992, it proceeded laissez faire. About half way through 1993, the Principal and I discussed the Local Process of Change model (LPC) at length.

In the previous period the use of computers for productivity and automation became internalized, and the use of computers for instruction was becoming more wide spread among computer users. It was in the 1993 and 1994 period that the instructional use of computers became entrenched in the organization.

Computers had become part of organizational routine. The summary of the Evaluation Report concluded that computer technology had become an integral part of the culture, and that much of the social conversation evolved around computers, software, and technical problems. In addition, the evaluation reported that there 'seemed to be a sense of pride among teachers in the ability of the school to show leadership in the area of using technology in education.'

In this period more school functions are automated, more CAI was introduced, more CAI facilities were established, we participated in another on-line project, another implementation questionnaire was administered, and school renovations to accommodate CAI began.

School Plan

My notes for 1993 and 1994 showed that we were desperately struggling to procure funding for renovations. After producing the Vision 2000 document we compiled the Modernization Plan (the 90 to 92 period). In April of 1993, we were informed that the $20 million funding proposal was rejected, but we were invited to apply for other funding of a lessor amount. The Principal held a meeting with the me and the department heads to develop a new strategy for acquiring funding. The Principal's notes showed that grants were available for schools that needed to upgrade facilities for the delivery of CTS (Career and Technology Studies), and that we decided to apply for these funds. The Principal asked me to chair the application development process and to write the final document. A committee of twenty was assembled to identify the strands, modules, and

equipment required for program delivery. This information was compiled and a document was written for submission to the School Board. On November 29, 1993, the School Board approved the CTS Equipment Funding Proposal and it was sent to the provincial Department of Education. The document was based upon the principles outlined in the Vision 2000 and contained information about our educational philosophy, CTS philosophy, programs, students, teachers, CTS strands that would be offered, and the required facilities. The proposal was a request for $1.4 million to upgrade facilities and equipment, including computer centres.

In January of 1994, we were informed that our proposal was rejected by the provincial Department of Education. The Principal's scheduler showed another meeting with me and the department heads. He informed us that the provincial Department of Education indicated that our CTS equipment request was too expensive. Once again we were invited to submit another proposal but the deadline was the end of February. The Principal asked if I would write the proposal and chair a committee of five. We decided on a whole new approach. The document was still based upon the concepts outlined in the Vision 2000 document but the new proposal concentrated on fewer CTS strands. It stated, 'In view of the capital constraints set upon us, this revised CTS plan will emphasize Communications, Management and Marketing, Information Management, and Design and Innovation studies.' It presented the case that in considering the impact that life-long learning, the information age, and communications will have on education, the selected strands would best satisfy the needs of the students, the school, and the District. Furthermore, the document delineated 'an approach to optimize CTS delivery while maximizing the impact on academic and other components of the school.' It proposed a new approach that offered an alternative delivery system involving the use of learning centres equipped with computers. The computers would be clustered in groups of 3 to 5 called a covey. A covey would serve individuals or pairs of students at each workstation of the covey. The capital requirement was $379,000 and it included developing three networked learning centres with computers. My notes showed that the Revised CTS Equipment Proposal was

submitted to the provincial Department of Education at the end of February and was approved for funding April, 1994.

From June to September, 1994, I designed the network requirements for the learning centres, and my daily log showed that in October a Technology Team of four teachers was formed to determine instructional format, and equipment and furniture requirements for the learning centres. The architectural drawings were completed in November, 1994, and renovations began.

Instruction

Although the instructional use of computers was the focus of this period, automation of school functions continued. A Principal's memo to me indicated that, in January of 1993, he and the Superintendent decided that our school would run an experiment and assume all the responsibility, including financial, of the text book rental system in our school. The Principal's scheduler showed a meeting in which we discussed how we might track text books. I was asked to review library automation programs and make a recommendation to him. After carefully reviewing automated library systems, in March of 1993 we selected Library 4™. My daily log showed that in September, 1993, we began preparations for automation. All 10,000 text books and 1200 student ID cards had to be bar coded. In 1994, we networked the Business Office, Library, and the Bookstore. We installed workstations, a server, Library 4 software, and bar code scanners. Textbook titles and coding were entered into the library system over the summer by support staff, and in September, 1994, I began training staff on the use of the system and backup procedures.

My notes showed that by 1993, the mathematics department was running four CAI courses, and other teachers were requesting more time in computer labs. The Evaluation Report of 1992 indicated that the staff of the School was prepared to move into the instructional use of computers, however, it warned that two factors may impede success: (1) the demand for more teacher training, and (2) the need for additional computer facilities upon which to deliver CAI. My daily log showed that I had a

meeting with the Principal in January to discuss the issue of teacher access to computer labs. We could not afford to introduce many more computer labs. We thought the access problem might not have been the number of computers but instead it might have been the number of spaces that teachers could book. Our lab booking sheets were always full but my observations were that teachers didn't necessarily fill the lab. We decided to introduce the concept of a computer pod. A computer pod was a mini computer lab which may or may not have been attached to a server. We introduced our first pod in February (12 Macintosh Classics and a printer), and my daily log showed that two more pods with the same configuration were established in September. Two other actions precipitated from the Evaluation Report. We introduced a Teacher Training Centre in October, 1993, and upgraded the Business Education department from IBM AT computers to Macintosh LC 475 computers with a Power PC server and ethernet in 1994.

Participation in the Olympic Data Technology Project (1988) and the Statistics Canada CANSIM Project (1990-1992) had left an impression on teachers. My daily log showed many entries where teachers were requesting access to on-line activities, including e-mail. To facilitate their requests, we installed remote access and e-mail in May of 1993. Remote access allowed teachers to access a secured server at the school from home using a dial-up modem. My observations were that most teachers enjoyed using the e-mail but few (myself and one other teacher) used remote access. It wasn't a tool that they could find a use for. Internet access is what they wanted. SchoolNet documentation showed that I submitted an application to Distance Learning to participate in the Federally sponsored SchoolNet Project in October 1993. The Project required that we incorporated Internet activities into the curriculum. In an acceptance letter sent to us December 15, 1993, we were told that our school was one of thirty schools that were selected from the ninety applications to participate in the Project. We remained in the Project until the end of 1995. Teachers accessed the Internet with their classes from the Teacher Training Centre, and e-mail was available from the Technology Support Centre. The first year of the Project was not all that successful. In a Project evaluation

submitted to Distance Learning after the first six months (June, 1994), I noted that only a few teachers were applying Internet to curricular activities, however, many teachers used the Internet for personal reasons. I concluded that most teachers did not feel competent enough with the Internet to introduce it to their classes.

1994 held remarkable improvements in the use of computers for the Science Department. After a meeting with the department I had noted in my daily log that they had collectively decided introduce CAI. CD-ROM based tutorials were introduced in biology, chemistry, and physics. One teacher integrated various software programs to construct a lesson. The student reviewed a tutorial from a CD-ROM, constructed an experiment on a word processor, conducted the experiment and collected data using probes attached to a computer, calculated the results using a spreadsheet, and reported the results of the experiment from a word processor.

Teachers

My observations were that there were three significant changes for teachers that came about in this period. These changes indicated that implementation was progressing.

The first is that the teachers at the school had internalized the use of computers and were embracing the use of computers for instruction. Mathematics teachers had introduced more CAI, the science teachers introduced it in three science subject areas, and teachers in English were looking for software. There was more conversation among teachers about how to use software in their courses than in the previous period. Using computers for instruction was important enough to send 5 teachers, including myself, to San Francisco, California, to visit the Apple Classroom Of Tomorrow (ACOT) schools, in January of 1994, to improve our understanding of using computers in education.

During this period teachers were definitely committed to using computers. The Principal asked that I administer another questionnaire to determine the status of the implementation progress. I designed and administered the Computer Technologies Implementation Program questionnaire (Appendix D) in June, 1993. The 53 respondents to the

questionnaire were computer users A computer user is a teacher that used a computer at least once per month. Of the 53 respondents, 34 were self-proclaimed frequent computer users.

When asked if they owned a computer (Question 11) 38 of 53 agreed (72%). When the frequent computer users were asked how often in a week they used a computer (Question 12), 34 of 34 (100%) responded 3 to 5 times or more. When the entire group was asked the same question 45 of 53 (85%) responded 1 to 2 times or more. When the frequent computer user group was asked to rate how frequently they used a computer in a week (Question 13), 26 of 34 (76%) replied that they used computers either every second day or almost every day. The teachers were asked how many different software programs they used in a week (Question 14). In the frequent computer user group 22 of 34 (65%) replied they used 3 or more software programs per week, and in the entire group 46 of 53 (87%) replied they used at least one per week. The response from these questions provided the Principal and me with evidence that implementation was progressing.

The last two questions examined how implementation was proceeding with respect to the instructional use of computers. When the group was asked if they thought it was a good idea to use instructional software (Question 16), 52 of 53 (98%, one questionnaire had no response) either agreed or strongly agreed. However, when the group was asked if they used instructional software (Question 18), only 17 of 53 (32 %) either agreed or strongly agreed. All of these responses came from the frequent computer users, therefore, 17 of 34 (50%) of the frequent computer users used instructional software. It was apparent to the Principal and me that the instructional use of computers was growing but the user had to achieve a comfortable state with computers first.

The second significant change that indicated that implementation was progressing was the way training had evolved. Teacher training changed continuously from the beginning of implementation in 1987:

- 1987 - large group training began
- 1990 - regularly scheduled small group training introduced
- 1991 - Technology Support Centre established

- 1992 - large group training stopped
- 1993 - regularly scheduled small group training stopped
- 1993 - training on demand available upon request and specified topic

Notes made when the Principal and I were discussing the results of the questionnaire indicated that large group training became less useful than small group training and individualized help. Therefore large group training was stopped in 1992. Regularly scheduled small group training remained in effect until 1993 when it was no longer successful because of the varied skills of the trainees. It was replaced with training on demand, in which a small group with the same interests and skills requested an informal training session on a specific topic. The Technology Support Centre provide individualized training and continued to be effective. The linkers also provided individualized peer-to-peer help, and although there was no longer linker training, they continued to learn and help others.

The trend in training delivery evolved from group to individualized, from generalized to specific content, and from a focus on productivity to instructional tools. The training evolved as the computer skills and knowledge of the teachers increased. Teachers progressed from a mental state of 'I don't know what I need to know' to 'I know what I need to know.'

Further evidence that implementation was progressing came from the teachers' increasing self-confidence and self-reliance. The Questionnaire revealed that 75% (40 of 53) of the computer user group agreed or strongly agreed that they felt confident about using computers (Question 8). Approximately one year earlier, the 1992 questionnaire revealed similar findings (81%, 29/36) on the same question. Both questionnaires determined that 100% of the frequent users felt confident (agreed or strongly agreed) about using computers.

Other notes made while discussing the questionnaire with the Principal indicated that we discussed the impact of my absence while I was attending the University of Alberta (January 1992 to September 1993). During that interval, other than weekly visits, committee work, and

support provided by telephone, I was not available. Teachers were compelled to discover ways of navigating their way through daily problems associated with using computers. During this time the teaching staff became more self-reliant and more willing to take chances concerning the use, maintenance, and repair of computers. More importantly, because of my absence, others began providing technological leadership and support. In particular, the Principal noted that the individual who had assumed my role during my absence had become far more confident and competent, and that his technological leadership was now significant in the implementation process.

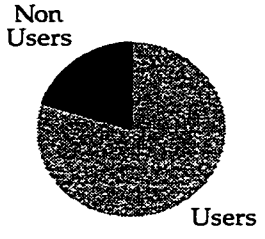
Increased confidence and self-reliance on the part of teachers affected the type of training they required. They had progressed from a state in which they thought they needed to know everything because they didn't know what they needed to know, to a frame of mind in which they knew what they need to know so they didn't need to know everything before they started using the software. The training they required was highly individualized with specific content devised to address a particular problem.

Model Usage and the Period

My daily log indicated that in April of 1993 the Principal and I discussed the merits of various change models and their associated views of the change process. The Local Process of Change (LPC) model was discussed at length. Although a model to use for strategy development had not been settled upon, the strategies that emerged during the period were guided by the LPC model. The influence of the internal group on the change process is similar to the Linkage model, and their role had not changed from the previous period. The LPC model is political in its orientation and recognizes the incentives, constraints, opportunities, and conflicts associated with the change process, factors which were prevalent in our school. Most importantly, the LPC model emphasizes implementation strategies in the form of planning, support, and training, which were dominant in the strategies executed throughout this period. Lastly, the LPC model places importance on the innovation, and during

this period we introduced many new facilities to encourage the use of computers for instruction.

