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UNIVERSITY OF ALBERTA

INNOVATIONS: STRATEGIES FOR IMPLEMENTATION

by

TERRENCE A. BRUCHAL

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

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Abstract

This study examines data collected from the Olympic Data Technology Project and some theoretical models of change to ascertain the success of certain strategies for the implementation of an innovation. The project focused on the XV Winter Olympic Games which were held in Calgary, Alberta, from February 14 to February 28, 1988. The project was the result of the cooperative efforts of Alberta Government Telephones, International Business Machines (Canada), Alberta Education, University of Alberta, the Olympic Organizing Committee, and school districts geographically distributed across Alberta. The project was fully operational in the project schools from February 14 to March 14, 1988. During this period data were collected by three questionnaires from 26 schools across Alberta which were participating in the project. One year after the project, data were collected from the project schools by a fourth questionnaire.

It was determined that the models of change which were examined in this study could be grouped into three processes of change; autocratic, bureaucratic, and adhocratic process of change. The bureaucratic process of change was used as a basis for the examination of the success of strategies used during the project to implement telecommunications, electronic bulletin boards, and remote electronic databases in 26 Alberta schools.

The study identified support, training of the internal group (users), involvement of the internal group, planning, bi-directional communication between the internal and external groups, and the use of a linker ('hand-holder') as some important strategies during the implementation of an innovation.

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I would like to thank the members of my thesis committee, Drs. Eugene Romaniuk, Craig Montgomerie, and Milt Petruk. I am especially grateful to Dr. Eugene Romaniuk for his support, patience, and guidance throughout this study. His personal concern and encouragement have been particularly beneficial to myself and the study.

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CHAPTER I

THE PROBLEM

Introduction

Background: Technology, Society, And Education

The structure of civilization is the result of the interaction of technological, societal, and scientific aspects of the culture (Hurd, 1975). According to Hurd (1975) technology refers to the development of tools, implements, and processes. Society is the human factor that represents living practices and morals that comprise the culture, and includes educational practices and orientations. Education, in a broad sense, refers to the transmission of knowledge and skills from one generation to the next, and is not restricted to a single type of institution. Science contributes a collection of theoretical knowledge and research. Society, science and technology are interrelated and consequently a change in any one of these aspects of civilization will result in an alteration of the existing cultural structure. According to Bell (1980), society has always had its base in knowledge, but recently technological change has become more dependent on theoretical knowledge and the influence of technology on society has become more profound. As a result, information and communication technologies, linked with computers, have been introduced into society (Bell, 1980). One would expect this to effect the structure of society and its educational practices, since, historically, implementation of technology has initiated change.

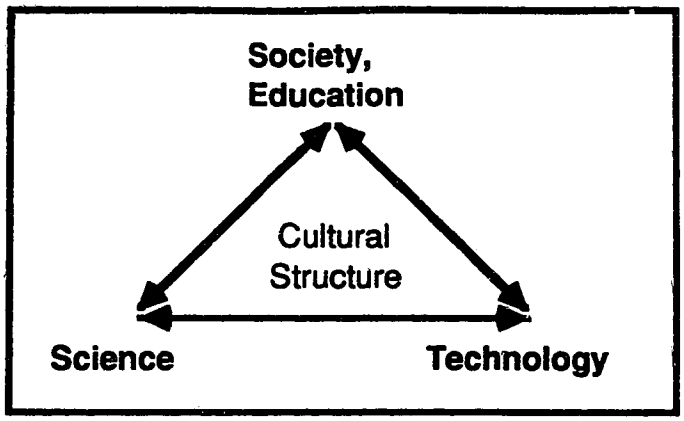


Figure 1. The Interrelationships Between Society, Science, and Technology

Gilchrist and Sanders (1983) explained that the first notable change of modern man came about when agriculture was discovered. No longer was it necessary for man to move around in search of food. Instead, agricultural goods where traded for other goods and services, allowing individuals to specialize in a particular activity or occupation. Knowledge flourished and the need grew for an effective method of transmitting basic knowledge from one generation to the next. Formal education was established. Since then education has evolved in response to the needs of society and technological advances, including advances in communications and information transmission.