1995: Increased Instructional Use, and the Introduction of Integration



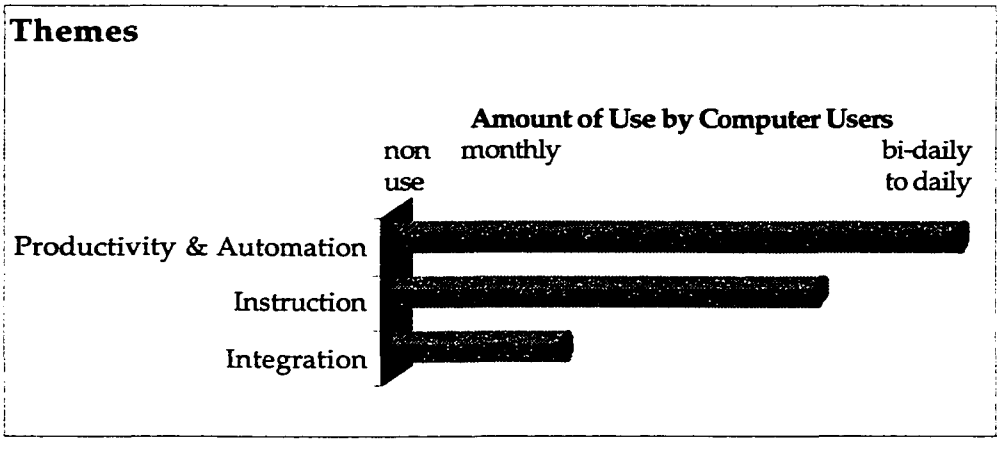


Figure 14. Computer Users and Themes for 1995 Period

The LPC model was still employed in the 1995 period. However, the numerous wide spread innovations that occurred in this period prompted teachers to change the way they approached instruction. The Principal and I were using a more eclectic approach to strategy development while retaining some of the older approaches to accommodate the changing needs of teachers. I believe that near the end of this period we were implicitly using the Adaptive Development (AD) model. It is a model that the Principal and I had discussed, along with

others, because this model was the result of the combination of many models. The data for this period was collected over a 6 month duration (January to June, 1995).

This period represents the final segment of the case study. The hallmark of this period is the integration of CAI, productivity and development tools. Teachers were beginning to understand that using various combinations of computer software could achieve a desired instructional result. For this realization to develop, teachers required an understanding of various productivity and automation tools, CAI packages, and networked environments.

School

In February, 1995, my log showed that building renovations were completed. The school now had the facilities it needed to fully utilize computers for student learning. The Learning Centres were inspiring and the teachers were proud of them. Fundamentally, the facilities were the result of a long process and they demonstrated the schools' commitment to use computer technology for instruction. This commitment did not go unnoticed and as the year progressed several events occurred that attest to the fact that the school was gaining recognition for its innovative efforts.

The Principal's notes showed that the first event happened in February. The District had approached the Principal to establish the school as a leader for a group of schools. The group was called a family. There were eight families in the District. The role of our school was to demonstrate the use of computers in education, assist other schools in using computers, and to provide a conduit for the family for the communication of ideas relating to the use of computers.

My notes showed that the second event occurred in April. The Principal was approached by a local MLA to provide insight about using computers in education. The Government was attempting to establish a computer technology assistance plan for schools in our province. The MLA then requested that a presentation be made to a sub-committee in the Alberta Legislature. The Principal asked me to the do the presentation and, in April, I delivered a computer driven presentation about the use of

computers for learning and some of the obstacles that we experienced during our implementation process.

My notes recorded the third and fourth events in May and June. These were both tours of our school by instructors from a local college, and teachers from a school district from another city.

Instruction

The Business Office database files showed that we ran the Library 4™ automated library system to handle the return of text books for the first time in January, 1995. The Business Office, the Book Store, and the Library were networked, and all text books were entered into the database through the use of bar code scanners. Automating the text book rental system saved us significant amounts of time during semester startup and closure, when books were checked in and out for each student. When performed manually the task required twenty people for two days, while the automated system completed the task in three hours using four scanning workstations and 8 people. The Business Office recorded that later in the year we began the retroconversion of the library books and it became part of the automated library system. However, that process continued through the summer and beyond the data collection of this study.

The most significant event in this period was the completion of renovations: three new Learning Centres, two new computer labs, a new Teacher Resource Area, an additional Science area, and a Network Centre. The network cabling was installed by contractors but terminating cables and setting up patch panels was completed by three teachers, including myself. The Network Centre linked all the other areas with ethernet cabling and it the contained servers, hubs, and a router. A note in my log indicated that we had made several comments regarding our amazement that some teachers in the school hadn't used computers while some of us had learned to install computer networks.

The Principal was determined to ensure that the Learning Centres would be successful by committing finances and his personal attention to the Centres. Invoices recorded that the largest Learning Centre consumed

$70,000 of school funds for equipment. The Learning Centres were filled with Macintosh PPC 5200 computers and there were two servers (Macintosh 7300 and Macintosh 6100). The three Centres had the combined capacity to accommodate 180 students. In addition, 50 more students could be accommodated in the two computer labs. While teachers could book entire computer labs, they could only reserve portions of the Learning Centres. Initially we didn't allow any reservations, however, the Centres were always open to students during the instructional school day and this occasionally caused a shortage of workstations when teachers arrived with entire classes. Booking sheets showed that initially the Centres were moderately busy, but by mid year they were always busy.

We provided the Teacher Resource Centre with 5 Macintosh computers (various types), a Laserwriter printer, an inkjet color printer, and a scanner. This facility was open to teachers all day long on a first come first served basis. My observations were that the Centre was occupied to capacity almost all day from the day it opened.

The Science area facilitated experiments that needed digital probes and sensors, and software simulations. Although computer bookings showed that much of the science CAI delivery occurred in the Learning Centres, the Science area was necessary for integrated software approach to learning.

In this period, automation made its way into the Automotive department. Two automotive teachers decided to introduce digital parts and repair manuals. The automotive student was assigned a repair task. The student would access the CD-ROM based references to collect and print pertinent information, such as diagrams, disassembly and assembly instructions, and a list of required parts. Then the student would begin the repair. In my notes, I recorded that the teachers reported that students liked the approach, as opposed to a lecture style, because it was very task oriented. The teachers also liked it because they had more time to observe and guide students, and the student made fewer errors.

Teachers

There were two noticeable trends in this period that I recorded in my notes. The first is that teachers were beginning to take ownership of their learning and the software they were using. As noted in the last period, the type of support and training required changed as the computer user group became more knowledgeable. It continued to change in this period. The users, both novice and advanced, spent considerable time showing each other software and how to use the new instructional networks. I continuously redirected inquiries and requests for assistance to other teachers or departments having expertise in a particular use of computers. Teachers would seek information, when they needed it, from whomever possessed the knowledge. Almost all knowledge was acquired peer-to-peer. Consequently, the Technology Support Centre and the Teacher Training Centre were disbanded. Teacher learning occurred every place in the school, and support could be found from former linkers, advanced users, and myself in the Teacher Resource area and the Network Centre.

The second noticeable trend is that computer users were investigating ways to use computers for learning. My notes show that in January of 1995, teachers came to me on a regular basis for instruction on the use of the Internet in their courses. The SchoolNet project was still in progress and teachers were using it, however, the cause for the increased enthusiasm came from the knowledge that the Internet was going to be available in the new Learning Centres (opening the end of February) through our own ISDN connection.

The opening of the Learning Centres precipitated abundant requests to load various types software on workstations and servers. Invoices showed that many departments diverted sizable portions of their budgets to the purchase of curriculum based software. My daily log contained entries pertaining to questions from teachers who were investigating various combinations in which software programs could be used together to achieve new teaching strategies. Teachers discussed among themselves which strategies worked and which did not.

The Principals' notes contained remarks regarding requests he had received from many teachers to a attend conferences where computers in education was the focus. In February of 1995, five teachers, including myself, were sent to a conference held in Denver. Conversations with attendees revealed that many schools were in similar situations, and they too were seeking new ways to use computers for learning. We returned with appreciation that change is a long process and that our situation was not unique. One highlight of the trip was that before we left Denver, we visited a major innovative telecommunications company that specialized in satellite and fiber optic transmission and state-of-the-art communications, including teleconferencing. It prompted some thinking.

In June the Principal forwarded to me a hand written letter attached to an article. The first sentence of the letter said, 'This article represents somewhat part of what we had in mind for teleconferencing for the future.' The article described the use of video teleconferencing for instruction in CTS, including a 'talking to the experts' segment. Before I returned the article to the Principal, I wrote on it, 'Teachers are becoming creative in their view of how computers might enhance learning and supplement traditional pedagogy.'

Model Usage and the Period

At the beginning of this period, we were still using LPC model for guiding strategy development. I am not sure how suitable it was at that point. However, by the end of the period we were developing strategies that were based on the Adaptive Development (AD) model. This model allowed flexible strategy development because it was the result of the combination of four models: rational planning, social interaction, human problem solving, and political. It provided a more eclectic approach for strategy development. In our diverse school environment with its various groups that had evolved during implementation we needed to develop several sets of the strategies, some just for a specific group.

The AD model outlined linkage, openness, leadership, ownership, and rewards as critical factors during change. The Principal and I believed

that linkage and leadership were still required in 1995, and that ownership of the learning and the software, used for instruction and integration, was developing among teachers.

Finally, his notes showed that the Principal and I thought that we were still required to perform the role of change agent, and in this model the change agent still initiated strategies, supported the internal group, and linked the internal group to resources and information. We believed that teachers were important in the process of determining how to use software for learning by modifying and adapting its use. The AD model purports that it is the internal group (teachers) that modify the externally developed innovation.

Summary

Figure 15 summarizes the usage of change models over the duration of the case study.

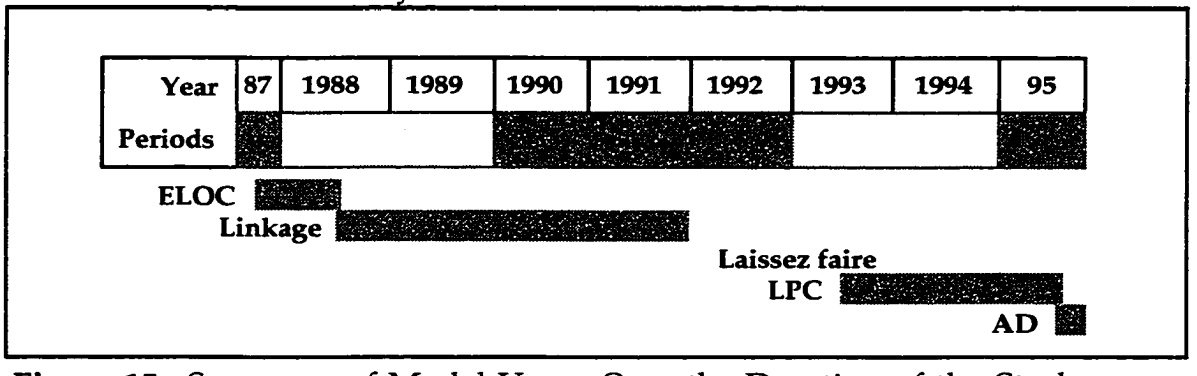


Figure 15. Summary of Model Usage Over the Duration of the Study

The school was in an almost static state regarding change in 1987. Teachers resisted the implementation of computer technology even though they understood very little about the innovation. The Principal and I developed change strategies designed to reduce resistance and direct the change process based on the ELOC model.

By 1988, the computer users in the school had acquired knowledge about the innovation and they regularly used computers for productivity and automation. These conditions imposed impossible demands on myself, the change facilitator, to manage the training and assistance.

These circumstances led to the selection of the Linkage model in May of 1988, and a shift in my role from change facilitator to linker. In March of 1989, we assembled a linker group and trained them with respect to the technical aspects of computers. They assisted in providing computer support for the staff in the school.

The use of the Linkage model continued into the next period through to the end of 1991. In this period (1990-1992) teachers were routinely using computers for productivity, automation, and some instruction. We abandoned the Linkage model because strategies derived from the model were losing their effectiveness . No particular model was selected to replace it.

I had less presence in the school between January of 1992 and September of 1993. The Principal decided not implement any major computer changes during this period, but change continued in a Laissez faire manner. Some positive unintended effects developed during my absence: Teachers became more confident and self-reliant regarding the use of computers, and others began demonstrating technological leadership. No apparent model was in use until about the middle of 1993 in the next period (1993-1994) when a discussion with the Principal lead to at least the implicit selection of the LPC model. By this time the instructional use of computers was routine in the school and some integration was emerging.

Renovations were completed in the last period (1995), and many new facilities for using computers in learning were available. Not only did instructional use of computers increase but the integration of software for achievement of educational outcomes increased. The school now sustained a diverse learning environment with groups that had varied interests and skills. Teachers were taking ownership of their learning and the software that they used for student learning. They were also investigating new ways to use computers to achieve desired outcomes. In this new environment the Principal and I required a more diverse model to follow for strategy development. Near the end of the period we were using the AD model for strategy development.

Throughout the duration of the case study another influential group existed in the school. A group of four teachers, known as the "senators", commonly influenced other teachers in the school and were frequently consulted and directed by the Principal. Held in close confidence by the Principal, they were an influential arm of the formal leadership in the school. Roger's (1995) referred to groups having this kind of informal power as "old women", and underlined the importance of their role in communicating ideas about the innovation within the organization. However, within this context of implementing computer technology in the school, the senators were of no consequence. Two teachers of the group were not interested in computer technology at all. At best, the senators held a neutral position with respect to using computer technology and in no way facilitated its implementation. The Principal, however, was committed to implementing computers in the school, and his sphere of leadership and influence, and informal and formal power, was extensive. He was able to guide the implementation of computer technology without the usual influence of the senators. Since the senators did not play a significant role in implementing computer technology, and knowledge of their existence did not increase the readers understanding of the case, I decided not to include the senators in the case study.

CHAPTER V

CASE ANALYSIS

The CBAM has been selected as the analytical model for this case. It will be used to determine the changing conditions over the duration of the study and to link the periods of the case to models. To change something, someone has to change first (Hope, 1996). The CBAM places emphasis on people and the general pattern of evolving concerns of participants as the innovation moves through implementation to internalization (Hall & Hord, 1987). The CBAM has been particularly useful in studies of technology innovations (Saye, 1997).

The CBAM

The CBAM is a dynamic model in which the change facilitator (CF) performs a central role in assessing change conditions and applying resources and interventions to promote the success of the innovation. Members of the organization are active in the change process and the innovation is modified and adapted as it is implemented. The focus of the CBAM is on individuals, the innovation, and the context. The CF uses three diagnostic tools to monitor these aspects during change: innovation configuration (IC), stages of concern (SC), and levels of use (LU).

Innovation configuration refers to the various forms in which the innovation may be implemented as it is modified and adapted by the internal group. An evaluator, a group of evaluators, or a CF identify a checklist of these configurations, and during implementation a checklist can be used to monitor program progress (Hord et al., 1987). Innovation configurations for this case study were predominantly identified at the beginning of the case (Table 5). I slightly modified the themes presented in Table 5 to produce the components listed in Table 10.

Table 10

Innovation Configurations for Case Study

Component	Description
0	non use
1	acceptance of computer technology
2	using computers for productivity using computers for automation
3	using computers for instruction
4	using computers for integration

The strategy of the CF is a set of interventions and resource allocations that provide a method of guiding the change process. As the strategy of the change process affects the people of the organization, the people affect the change process, and the innovation is the outcome of the interaction (Riffel & Levin, 1997). The IC, SC, and LU are tools that measure the progress of successful change as implementation occurs. Movement from one level of use to another, or one innovation configuration to another, implies further implementation of the innovation. When Anderson (1997) described CBAM he noted that "Each higher level is portrayed as more desirable and difficult to implement than the preceding step" (p. 347), and that progression moves from a teacher-centered to student-centered focus. Some teachers manage to reach the integration level of use in which collaboration among teachers is a characteristic. IC progresses from non use to integration while SC and LU progress from awareness and non use, respectively, to refocusing and renewal (Figure 16).

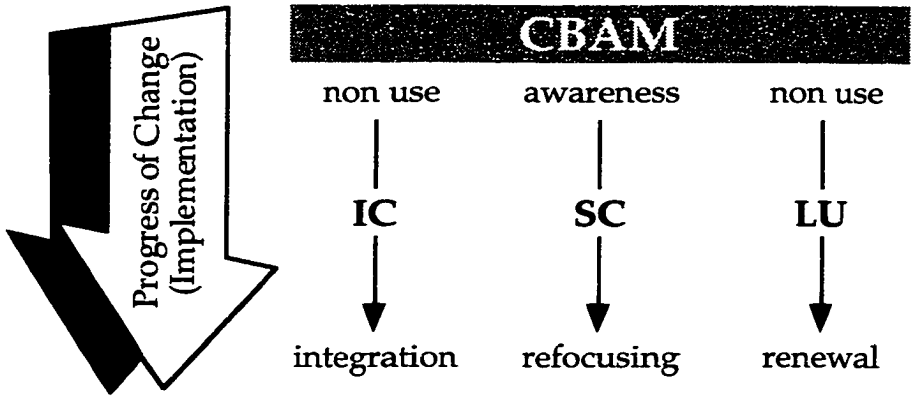


Figure 16. CBAM: Progress of Successful Implementation

The progression through levels of use and innovation configurations as change proceeds is reinforced by complementary work conducted by Leithwood and Montgomery (1987) in Canada. They acknowledged the CBAM levels of use framework but introduced Innovation Profiles instead. Innovation profiles are a set of key dimensions, involving knowledge and practice, that users might progress through before reaching an ideal implementation of the innovation. Implementation is incremental and growth occurs as the user progresses through a sequence of operationally defined levels of use. Innovation profiles idealize a hypothetical progression from one state of practice to another. A user profile describes where a user fits on the profile at a given point in the implementation process. Anderson (1997) noted that there is more in common between innovation profiles and innovation configurations than between innovation profiles and levels of use. In any case, a progression through levels occurs as implementation proceeds and an innovation profile is a tool for assessing the degree of implementation of a change.

Whittington's (1993) perspectives on strategy provides a useful typology for illustrating the changing conditions identified by IC, SC, and LU. The condition at the beginning of the IC and LU scales is non use of the innovation, and SC is awareness of the innovation. From the perspective of the individual, non use is a desirable position regarding change because it requires the least amount of energy and provides the

greatest amount of stability. Therefore, the outcome is profit maximizing from the perspective of the individual, and the strategy to not use the innovation is deliberate. At the other end of the scales, use of the innovation presents multiple complexities. The condition is one of uncertainty and variability, and the innovation user is challenged with examining multiple solutions and improvements with no clear direction for additional success. Therefore, the change is pluralistic regarding goals and desirable outcomes since there are many variants of possible solutions and improvements, and the strategy to achieve these is emergent rather than deliberate.

Whittington's typology consists of two axes (Outcomes and Process) and four quadrants: singular outcomes and deliberate strategies, singular outcomes and emergent strategies, pluralistic outcomes and emergent strategies, and pluralistic outcomes and deliberate strategies. Since IC, SC, and LU appear to evolve from singular outcomes and deliberate strategies to pluralistic outcomes and emergent strategies as implementation progresses, these components can be plotted on Whittington's typology (Figure 17).

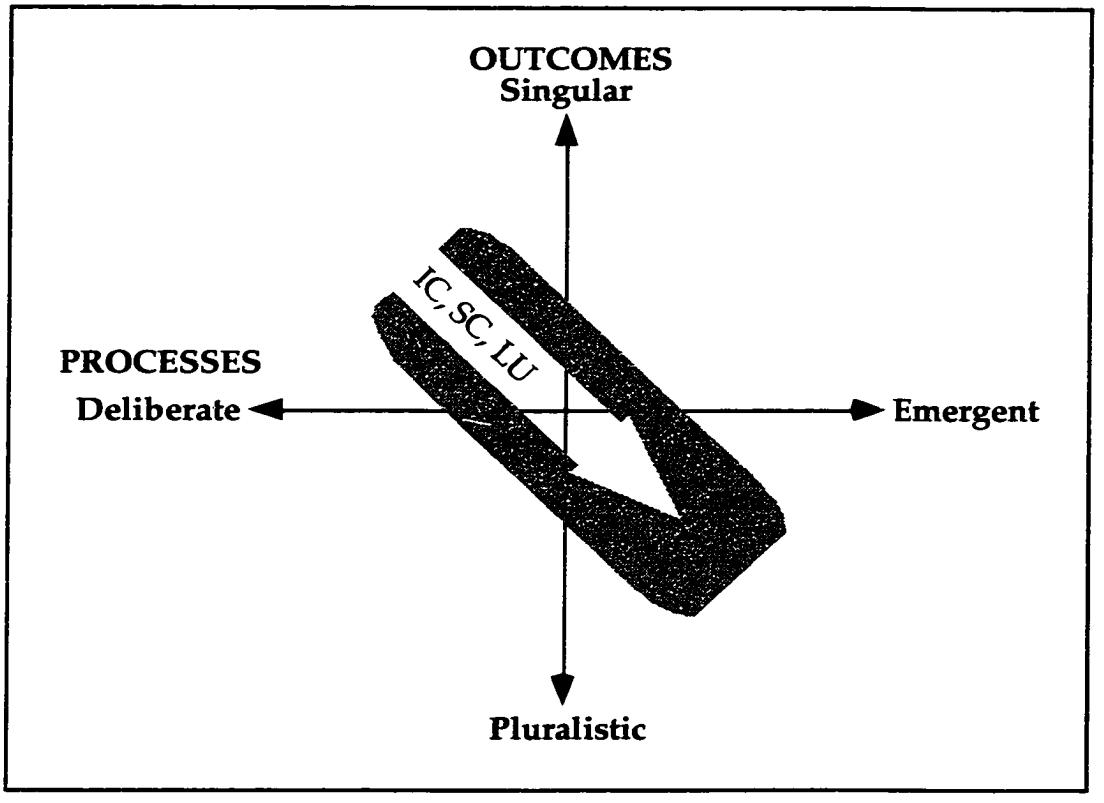


Figure 17. Typology based on Whittington's (1993) Perspectives and CBAM's IC, SC, and LU

Analysis of Case Study Using CBAM

The case study was reviewed for any instances that may reflect some aspect of the progress of change during the five periods extending from 1987 to 1995. A total of 182 statements were extracted from the case and then classified using the levels of IC (0 to 4), SC (0 to 6), and LU (0 to 6). For each of the five periods of the case study the average values of IC, SC, and LU were calculated. The extracted statements, their classifications, and averages are presented in Appendix A. A summary of the results is provided in Table 11.

Table 11
Summary of Averages of IC, SC, and LU for Each Period

Period	IC	SC	LU
1987	0.41	0.14	0.45
1988-89	1.29	1.50	2.11
1990-92	2.12	3.24	3.30
1993-94	2.67	4.00	4.08
1995	3.15	5.13	4.53

The averages of IC, SC, and LU show an increase in value for each successive period of the case, indicating that on each of the measured components (IC, SC, and LU) progression had occurred, and therefore, some change had occurred. The average value of IC rose from 0.41 in 1987 to 3.15 in 1995, from approximately the mid point between non use and acceptance of computer technology to using computers for instruction. The average SC level rose from 0.14, awareness or not concerned, to 5.13, collaboration, over the duration of the study. The LU level also increased from approximately the mid point between non use and orientation (0.45) to midway between routine/refinement and integration (4.53). The progression of IC, SC, and LU is illustrated in Figure 18.

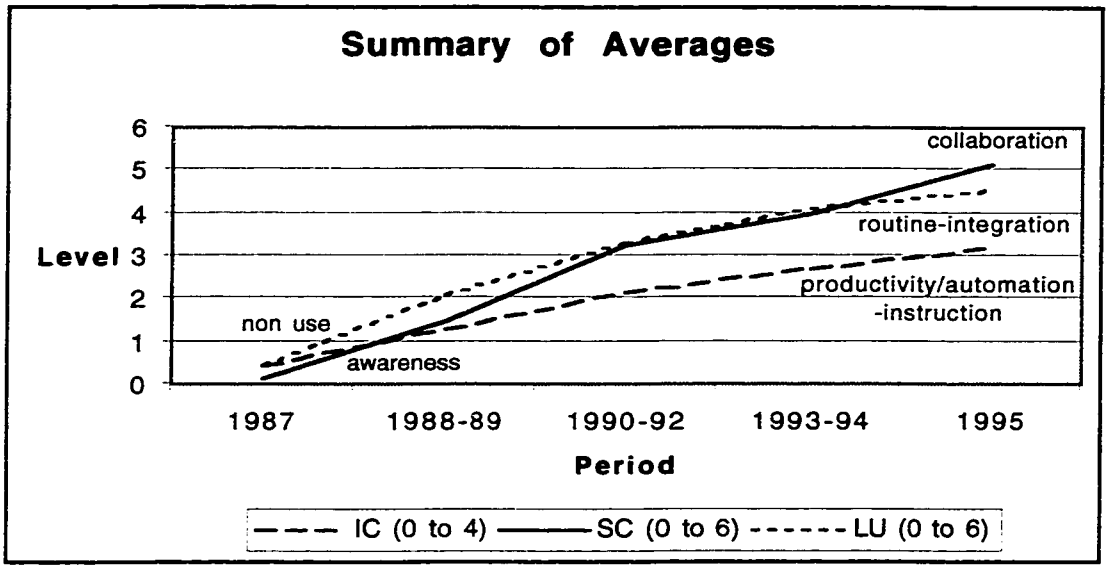


Figure 18. Summary of Average Values of IC, SC, and LU Over the Five Periods of the Case Study.

The average values illustrate trends over time but they depict little about the range and distribution of IC, SC, and LU values. For example, although the highest average value of IC was 3.15 (instruction), by the end of the study some teachers had actually achieved implementation to level 4 (integration) of IC. The range of classified levels for IC, SC, LU for the periods of the study are illustrated in Figure 19.

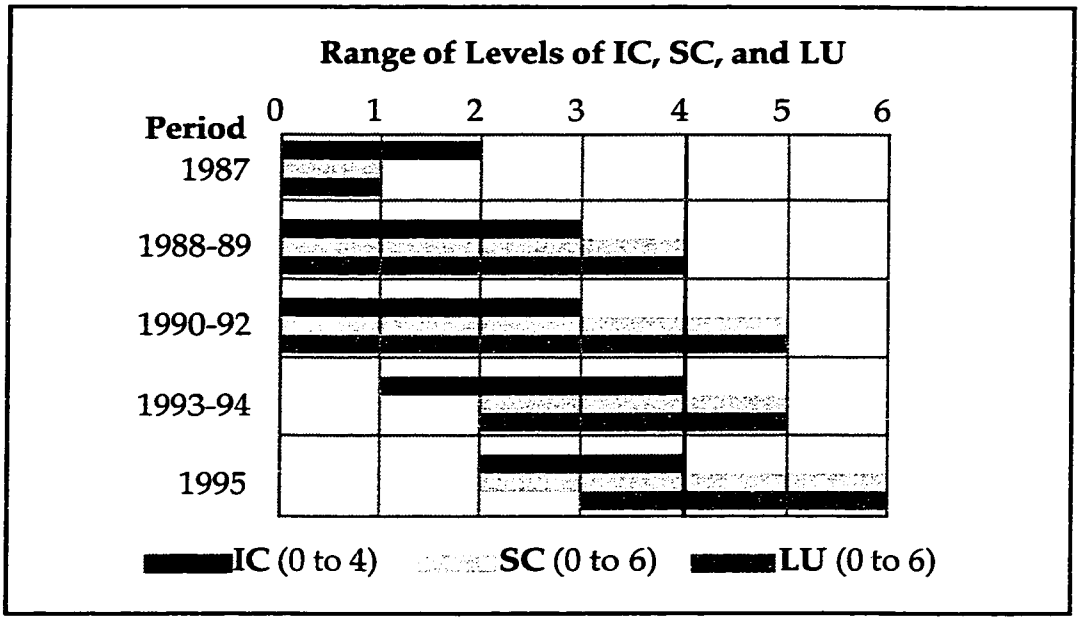


Figure 19. Range of Levels of IC, SC, and LU Over the Five Periods of the Case Study

Some teachers had achieved level 6 (refocusing) in SC and level 6 (renewal) in LU by the end of the study. Notice that the bottom of the range rose in the 1993-94 and the 95 periods as some teachers achieved a higher level of IC (integration), SC (collaboration), and LU (integration) during the 1990-92 and the 1993-94 periods.