Bell (1980) described society as having an infrastructure that links it together. He mentioned three aspects of the infrastructure: transportation, energy grids, and communications. Human communication has gone through four distinct revolutions (Bell, 1980; Shane, 1985). Each has been dependent on technological means and has had an effect on the development of society. Speech represented the first advance in communication. This form of communication was characteristic of the early nomadic hunters and gathering bands, and it facilitated the communication of thoughts and the passing of knowledge from one generation to the next. Written communication spurred

the second revolution. Writing had many early forms (e.g., hieroglyphics, script, etc.) but in its modern form became the basis of agricultural societies. Writing provided a means of record keeping and the codified transmission of knowledge and information, and it had a pronounced effect on education. Shane (1985) attributed the third revolution to the technological innovation of Johann Gutenberg, who first used movable type setting in the printing process during the 15th century. Printed materials became the basis of the industrial society and an important factor in mass education and the increase in literacy (Bell, 1980). We are in the midst of the fourth revolution in communications (Shane, 1985). It started with the creation of telegraphy in 1845 (Bell, 1980) and has introduced the radio, the telephone, and the television, within the span of a single lifetime. This revolution is characteristic of the information society. Unlike the industrial society that was dependent on manufacturing and commodities, the present era is reliant on the accessibility and transmission of information. Recent technology has introduced the microcomputer, fiber optics data transmission, compact disk data storage, and satellite communications. These technological advances and society's need for information and communications has stimulated the development of facsimile systems, teletext systems, information banks and retrieval systems, data processing networks, interactive on-line computer networks, and a system that combines audio, video, and data transmission called compunications (Telematique) (Bell, 1980). During the fourth revolution of communications, the present era, almost every aspect of society, including education, has experienced some change associated with the innovation of computer and telecommunications technologies.

Educational institutions have historically experienced the implementation of technology in pedagogical methods and curriculum (TVOntario, 1980). The advent of printed materials led to the reliance on text books and duplicating devices. More

recently overhead transparencies, films, television, video cassettes, and tape recorders have changed the nature and the delivery of educational content. Most recently, microcomputers have been implemented into many schools and computer literacy courses have been developed (Gilchrist and Sanders, 1983). However, educators have not shown strong inclinations toward the processes of information acquisition, manipulation, and transmission; the essence of the fourth revolution of communications. These abilities rely on computer and telecommunications skills, and knowledge related to the processing of data into meaningful information.

Gilchrist and Sanders (1983) commented on the effect computer technology on the present evolution in communications when they expressed that computer technology may influence methods of information processing as much as the introduction of the printing press did in the 15th century. They went on to explain that just as the advent of the text book brought about mass literacy, computer technologies will also require the development of a unique set of skills. The educational process, however, has always lagged behind technology and the more immediate effects that are usually felt by society in general. Gilchrist and Sanders (1983) believed that this probably occurs because a new technology requires the development of new instructional strategies before implementation will be successful, and because the application of new technologies, upon which instructional strategies are built, will evolve as will the technology itself. Therefore, instructional strategies will evolve after applications for the new technology have been developed. This results in a slow rate of change in education.

Information and information technologies interact to produce a mode of data handling that is suitable for the volume and nature of the information. However, in education the lagging rate of implementation of information technologies may be problematic if the volume of information is changing as rapidly as forecasted by

Dyer (1984). He stated that the amount of information and knowledge accumulated up to the year 1700 was doubled by the year 1850, and quadrupled by 1900. In 1984, the amount of accumulated information was doubling in ten years. By the year 2034 (50 years), 97% of the total accumulated knowledge of the world will have been discovered during the last 50 years. Does this information boom have an effect on technological development and the development of information tools? Most probably, and students and teachers must adapt to a new way of handling and thinking about information. Therefore educational strategies must evolve more rapidly than before, so that students will not only have knowledge per se, but they will also understand the processes of acquiring, manipulating, and transmitting information. For education to meet the needs of society and to adequately provide students with essential skills, information technologies must be implemented into education. To facilitate change in education, it is important to understand the change process, and to utilize effective methods of implementation to adopt these innovations. Change of this technological nature is likely to be assisted by the private sector, since advanced technology is generally not well understood by most educators. Inter-agency cooperation to achieve educational goals may well denote a significant change in the way educational institutions evolve.

Problems Associated With Innovation And Change

Although an innovation and change are not the same, one does not occur without the other. An innovation is something newly introduced; implementation is the act of introducing it. By the virtue of introducing new things, an environment or condition is altered, thus invoking change to the status quo. It is difficult to imagine anything that is not changing in some way or another. The world and most things in it

are involved in some sort of orderly change or cycle (Miller, 1975). Although the introduction of a new condition into the cycle will alter its course, the dynamics of change continue to function according to specific rules and adaptation to the new condition occurs.