The average values of IC, SC, and LU demonstrated a trend of progression to higher levels throughout the duration of the case study. The range reveals that implementation was achieved at a higher level (early adopters) and a lower level than the average for each period. In fact, there were still non users in the 1990-92 period in spite of averages of 2.12 (IC), 3.24 (SC), and 3.30 (LU), and higher levels of 3 (IC), 5(SC), and 5 (LU). The distribution of levels within each period will help to clarify the relationship between the average levels and the range.

The distribution of frequencies of each level within the IC, SC, and LU categories were counted and converted to a percentage of the total frequencies for all levels of the particular category (IC, SC, or LU) of the period. For example, of the statements classified for IC in 1987, 12 were level 0, 3 were level 1, and 2 were level 2. The percentages of each level of

the total number of classified statements (17) for IC were calculated (level 0 = 71%, level 1 = 18%, and level 2 = 12%). The frequencies for IC, SC, and LU are given in Appendix B and their respective percentages are shown in Tables 12, 13, and 14.

Table 12

Percent Distribution of Statements for IC

	Level				
Period	0	1	2	3	4
1987	71	18	12	0	0
1988-89	29	18	47	6	0
1990-92	12	12	28	48	0
1993-94	0	8	25	58	8
1995	0	0	15	54	31

Table 13

Percent Distribution of Statements for SC

	Level						
Period	0	1	2	3	4	5	6
1987	86	14	0	0	0	0	0
1988-89	25	25	30	15	5	0	0
1990-92	12	0	12	29	24	24	0
1993-94	0	0	17	0	50	33	0
1995	0	0	13	0	0	38	50

Table 14

Percent Distribution of Statements for LU

	Level						
Period	0	1	2	3	4	5	6
1987	64	27	9	0	0	0	0
1988-89	26	0	16	53	5	0	0
1990-92	10	0	0	40	40	10	0
1993-94	0	0	8	0	67	25	0
1995	0	0	0	13	40	27	20

In 1987 each category (IC, SC, and LU) was concentrated at lower levels and no implementation had occurred at higher levels. A shift occurred in each period toward higher levels of implementation. It is apparent that frequencies were stratified across more than one level in any given category within a period. The distribution of frequencies across levels is more conspicuous when illustrated by area charts (Figures 20, 21, and 22).

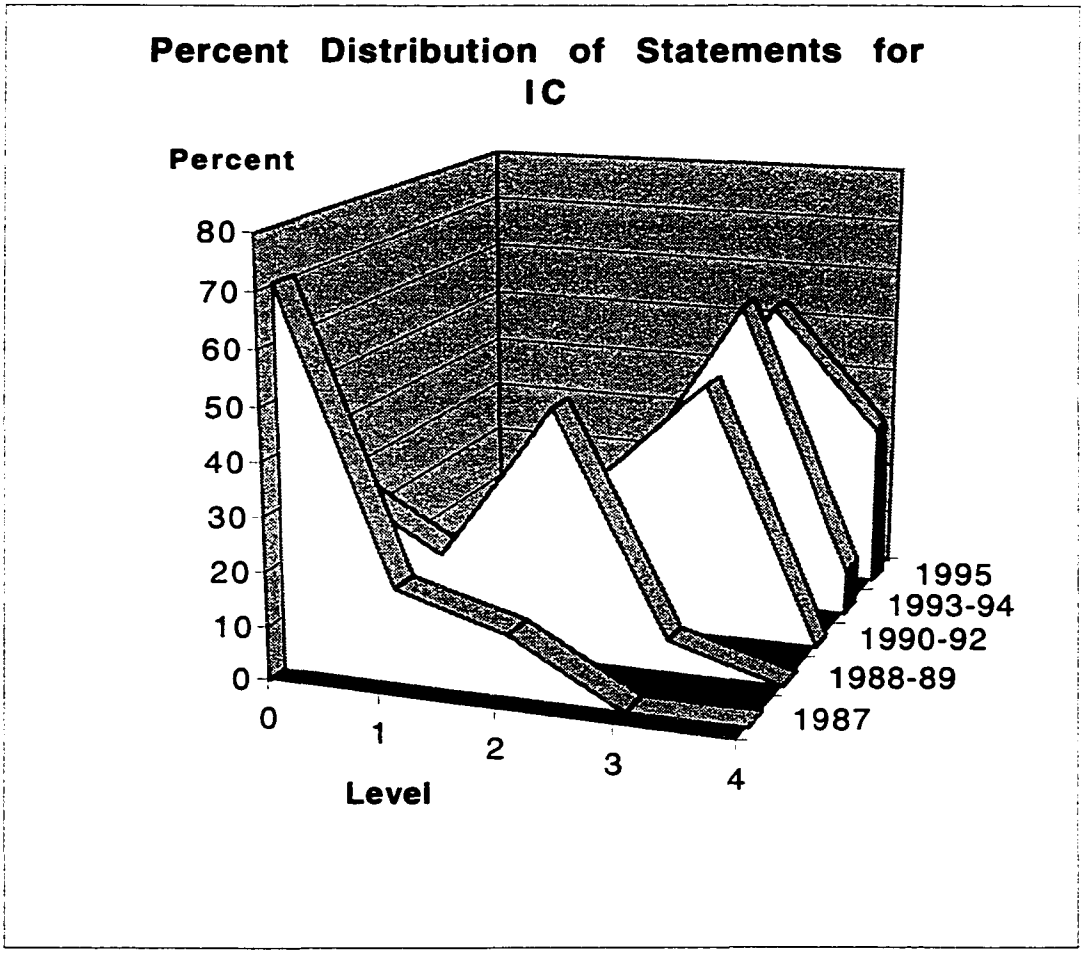


Figure 20. Percent Distribution of Statements for IC Over Levels for Each Period

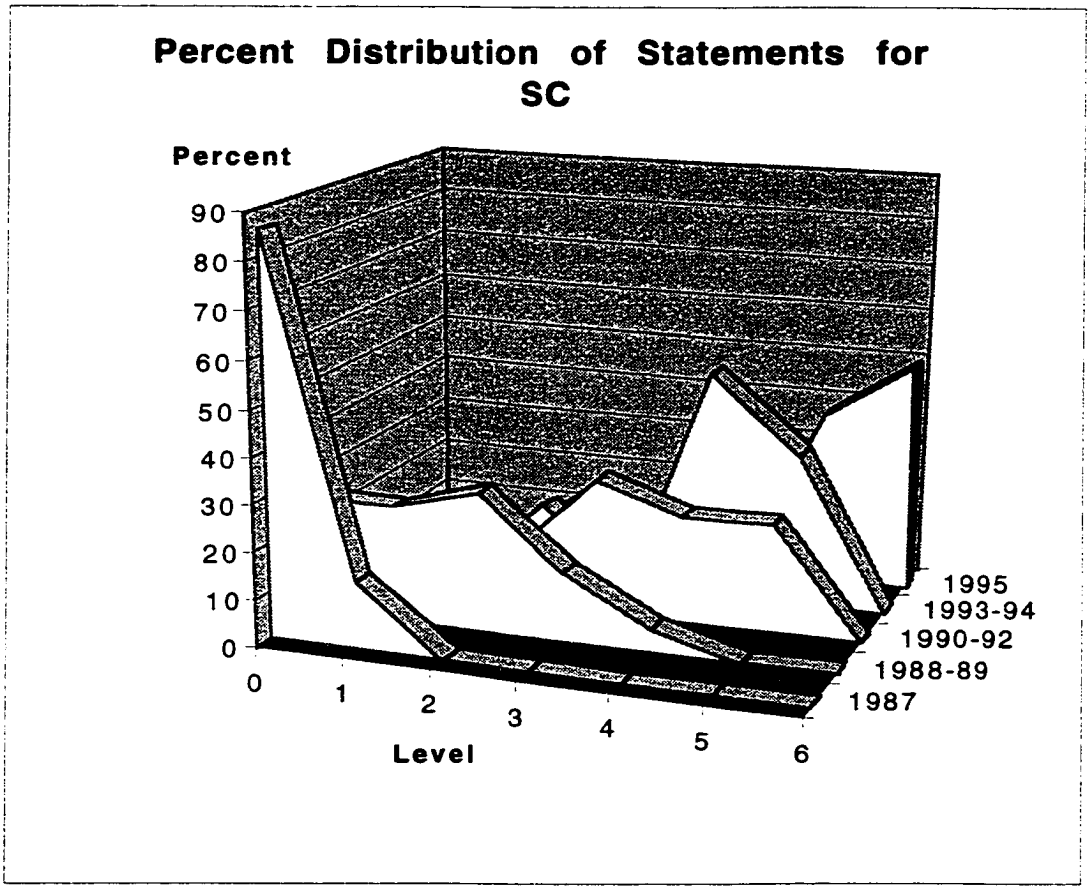


Figure 21. Percent Distribution of Statements for SC Over Levels for Each Period

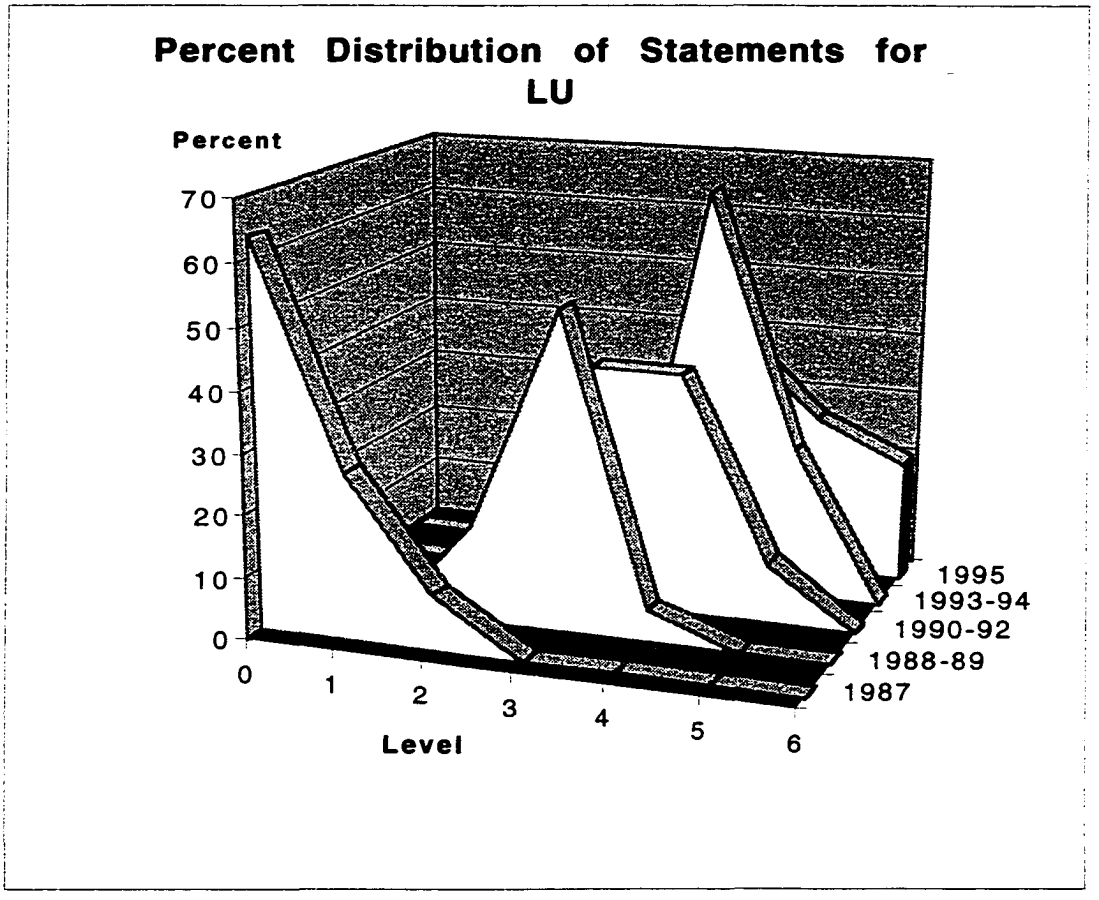


Figure 22. Percent Distribution of Statements for LU Over Levels for Each Period

The distribution of frequencies demonstrates a progression from low levels of IC, SC, and LU to higher levels as implementation proceeded. This was also apparent in the summary of averages (Figure 18). As in the case of the summary of averages IC, SC, and LU the distribution of frequencies appear to have simultaneously progressed to higher levels through the periods.

The distribution of frequencies illustrate more than progression of the categories (IC, SC, and LU) to higher levels. The area shapes on the distributions have a small leading edge, a larger middle portion, and a small trailing edge. Each area shape exhibits these qualities except in 1987 when data collection suddenly started and in 1995 when it suddenly

stopped. At the ends of the range, where there were low and high levels of implementation of IC, SC, or LU, the frequencies are low. In each successive period (1987 to 1995) the leading edge of the area appears at a higher level for each category, and the majority of the frequencies also shift along with the leading edge to higher levels. This would suggest that higher levels of IC, SC, and LU are achieved at low frequencies before becoming widely dispersed activities. That is, a progression to a higher level of implementation is first achieved to a small degree as a precursor to a larger degree of implementation later. Progression of implementation occurred as the leading edge moved to higher levels throughout each successive period in the case study.

As the leading edge moved to higher levels some lower levels of IC, SC, and LU became irrelevant. For example, in 1995, non use and acceptance of computer technology (levels 0 and 1 in IC) were irrelevant to the change process because implementation passed that level. Similarly, Awareness and informational levels (0 and 1 in SC) and non use and orientation levels (0 and 1 in LU) became irrelevant. In other terms, the trailing edge of the area moved to a higher level, indicating the non users became users. Further implementation had occurred.

Summary of the CBAM Analysis

Four major points can be derived from the analysis:

1. Successful implementation occurred.
   The five periods of the case study extending from 1987 to 1995 demonstrated successful implementation, and consequently successful change, using the CBAM diagnostic tools (IC, SC, and LU) as the basis for analysis.
2. Progression occurred through the levels of IC, SC, and LU.
   As change proceeded implementation moved through the lower levels of IC, SC, and LU to the higher levels: IC evolved from predominantly non use to mostly the instruction and integration levels, SC evolved from almost entirely the awareness level to mostly the collaboration and refocusing levels, and LU changed

from mostly the non use and orientation levels to predominantly the routine/refinement and the integration levels.

3. The progression of implementation was a process.
   Progress to a higher level of IC, SC, and LU first occurred with low frequency, probably early adopters, and later at a higher frequency. The low frequency was a precursor to greater frequency as implementation occurred over the five periods of the study. Just as there was a leading edge, there was a trailing edge. The trailing edge consisted of non users until the end of the 1990-92 period. Then the non users became late adopters and the trailing edge moved to a higher level on the IC, SC, and LU scales.
4. As implementation proceeded diversity increased.
   As implementation advanced the way in which the innovation was used, concerns about its use, and the levels of use became more stratified across the levels of IC, SC, and LU. In 1987, the range of levels generally extended from 0 to 2 but in the 1990-92 period the range extended from 0 to 5 (except for IC because the highest level is 4). The increase in stratification across the levels is also demonstrated by the distribution of frequencies.

The Case Study, CBAM, and Models Used During Implementation

As planned change progressed, movement from a low level of IC to higher levels occurred. Similarly, there was movement to higher levels of SC and LU. These levels can be used to evaluate the success of implementation (Hord et al., 1987). The CBAM analysis of the case demonstrated that throughout implementation there was a steady migration from the lower levels of IC, SC, and LU to higher levels. The migration through the levels was illustrated using averages of levels of IC, SC, and LU over the periods of the case study (Figure 18), ranges of levels over the periods (Figure 19), and percent distribution of statements (Figures 20, 21, and 22). According to the diagnostics of IC, SC, and LU, successful implementation of the innovation had occurred, although implementation was not completed.

According to Hord et al. (1987), change is a process and not an event, and that progression through levels is a measure of progression in the change process. Figure 17 illustrated the relationship between the CBAM and Whittington's (1993) typology as change progresses, demonstrating a movement from the singular/deliberate quadrant to the pluralistic/emergent quadrant as implementation occurs. The change is reflected in the movement from lower to higher levels in IC, SC, and LU. Combining the CBAM analysis of the case study and the relationship between CBAM and Whittington's typology, the orientation of change strategies throughout the case study can be determined. The average level for SC and LU are plotted over a 0 to 6 scale for each period and the IC values are plotted on a 0 to 4 scale (Figure 23).

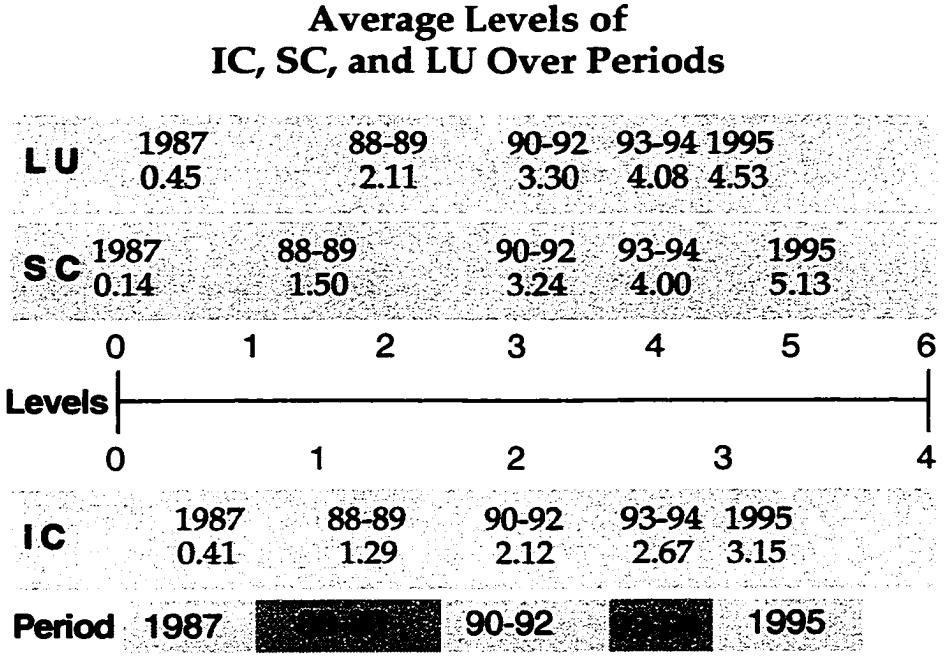


Figure 23. Timeline and Levels (IC, SC, and LU)

The significance of Figure 23 is not the date of the period, nor its length. What is important is that each successive period of the case study shows a sequential progressive evolution to a higher level within each category (IC, SC, and LU). The average levels consistently increase along the scale throughout each period, although the value of the increase

varies. If the progression illustrated in Figure 23 is placed on the Whittington's (1993) typology with the CBAM a pattern of progression from one quadrant to another is evident (Figure 24).

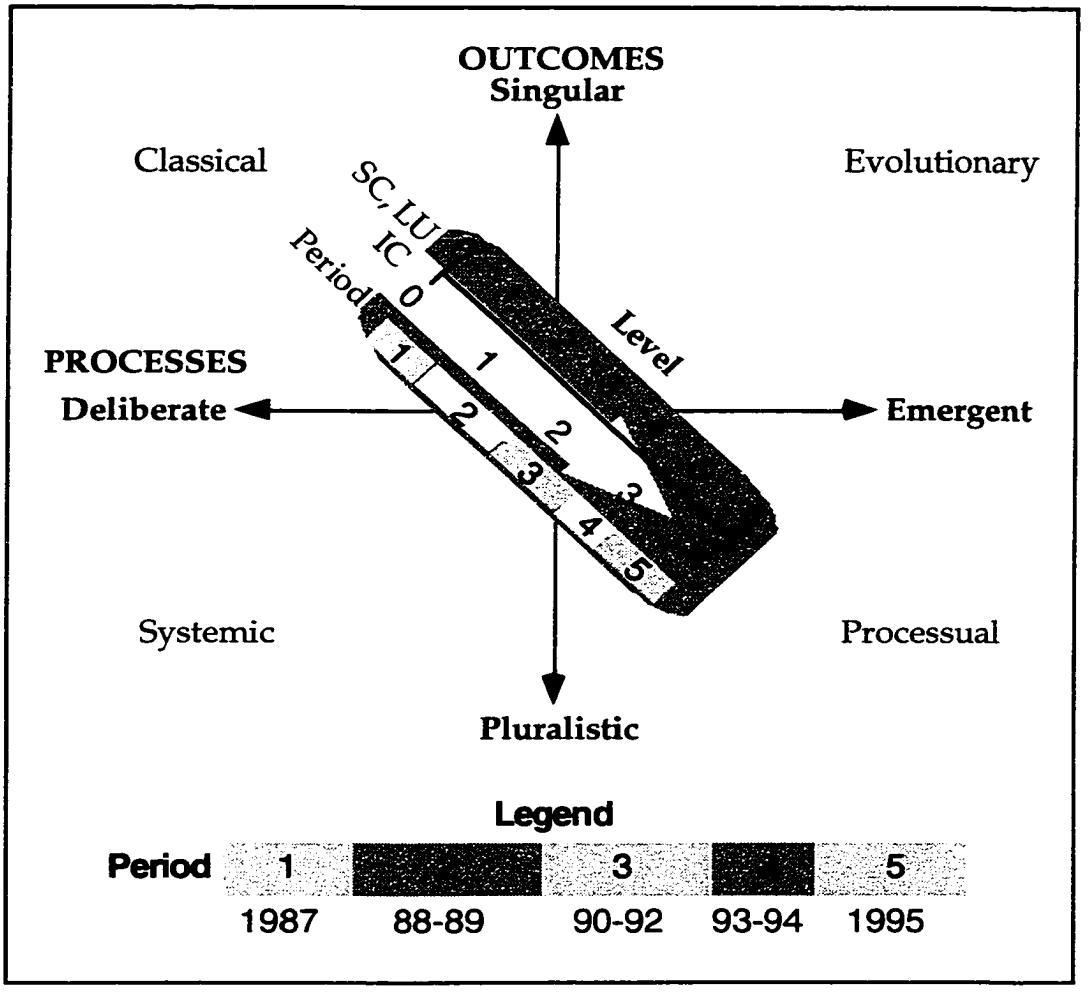


Figure 24. The Periods and CBAM on Whittington's (1993) Typology

In 1987 (period 1 in Figure 24), the initial implementation stages, strategies were drawn from within Whittington's classical quadrant (singular and deliberate). In 1995 (period 5 in Figure 24) strategies were more consistent with those derived from the processual quadrant (pluralistic and emergent). Change strategies evolved from those of one quadrant to those of another as implementation proceeded.

Figure 15 summarized the models used throughout the case study along with the approximate duration of their usage. The relative position of those models on Whittington's (1993) typology was presented in Figure 5. The models used during the case study and their approximate duration are illustrated in Figure 25.

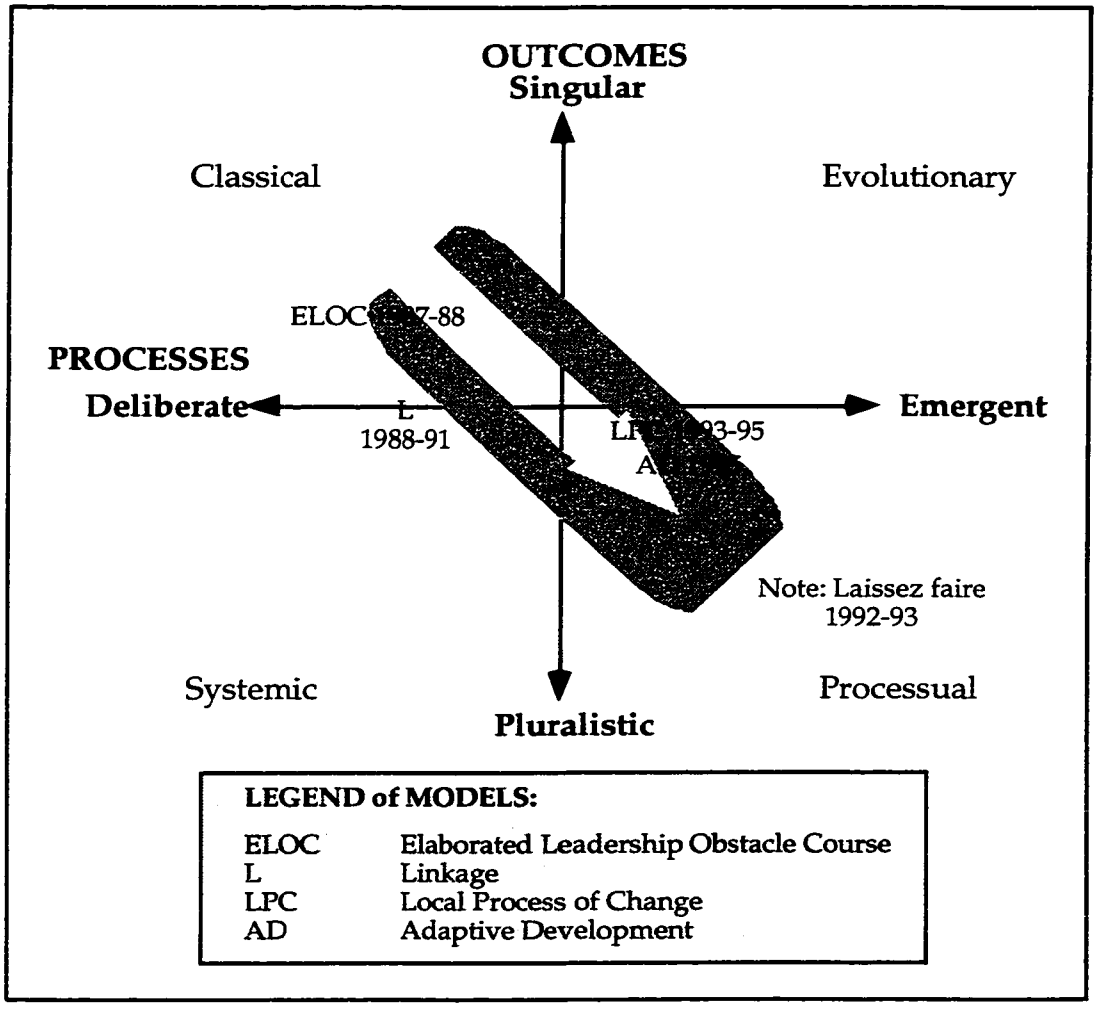


Figure 25. Models Used and CBAM on Whittington's (1993) Typology

The model first used during the case study was the ELOC in 1987 (period 1 in Figure 24) and the last model used in the case study was the AD model in 1995 (period in Figure 24). These two models are situated in different quadrants. The linkage and LPC models were used between the start of implementation and the end of the case study. The change from

one model to the next denotes a path from one quadrant to the next, and a change in implementation strategies.

From the end of 1991 to the first part of 1993 no model had been deliberately selected for guiding implementation strategies. However, having no deliberate strategy is a strategy, and implementation proceeded along in a laissez faire manner, probably due to change momentum.

Summary

The CBAM analysis of the case using IC, SC, and LU indicated that the school had undergone successful implementation. It also revealed that the change process involved an upward progression through the levels of IC, SC, and LU with a leading and trailing edge in the distribution of frequencies regarding the innovation. Throughout the implementation process there was an increase in the diversity of IC, SC, and LU. Initially the change process was less complicated since teachers were at a lower level of IC, SC, and LU. As implementation proceeded higher levels of IC, SC, and LU were achieved and stratification across the various levels increased, complicating the change process.

When IC, SC, and LU of the CBAM were related to Whittington's (1993) perspectives on strategy, a migration from one quadrant to the next, or a least movement along a diagonal path, became evident as the evolution from lower to higher levels of IC, SC, and LU occurred. That is, as change progressed because of successful implementation, change strategies evolved as well.

Finally, the models that were used at the study site between 1987 and 1995 were plotted on Whittington's (1993) typology along with the path established by relating IC, SC, and LU to the typology. The paths of IC, SC, and LU and the models show a consistent directional migration across the typology as implementation progressed.

It is clear that successful change had occurred at the study site and that several models had been used to develop strategies as change progressed. There was a shift in strategy development. It is not as

important to know which models were used as is it is to know from which quadrant strategy development was guided.

When change was initiated at the study site, there were only a few computers and they were infrequently used. There were only a few teachers interested in using computers, and IC, SC, and LU were at low levels. Change was directed by administration to promote the use of computers as personal productivity tools. By 1995 the conditions of change had been significantly altered. There was a demand for computer facilities, and there were high levels of IC, SC, and LU. There were many interested teachers and many diverse and specialized uses of the innovation. Teachers were experimenting with alternate methods of achieving educational outcomes using the innovation. The innovation became multi-faceted, representing different degrees of usefulness to many individuals and groups within the organization.

If change does become more complex as it proceeds, as indicated by IC, SC, and LU on the typology, and as experienced by the organization in the case study, then should not strategies change? The path indicated on the typology suggests that strategies and processes evolve from singular and deliberate to pluralistic and emergent. As implementation becomes more complex, the goals of the organization become multi-facilitated, and strategies are developed upon assessment of emergent conditions as well as deliberate or contrived ones.

An interesting anomaly in the case study is the period in which the organization was moving through implementation in a laissez faire manner, with no particular model selected for strategy development. This period lasted over a year, and one would suspect that this period would reflect some change in the rate of progression through the levels of IC, SC, and LU. However, the distributions and averages show no significant slowing in the rate of implementation, probably because the momentum for change was already established in the organization.

CHAPTER VI

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary

This is a study of planned change in which I was both researcher and participant. My role was to implement computer technology. The study site was a large and diversified inner city school where a planned approach to implementing computer technology began in 1987. The case study extends over nine years to 1995, and was developed from observations and data contained in implementation plans, yearly event timelines, school reviews, and an evaluation of the computer implementation program including interviews and surveys. These documents were maintained by myself and staff members at the school. In the case study, the various models of change that were used to guide the implementation of computer technology during the change process were identified.

The purpose of this study was to conduct an inquiry to describe the various change models that were used to guide implementation of computer technology over the duration of the study, to determine whether successful change was achieved, and to develop an integrated approach for using various models during the implementation of computer technology.

The case study was analyzed using the CBAM (Concerns Based Adoption Model). It was used to determine the changing conditions over the duration of the study.

Conclusions

1. Successful change was achieved. The CBAM diagnostic tools were used to assess the progress of change efforts. Throughout each of the five

periods of the case study extending from 1987 to 1995 the levels of IC, SC, and LU increased indicating further implementation, and therefore successful change.

2. Various change models were used to guide implementation of computer technology over the duration of the study. When levels of IC, SC, and LU of the CBAM increased a migration from one quadrant to the next, or at least movement along a diagonal path, occurred (Figure 17). When the levels of IC, SC, and LU were assessed for successive periods of the case study (1987 through 1995) the values progressively increased, indicating movement from one quadrant to the next regarding change strategies (Figure 24). When those models used to guide implementation of computer technology over the duration of the study, as identified in the case, were placed on the typology they were also situated in two quadrants (Figure 25). That is, as change progressed because of successful implementation, change strategies, and the model from which they were derived, changed.

3. The directional migration across the typology as implementation proceeds provides the change facilitator with guidance for selecting models for strategy development. The paths of the IC, SC, LU and models of the case study showed a consistent directional migration across the typology as implementation progressed. The path suggests that processes evolve from singular to pluralistic and strategies evolve from deliberate to emergent. As implementation becomes more complex, the goals of the organization become more multi-facilitated and strategies tend to be developed upon emergent conditions as well as deliberate or contrived ones.

Implications

1. The progression of implementation was a process. According to Hord et al (1987), change is a process and not an event, and that

progression through levels is a measure of progression in the change process. Progress to a higher level of IC, SC, and LU first occurred with low frequency (early adopters) and later at a higher frequency. This was evident in the percent distribution of statements of the five periods of the study (Figures 20, 21, 22). Just as there was a leading edge, there was a trailing edge. The trailing edge consisted of non users until the end of the 1990-92 period (the fifth year of implementation), after which the non users became late adopters and the trailing edge moved to a higher level of IC, SC, and LU.

2. As implementation proceeded diversity increased. As implementation advanced the way in which the innovation was used, concerns about its use, and the levels of use became more stratified across the levels of IC, SC, and LU. In 1987, the range of levels for IC, SC, and LU (Figure 19) generally extended from 0 to 2 but in the 1990-92 period the range extended from 0 to 5 for SC and LU, and 0 to 3 for IC. The increase in diversity among the levels is also demonstrated by the percent distribution of statements (Figures 20, 21, 22).

As implementation proceeded higher levels of IC, SC, and LU were achieved and stratification across the various levels increased, complicating the change process. Riffel and Levin (1997) concluded from their study "that the outcomes of technological change can be divergent, with change opening a widening array of possibilities rather than creating one new way of doing things" (p. 53).

When change was initiated at the study site, there were only a few computers and they were infrequently used. There were only a few teachers interested in using computers, and IC, SC, and LU were at low levels. Change was directed by administration to promote the use of computers as personal productivity tools. By 1995 the conditions of change had been significantly altered. There was a demand for computer facilities, and there were high levels of IC, SC, and LU. There were many interested teachers and many diverse and specialized uses of the innovation. Teachers were experimenting with alternate methods of achieving educational outcomes using the innovation. The innovation

became multi-faceted, representing different degrees of usefulness to many individuals and groups within the organization.

3. As implementation proceeded different models were used as the basis for strategy development. In the context of this case there was movement from a position of deliberate processes and singular outcomes to one of emergent processes and multiple (pluralistic) outcomes as change proceeded. Change strategies evolved as change proceeded and a migration from the classical to the processual quadrant occurred.

The context of this study is specific. It is a study of planned change in a large school where the introduction of computer technology was an innovation. In 1987, there were few organizations to model, the use of the innovation (computers) in education was evolving, and the innovation itself was rapidly changing. At the inception of this study the computer skills of the user group were almost non existent, computers were very limited in their capabilities (video, sound, animation, robust programs, software, educational software), and networks were scarce in schools. Developing strategies for long term planning was difficult.

Change strategies and implementation result in unintended as well as intended effects. In this case study, initially there were few unintended (second order) effects because there were few users and IC, SC, and LU were at low levels. There were also few intended effects because implementation had just begun. As implementation proceeded the number of unintended and intended effects became more significant and the diversity of innovation usage widened. Unintended effects are highly variable and hard to foresee, therefore the strategic planner can only be prepared to modify and review strategies as change proceeds (Kiesler, 1987). This results in a number of strategic decisions in response to unforeseen conditions (Papadakis & Barwise, 1998). Therefore, strategy development is contextual and is the result of assessing both intended and unintended effects.

4. Selecting a starting position for strategy development is a necessary step for planned change. In this case study the ELOC model from the

classical quadrant was chosen to develop strategies to initiate implementation. More important than the model, is the quadrant (classical, systemic, processual, or evolutionary) upon which strategy development is based. Each quadrant is fundamentally different. Within each quadrant are a number of models or schools that are characterized by more subtle differences.

Selecting a quadrant for initial strategy development may not be as difficult as it appears. O'Neil (1995) cited *Teachers and technology: Making the connection* produced by the Office of Technology Assessment which states that the lack of vision and clarity of goals with regard to technology's role in the school is one of the major reasons for the disappointing use of technology in US schools. It may be the function of leadership to define these goals. A Canadian study (Riffel & Levin, 1997) on information technology implementation involving four school districts (a large urban, a mid-sized suburban, a combined rural and suburban, and a rural) revealed that the four districts reported a pattern that, initially at least, placed the initiative for change on the school principal. In another study where computer technology was introduced to enhance teachers' productivity skills, Hope (1996) wrote that "the impetus to change and the introduction of the innovation originates with the school administration" (p. 55). These findings are consistent with those of this study, that initially implementation of computer technology may require strategy involving a classical orientation.

5. As implementation proceeded utilization of the innovation rose from productivity and automation, to instruction, and to integration. Not surprisingly, as the levels of IC, SC, and LU rose as implementation proceeded, higher levels of innovation use appeared in daily routines (productivity, instruction, and integration).

The lower levels of IC, SC, and LU rose to higher levels: IC evolved from predominantly non use to mostly the instruction and integration levels, SC evolved from almost entirely the awareness level to mostly the collaboration and refocusing levels, and LU changed from mostly the non

use and orientation levels to predominantly the routine/refinement and the integration levels.

In this study implementation from acceptance of computer technology, to productivity and automation, to instructional use of the innovation required 7 years (1987 to 1993). To reach the integration level of use required 9 years (1987 to 1995). Because computer software and computers are generally easier to use now than in 1987 implementation may occur more quickly. However, other recent studies have concluded that implementation and change may take as long as a decade to complete (Riffel & Levin, 1997; Green, 1996).

Recommendations

"Technology is widely seen as a change in society to which schools must respond" (Riffel & Levin, 1997, p. 61). When technology is implemented properly, individuals will grow and become more proficient with its use, and will become innovative in applying it to learning (Saye, 1997). However, technological change in schools involves many complex, diverse, and uncertain organizational processes. Change facilitators and administrators need tools resulting from research to help them guide the change process. Often, as in this study, the results of the research is contextually bound and does not allow for helpful generalizations (Klimczak & Wedman, 1997). This study, however, does provide the change facilitator or administrator with helpful insights about implementing computer technology, and this study does have a fittingness to other contexts where computer technology is implemented.

For Practice

The following are insights for change facilitators and administrators about implementing computer technology:

1. A change facilitator should expect that the user group will be stratified as early adopters, followers, and late adopters throughout implementation.

2. A change facilitator should expect to change implementation strategies to account for the increased diversity of the user group as the change progresses.
3. A change facilitator can expect migration from models of the classical quadrant to models of the processual quadrant.
4. A change facilitator should expect to select a quadrant for initial strategy development, probably the classical quadrant, and to select a model that is a good fit for the organizational context.
5. A change facilitator should expect members of the user group to progress to higher levels of use (productivity and automation, to instruction, to integration) as implementation proceeds. This progression may take up to a decade.

For Further Research

Further research is required to produce diagnostic tools for the practitioner. The change agent or administrator would benefit from knowing:

a) which organizational factors to assess to determine which change model (or school of thought) is the best fit for the context of the change site.
b) organizational factors that are key indicators of when to adopt a new model during the change process.

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Appendix A

Statements Extracted From the Case Study IC, SC, and LU Classifications and Their Averages

1987 Case Study Statements

#	IC	SC	LU	Excerpt from Case
1	0	0	0	that number of computers would be inadequate for the amount of staff, however, at the time, it was ample because many of the computers were idle
2				Principal intended to introduce computer technology in to the school on a larger scale
3	1		1	only existed small pockets of early adopters
4	0	0	0	other departments had no members that embraced computer technology
5	0	0		Why are we buying computers when I need more books for my department?
6	0	0		most teachers were simply indifferent
7	0	0		It can't do anything for me that I can't already do
8	0	0	0	computers are not necessary
9				1987 the Principal met with me to discuss the state of the school concerning computer technology
10				interested in facilitating the implementation of computers
11	0	0		it was difficult to engage staff members in dialogue regarding computers
12	0	0	0	Initiating teacher involvement with the use of computers was a persistent problem
13	0	0	0	Some department heads refused to have a computer in their department resource area
14				Principal and I decided to initiate live-in training (or modeling)
15				another factor in initiating teacher involvement was accessibility to computer equipment
16				accessibility of teachers to computers so that they could familiarize themselves before they used them around students
17				Macintosh computers and printers were deployed to department resource areas
18	2	1	2	two departments wanted more computers,
19	0	0	0	a few didn't want them at all
20	1		1	and the rest accepted them because they were free to the departments
21				planned inservice training sessions for the whole staff to reduce the fear of using computers and to create an awareness of their utility
22	2			We planned to use early adopters as trainers
23		0		two sessions were delivered before December 1987, and each had marginal success in achieving our goals.
24	0			goal for this period was to achieve the acceptance of computers in the school as a legitimate tool
25	1	1	1	For some, that meant the acknowledgment of the usefulness of computers as a tool,
26	0	0	0	while for others it meant tolerating their presence

27				Principal and myself realized that administration played a key role in initiating the implementation of computer technology into the school
28				goal of administration was to devise strategies that reduced resistance to the implementation of computers
count	17	14	11	
sum	7	2	5	
average	0.41	0.14	0.45	

1988-1989 Case Study Statements

#	IC	SC	LU	Excerpt from Case
1				productivity and automation captured the focus of implementation for the next two years, 1988 to 1989
2	2			the school experienced major equipment enhancements to facilitate personal productivity and to automate school functions
3	2		3	The use of computers as personal productivity tools increased over the period and automation leaped ahead
4	0		0	the levels of computer usage among teaching staff ranged from none
5	2		3	to everyday
6	1	1		By 1988 almost all staff members acknowledged that computer technology was not going away,
7	0	0		but pools of resistance were evident
8	0	0	0	'It would take me longer to use the word processor than it does to write by hand'
9	0	0	0	'I will be gone (retired) before I have to use a computer,' 'Doing marks on a computer is more time consuming and complicated than doing them the way I always have'
10	0	0	0	'I can do marks faster in my head'
11	2	2	3	group of teachers that adopted computers were not confident in their skills but they were eager to show others the work they had done
12		2	3	In a jovial manner, a one-up-man-ship interaction existed among the users, as each tried to excel beyond the other
13		1	2	'Can you help me this afternoon?'
14		1	3	'Can you tell how to fix it?'
15	1	2	2	'I would like to use a computer but I don't have a use for it.' I suggested he that he try a database. He asked what it was and if I would help him make one.
16	1	1	2	Principal was approached by some teachers with a request to have me move into other department
17				to continue the live-in training
18		0	0	A pocket of resistance carried on through 1989,
19		3	3	but a strong group of users was emerging as well
20	2	2		The user group shared information and skills with each other

21	2		3	computers had a permanent and strong presence in the teachers' cafeteria
22		2		computers had presence in conversations between colleagues as they walked down the school corridors
23				introduction of new equipment
24	2	1	3	demand for training and assistance had grown
25	2		3	the many diversified requests, such as installing and learning accounting software, installing and teaching the use of subject specific software, and resolving administrative software needs
26				We believed a problem was best solved by the user
27				that the user would require the assistance of a change facilitator in the search and retrieval of information and the selection and implementation of the innovation
28				resource person (linker) must have a good understanding of the user's problem and resource limitations
29		3	4	teachers were demanding training beyond the use of productivity tools
30				named this group the linkers
31				Their task was to assist other teachers in resolving computer problems
32				They acted as a link between the numerous staff members myself
33		3		they had to commit their own time for linker training (training occurred after school), and they were expected to help others during the school day when needed
34				Linker training commenced in March 5, 1989
35	3	4		participation in the Olympic Committee Organization (OCO) Project
36			3	one-third of the teachers and students in the school regularly participated
37		2		The exposure to on-line communications created a desire to participate in another project in 1994
38				review of the school conducted by the District and the provincial Department of Education conducted ...to examine the school's role and function
39				the significance is that it was this event that later prompted the staff and administration at the school to conduct a self-examination of its purpose and direction, which lead to the development of a guide for school's development, called Vision 2000
40				in 1989, the school conducted a Technology Awareness Seminar for district principals
count	17	20	19	
sum	22	30	40	
average	1.29	1.50	2.11	

1990-1992 Case Study Statements

#	IC	SC	LU	Excerpt from Case
1	2		3	continued growth of the use of various personal productivity tools, increased automation, and an increase in the number of teachers that were using computers
2	3		4	it was the introduction of CAI (Computer Assisted Instruction) programs that distinguished this period
3	2		3	most of the utilized software was designed for productivity (marks, and word processing) and automation (accounting, and graphics
4	3			the implementation of computer facilities specifically to accommodate CAI...few teachers used CAI programs
5		4		the initiation of plans for a new delivery system (including CAI)
6				expand our understanding of the use of CAI by visiting other educational facilities that where already routinely using it
7				Feb, 1990, we had a meeting in which we discussed formulating and overall plan for the school
8				Vision 2000 document was delivered to the Superintendent April 30, 1991
9	3	4		established a facilities committee in June to examine the nature and extent of renovations that would be required to accommodate a new delivery method involving the use of computer technology
10				Modernization Plan that was submitted to the School Board for approval in March 1992
11	3			the plan included the addition of computer centers designed for delivery of CAI
12			3	the capacity of our computer facilities was inadequate the accommodate the rising demand
13	2	3	3	Teachers were complaining that the computer labs were busy all the time, and that they couldn't book time for their classes
14				the negative impact that the unavailability of computer lab time might have on implementation efforts...the purchase of more computer equipment was authorized
15				In 1990, computers situated in a room adjacent to the library were upgraded
16			4	This room was available for teacher bookings and for general student access
17				created two new computer labs in 1991... one computer lab (Macintosh LC lab with 26 networked computers) in March, and another in September (Macintosh LC 475 lab with 24 networked computers)
18	3	3		we were actively seeking CAI software...we purchased the program (Autoskill)
19	3			An English teacher was willing to learn and administer the program (CAI) to students

20	3			established a permanent lab (CAI)
21	3			we introduced additional tutorial software in 1991 (Math)
22		2		Initially only a few interested mathematics teachers used the software because many teachers were skeptical of its value
23			4	Other teachers became interested in using computers for specialized needs
24	2			we installed a pattern assisted design (PAD) program
25		4		two teachers attended courses over the summer to learn the PAD and CAD programs
26		3		Teachers were becoming tired of the rapid pace of change
27		3		Many teachers said they preferred to stop innovating for a year
28	2		3	we still had two groups in the school: Those that used computers,
29	0		0	and those that didn't
30		5	5	In 1990 we formed a discussion group to determine how to further implement computers into the school
31			4	shortages of computers in the English, Social Studies, and Science teacher resource areas because of the increased number of users
32	2		4	increased number of daily tasks bing performed on the computers
33	2		3	Limited computer access caused teacher frustration
34				shortcomings of small group training
35				1991, Technology Support Centre: (1) to offset the demand for more computers in the department resource areas by providing another common work area, (2) and to provide teachers with individualized computer support at anytime from either, a linker, another user, or myself
36			4	More advanced computer users were now beginning to emerge
37	3	4		some users were contemplating permanently incorporating CAI into their course delivery
38	3	5	5	1991 we decided it was time to expand our understanding of the use of CAI by visiting other educational facilities
39	3			some teachers stated that they wanted to use CAI programs to supplement their teaching, but required money to purchase the software
40				administration decided to divert some funding from the library book budget to the purchase of software
41			3	divergence between the two groups had been continuously growing since 1987
42			0	it was now a implementation impediment that required attention
43	0	0		Non users argued that departmental budgets should not be spent on computers

44	1		4	the non computer user group had diminished to about one-third of the teaching staff
45		0		'I would know computers too if I had the training that those guys (linkers) did'
46	0			or 'If the school wants me to know they should buy me a computer.'
47				'The train is leaving the station. Get on board or you'll be left behind'
48	3	5		user group had different concerns....discussion with this group regarding features of new software or how to use computers to for some new task, while other discussions were about the use of CAI to augment their teaching.
49	1		4	how they could acquire new software, how they could secure more training and individualized help, how they could buy a computer economically, or if they could borrow a computer from the school
50				1991, the school hosted a technology initiatives evening
51	1			The next day teachers felt as though they had endured the right-of-passage and were now members of a computer fraternity.
52		2		One of the linkers approached me and complained bitterly that I had left all the linkers behind (in computer knowledge) because I didn't spend enough time teaching them
53		3		They were tired of continually learning, especially when there appeared to be no end, and they were tired of helping others because it consumed much of their time
54				some teachers held considerable animosity for the linker group because they were thought to be elite
55				decided to abort the linker program and abandon the Linkage model
56				A fellow teacher that I trained was selected to assume my position while I was gone
57				Principal decided to maintain computer technology at status quo for 1992
58				decided to conduct an evaluation to determine the success of our computer implementation efforts
59				After abandoning the Linkage model and the linkers as a formal group, no other model was immediately selected
60				no linker training existed
61		5	3	a peer-to-peer exchange of information flourished
count	25	17	20	
sum	53	55	66	
average	2.12	3.24	3.30	

1993-94 Case Study Statements

#	IC	SC	LU	Excerpt from Case
1			4	the Evaluation Report concluded 'that computer technology had become and integral part of the culture' and that 'much of the social conversation evolved around computers, software, and technical problems
2			4	sense of pride among teachers in the ability of the School to show leadership in the area of using technology
3	3		4	teachers at the school had internalized the use of computers and were embracing the use of computers for instruction
4				•Evaluation Report of 1992 indicated that the staff of the School was prepared to move into the instructional use of computers
5				we established 3 computer pods
6				Technology Support Centre remained operational, we introduced a Teacher Training Centre to facilitate small group
7				Business Education department received an upgrade
8	3	4		Mathematics Department delivered four courses using CAI
9	3	4		Science Department introduced CD ROM based tutorials in biology, chemistry, and physics
10				We introduced Internet access and e-mail
11	2			Automation of the school continued
12	2			upgraded the administrative network
13	2			installed networking between the Business Office, the Library, and the Bookstore
14			2	Support staff training began in 1994 for text book/library system
15				November, 1993, we completed the proposal for renovations
16				completed proposals for CTS and computer equipment funding
17	3	4	4	Many teachers were still not clear on how to use computers for instruction
18		5		group attended an Apple Classroom of Tomorrow (ACOT)
19	3			struck a Technology Team to determine instructional, equipment, networking, and furniture requirements for the areas to be renovated
20	3		4	Users became more specialized
21				major concerns centralized on procuring computer laboratory time and acquiring money for software purchases
22				user group became stratified with various levels of skills
23			4	Some members of the group acquired more computer skills and may be thought of as advanced
24	4		5	While in 1987, I was the only integrated user, by 1994 three others had joined the rank

25	3	5	5	novice users wanted to be shown how to use the computer labs for their classes
26	1		5	advanced users generally assisted the novice users
27				Tension between users and non users diminished in this period
28		2	4	teaching staff became more self-reliant
29			4	notion emerged that one does not have to know everything about computers or a particular piece of software
count	12	6	12	
sum	32	24	49	
average	2.67	4.00	4.08	

1995 Case Study Statements

#	IC	SC	LU	Excerpt from Case
1	4	6	6	numerous wide spread innovations that occurred in this period prompted teachers to change the way they approached instruction
2	4	6	5	the integration of CAI, productivity and development tools
3	2			January 1995 we ran the automated text book rental system for first time
4	2			teachers introduced digital parts and repair manuals
5				completion of renovations, three Centres provided the capacity to accommodate 180 students
6				a Teacher Resource Centre was established
7				almost all knowledge was acquired peer-to-peer
8				the Technology Support Centre and the Teacher Training Centre were disbanded (no longer needed)
9	3		4	Science area facilitated experiments that needed digital probes and sensors
10	4		4	abundant requests to load software on workstations and servers
11	3	5	3	teacher learning occurred every place in the school, and support could be found from former linkers and advanced users
12	3		4	initially the Centres were moderately busy, but by mid year they were always busy
13	3		4	Centres were always open to students during the instructional school day
14				Centres were occupied to capacity almost all day
15		2	3	type of support and training changed as the computer user group became more knowledgeable
16	3	5	5	users, both novice and advanced, spent considerable time showing each other software and how to use the new instructional networks
17		6	6	I continuously redirected inquiries and requests for assistance to other teachers or departments having expertise

18				many departments diverted sizable protion of their budgets to the purchase of curriculum based software
19	4	6	6	teachers who were investigating various combincations in which software programs could be used together to achieve new teaching strategies
20		5	5	Teachers discussed among them which strategies worked and which did not.
21				we returned with appreciation that change is a long process
22	3		4	teachers were beginning to take ownership of their learning and the software they were using
23			5	teachers would seek information, when they needed it, from whomever possessed the knowledge
24	3		4	computer users were investigating ways to use computers for learning
count	13	8	15	
sum	41	41	68	
average	3.15	5.13	4.53	

Appendix B

Frequency Distribution of Extracted Case Study Statements for IC, SC, and LU

Frequency Distribution of Innovation Configuration (IC) Statements

	Level of IC				
Period	**0**	**1**	**2**	**3**	**4**
1987	12	3	2		
1988-89	5	3	8	1	
1990-92	3	3	7	12	
1993-94		1	3	7	1
1995			2	7	4

Frequency Distribution of Stages of Concern (SC) Statements

	Level of SC						
Period	**0**	**1**	**2**	**3**	**4**	**5**	**6**
1987	12	2					
1988-89	5	5	6	3	1		
1990-92	2		2	5	4	4	
1993-94			1		3	2	
1995			1			3	4

Frequency Distribution of Levels of Use (LU) Statements

	Level of LU						
Period	**0**	**1**	**2**	**3**	**4**	**5**	**6**
1987	7	3	1				
1988-89	5		3	10	1		
1990-92	2			8	8	2	
1993-94			1		8	3	
1995				2	6	4	3

Total Frequency Counts in Each Category of IC, SC, and LU Statements Per Year

	Category		
Period	**IC**	**SC**	**LU**
1987	17	14	11
1988-89	17	20	19
1990-92	25	17	20
1993-94	12	6	12
1995	13	8	15

Appendix C

Evaluation Report: Computer Technologies Implementation Program
Interview Sheet and Questionnaire
September, 1992

INTERVIEW User Group (T1)

Questions	Responses (T1)
1. What is (was) the most useful aspect of the program? 2. What is (was) the most frustrating aspect of the program? 3. What would be the most helpful to you now or in the near future with respect to using computer technologies?	

INTERVIEW Non User Group (T2)

Questions	Responses (T2)
1. What is (was) the most useful aspect of the program? 2. What is (was) the most frustrating aspect of the program? 3. What would be the most helpful to you now or in the near future with respect to using computer technologies?	

Questionnaire

1. The use of computers in the school has been helpful to students

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

2. The use of computers has been beneficial to your teaching (or job)

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

3. The use of computers has been personally helpful as a tool

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

4. You have enough time to learn the computer software and hardware that you need to know

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

5. You are satisfied with the support and training that has been provided

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

6. You would like more training/inservicing

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

7. People in the school share computer information and help each other to learn new skills

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

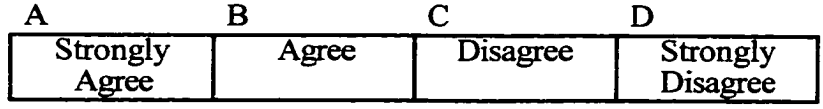
8. You feel confident about the use of computers

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

9. The implementation of computer technologies in the school has been successful overall

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

10. The implementation of computer technologies in the school has met your needs overall



11. You own a computer

12. You use a computer frequently, and you use various types of applications

Appendix D

Computer Technologies Implementation Program Questionnaire June, 1993

Questionnaire

1. The use of computers in the school has been helpful to students

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

2. The use of computers has been beneficial to your teaching (or job)

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

3. The use of computers has been personally helpful as a tool

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

4. You have enough time to learn the computer software and hardware that you need to know

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

5. You are satisfied with the support and training that has been provided

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

6. You would like more training/inservicing

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

7. People in the school share computer information and help each other to learn new skills

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

8. You feel confident about the use of computers

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

9. The implementation of computer technologies in the school has been successful overall

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

10. The implementation of computer technologies in the school has met your needs overall

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

11. You own a computer

A	B	C	D
Agree			Disagree

12. The number of times that I use a computer in an average week is

A	B	C	D
Not at all	1 or 2	3 to 5	6 or more

13. On average I use a computer

A	B	C	D	E
Not at all	Once per week	2 or 3 times per week	Every second day	Almost every day

14. The number of software programs that I use in an average week is about

A	B	C	D
None	1 or 2	3 to 5	6 or more

15. I think that it is a good idea to use productivity software, such as a word processor, a spreadsheet, database, graphics package, or desktop publisher, etc.

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

16. I think that it is a good idea to use instructional software, such as computer managed learning (CML), computer assisted instruction (CAI), or other software to assist classroom instruction, training, or testing.

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

17. I use productivity software, such as a word processor, a spreadsheet, database, graphics package, or desktop publisher, etc.

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

18. I use instructional software, such as computer managed learning (CML), computer assisted instruction (CAI), or other software to assist classroom instruction, training, or testing.

A	B	C	D
Strongly Agree	Agree	Disagree	Strongly Disagree

Appendix E

School Documents and Proposals

School Documents and Proposals

Year	Document
88	• Olympic Data Technology Project: Evaluation report
88-89	• Office Equipment Modernization Proposal • Network Implementation Schedule (MacProject PERT)
89-90	• Training Schedule for Linkers
90	• School Review • Vision 2000 Development Plan (MacProject PERT)
91	• Vision 2000
92	• Evaluation Report: Computer Technologies Implementation Program
93	• CTS Equipment Funding Proposal
94	• Revised CTS Equipment Funding Proposal

Appendix F

Events List/Time Line

Constructed Yearly from from daily logs, my notes, the Prinipals' notes and scheduler, school evaluations and reviews, and Business Office records.

Documentation	1987	1988
OCO Project (Sept 87-June 88)		
Instruments		
Initiatives and Events	• September - I return from Masters Studies • Initial stages of planning for future • September to October - Assessment of computer platforms - software and training were criteria for choice - how do we get teachers involved? • September - I moved into the Social Studies resource area to begin live-in training • Development of teacher resource areas (productivity tools and workstations) • Begin ongoing teacher support • Inservice training sessions for teachers were planned and delivered to reduce fear and create awareness, and to encourage the use of computer technology for productivity	• January to March - OCO Project, however teachers continued until June • January to June - INet 2000 project with AGT • Introduction of CAD • Chose the Linkage model of change for technology planning and implementation • Implementation of computerized accounting (Business Office) • A portion of the Library budget was allocated for software purchases • A library computer pod was introduced • Encourage use of computers for instruction • A CD ROM Information Centre was introduced into the Library • Introduction of DOS based computerized accounting for instruction (Business Education)
New Facilities	• Macintosh computer and printers for teacher resource areas	• CAD Lab (Mac Plus) (SE 30 Server) • Business Office (New Views Accounting on DOS computer -286) • 20 Apple IIe's for library Computer pod • Library Information Centre (2 Mac SI's with CD ROM)

Documentation	1989	1990
Linker Training (start March 1989)		
Admin. Network Implementation (Oct 1989-Dec 89)		
School Review (Nov 89-Jan 90)		
Vision 2000 paper for Integration of Technology into the School (Sept 90-Apr 91)		
Instruments		
Initiatives and Events	• Administrative network implementation -major network training for support staff and productivity tool training -some resistance to change from office staff • Technology Awareness Seminar for District principals (Nov) • some teachers in school demand more knowledge, beyond ongoing productivity tool training, other forms of support are required • a decision is made, a linker group will be established and linker training will begin in March • a School review begins, and is conducted by the District and Alberta Education to determine the nature of the school and the place it may hold in the Province • November- Questionnaires regarding the school are administered to teachers, students, and parents of students	• I am asked to collate and evaluate the data collected from the School review • January - the School Review report is compiled and released • the Review lead us to the need to articulate our plans for the future • upon request, I started the development of a vision statement for the School (for computer technology and other niches the School will have to fill • I did a thorough review of the literature with respect to restructuring and technology (from applied and theoretical sources) • established a plan and implemented a process for the development of the vision for the School • set up small and large group discussions regarding the further introduction of computer technology into the School • resistance to technological change became apparent - implemented small and large group computer training sessions in an attempt to reduce resistance

		• acknowledgment of Careers and Technology funding for procurement of computer equipment (a proposal must be submitted) • introduction of Autoskill™ program (English language-pronunciation, vocabulary, comprehension skills) and computer lab • Library goes on-line with Statistics Canada
New Facilities	• Administrative network	• Auto skill Lab (12 Mac's with Mac server (Mac SI)) • Library - StatsCan CANSIM (on-line) dial-out (2 Macs with modems) • Library pod upgraded from Apple IIe to MacPlus computers with SE 30 Server and Appleshare networking

Documentation	**1991**	**1992**
Linker Training (start March 89)		
Vision 2000 Paper(Sept 90-Apr 91)		
Evaluation Report: Computer Technology Implementation (Apr 91-Sept 91)		
Instruments		• April to Sept. - Interview of teachers regarding computer implementation conducted n=20 • April to September - Teacher questionnaires regarding computer implementation completed n=40

Initiatives and Events	• Linker sessions still in progress and very intense • April - Vision 2000 paper completed • Education Council and the Superintendent received Vision 2000 • formation of a facilities committee to begin plans for facilities revitalization (Based on Vision 2000) • September - development of Technology Support Centre • October - visited site that was using the BASE CAI program • November - Technology Initiatives night for teachers, principals, advisory groups of the District held at the School • December - visited a school in Calgary that was using computer technology for instructional delivery • began beta testing CM math programs • a CM lab established • an Auto skill language lab established •a decision was made to abort the linker training program • weekly training sessions instituted on a volunteer sign-up basis • instructional lab	• January - I am gone to U of A for Doctoral Studies - continue to work weekly at the School on a part time basis • more CM math introduced • Mar - Modernization Plan (based of work of the facilities committee) was approved by the School Board and submitted to Alberta Education • May to September - an evaluation of computer implementation in the School was conducted by this researcher • May - meeting with Alberta Education Buildings branch and Alberta Education Curriculum branch regarding the use to technology and facilities • June - a Fabric and Design lab was discussed and instituted using CAD and PAD

New Facilities	• a new instructional Lab (Rm. 224) of Mac LC's was built (24) • a CAI lab was instituted (26 L.C.) Computers • an Auto skill language lab (15 Mac Classics and a Quasar server) • a Technology Support Centre was established (teacher support) •Appleshare networking in these areas	• CAD/PAD Fabric and Design lab with 4 PC's (486's), graphic palettes, and 47" plotter

Documentation	**1993**	**1994**
CTS Equipment Funding Proposal #1 (0ct-Dec)		
CTS Equipment Funding Proposal #2 (Jan-Feb)		
Instruments	• June - Questionnaire regarding computer implementation in the School n=53	
Initiatives and Events	Jan to Mar - review of automated library packages • Feb - installed computer pod in RM 372 • May - installed remote computer access and remote electronic mail • now running 4 courses of CAI math • Sept - I return to the School from U of A • Sept - bar coding of student ID's and text books • Sept - installed 2 new pods (Rm 224 and 272 • Oct - regularly scheduled small group training was replaced with specialized small group training upon request. • Oct - Teacher Training Centre established • Nov - proposal for renovation (architectural plans) completed	• automation for issuing of text books has started • Jan - attended conference on computers in schools (San Francisco, ACOT (Apple Classroom of Tomorrow) schools) • Feb - Revised request for CTS funding - equipment, including computers, for renovation completed and submitted • SchoolNet - Internet links established in the Teacher Training Centre • training initiated on the automated text book/library system (Library 4) (in-house training) • CD ROM introduced into science on a large scale for instruction

	• Dec - submitted request for CTS funding - equipment, including computers, for renovation (November, 29 document)	• Jun to Sept - network design and requirement for areas to be renovated (Learning Centres) is completed • Oct - Technology Team struck to determine instructional format, equipment requirements, and furniture requirement for Learning Centres • Oct - Lab in Rm 230 upgraded • Nov - renovations start • Dec - Technology Team reports on recommendations - collaborative learning
New Facilities	• administrative network upgrade • 3 computer pods (12 Mac's each) • Remote access server (ARA) and e-mail • Teacher Training Centre (12 Mac's, server, network)	• Business office/Bookstore/Library computers, scanners, bar code readers, and networking • upgrade Rm. 230 lab to LC475's with Power PC 6100 server and Ethernet • Internet access through SchoolNet

Documentation	**1995**
Instruments	
Initiatives and Events	• Jan - text book rental automation ran for the first time (successfully) • Jan - Internet training for teachers began • Feb - conference in Denver, computers in education • Feb - renovations completed - now have 3 new learning centres, 2 new labs, and other new rooms • Leaning Centres (A, B, and C) networked and equipped • Mar - Automated CD ROM based parts and repair manuals introduced into automotives • Apr - presentation in legislature about technology in education, particularly for instruction • Technology Support Centre disbanded • a Network Centre was established, it also provided teacher support • a Teacher Resource Centre, equipped with computer equipment, printers, scanners, etc., was established in proximity to the Network Centre

	• a Science Centre, equipped with computers, was established for computer simulations, computer monitoring and measurement during experiments, and CD ROM access • the library was automated, including the retroconversion of books • the Information Centre was moved from the library to the Learning Centres • SchoolNet-Internet access (for second year) was moved to Science Centre, Teacher Resource area, and the Learning Centres • groups tour the school (AVC, Grand Prairie) • Teacher Training Centre disbanded because most training is one-on-one and peer-to-peer (Teacher Resource area and Network Centre will be used), small group specialized training still in occurring • ISDN Internet access is introduced • Satellite transmission and reception of CTS courses is requested
New Facilities	• Learning Centres (A, B, and C) equipped with computers (Mac 5200's) and servers (7300's) and ethernet with routing • Network Centre (including network room) linking all the other rooms • Teacher Centre (Power PC's, Laserwriter, Ink jet, scanner, modem) • Science Centre (3 Macs with specialized sensor probes, ink jet printer, modem) • automotive (PC 486, CD ROM, ink jet Printer)