Innovation and change are naturally occurring conditions and most people look forward to pleasant changes in their lives, but yet like to maintain some stability (Henson, 1987). Dyer (1987) believed that change in education was also natural since every other aspect of the culture, of which it was subservient, was dynamically evolving. However, he also realized that changes in educational institutions are not always enthusiastically awaited by all its members. That is, there are two sides, or opposing forces, that operate during the implementation process that leads to permanent change. Lozier and Covert (1982) addressed institutional change in this regard, "Social structures are created and altered in a balance between the natural tendency to preserve a high degree of stability and the equally natural pressure toward change." (p. 198). The need for change in education, in particular the introduction of information technologies, creates the pressure to innovate. Dyer (1984) wrote about this pressure:

> Computers used for information and communications allow for the simulations, synthesis, and analysis of immense amounts of data. These technologies have incredible potential for the learning process and education systems. Education systems should be sensitive to these forces and make appropriate adjustments. (p. 30)

There are various reasons for the resistance to change and the resistance may come from any level of an organization. Henson (1987) stated that the opposition to change may be generated from the fear of using new technologies, funding limitations, and apathy and attitudes of people within the organization.

If intentional change is to occur, a plan for implementation must be developed and decisions must be made (Lozier and Covert, 1982). Decision making and planning

ultimately impact the successful implementation of an innovation and the internalization of the change in the organization. However, the decision making process may also create resistance to change. Although decision makers often operate as though most of the essential parameters of a change are known, they are working with variables of unknown values since, by definition, the innovative process deals with the untried and the unproven. Therefore, decisions are often based on assumptions and this imparts risk on the decision making process and, hence, the decision maker. Under normal conditions, where maintenance of the organizational system is the main concern, the risk of making an error during decision making is not great. However, as the decision parameters become less known, as in the innovative process, the risk of making an error increases. Since the success or failure of the innovation reflects on the decision makers, they tend not to impose radical innovations. This aspect of innovation, in effect, operates to resist change and is operational within educational institutions as well as other organizations. Adams and Chen (1981) described the state of educational institutions in this manner, "An essentially conservative institution, education tends to plod well worn paths. Deviations tend to be few (and usually minor) and when they occur the stability of the remainder of the system can be taken pretty much for granted" (p. 256).

Dyer (1984) pointed out that although rapid change in education is necessary to meet the needs of the information age, the educational institution has historically demonstrated conservatism, and slow evolutionary change. He also stated that often innovations in education fail and no permanent change occurs because of inappropriate planning and implementation, creating resistance to the innovation. Under these circumstances, the detrimental aspects of the change may be thought of as exceeding the beneficial aspects. A number of theoretical models of innovation and change have been

developed for use in organizations and institutions to facilitate the implementation of an innovation. These models are tools that can help the decision makers in evaluating the innovation, planning effective strategies for the implementation of the innovation, and securing a permanent change in the organization. The intentional and planned innovative process is far more likely to result in successful organizational change (Lozier and Covert, 1982).

The introduction of information technologies , such as telecommunications and databases, into educational settings is an innovation. As with any innovation, difficulties are experienced during the implementation stage of change. In addition, some strategies can more effectively invoke the successful implementation of an innovation than others. The Olympic Data Technology Project was a telecommunications project that involved some Alberta schools. The project was the central focus of this study. This project provided an opportunity to observe the implementation of information technologies in educational environments, to evaluate the effectiveness of particular implementation strategies, and to relate these strategies to aspects of the theoretical models of change as outlined in the literature.

The Problem And Research Questions

The central focus of this study was the overall effectiveness of implementation strategies that were employed during the Olympic Data Technology Project. The Olympic Data Technology Project, hereafter, will simply be called the project. The project involved the cooperation of agencies of education, government, and the private sector. The purpose of the project was to provide selected Alberta schools with access to a database containing the results of events of the 1988 XV Winter Olympic Games, and other related information, through the use of computers and telecommunications

links. Schools were also able to communicate with other schools participating in the project by using telecommunications. The manner in which telecommunications and remote databases were used in the project schools was an innovation in Alberta schools. The findings from the evaluation of the project were used in this study.

The major purpose of this exploratory study was to assess various implementation strategies that were utilized during the project, and to relate these implementation strategies to some theoretical models of change. The research questions are:

(1) What strategies appeared to be important for the successful implementation of telecommunications and databases in the schools that participated in the Olympic Data Technology Project?

(2) How do the implementation strategies, identified as important in the Olympic Data Technology Project, relate to implementation strategies that are derived from some of the theoretical models change?

As the use of information technologies are becoming increasingly widespread, pressure increases to introduce telecommunications and databases into business and educational organizations. The identification of successful implementation strategies may enhance the process of implementing information technologies in organizations.

The Study

The central focus of this exploratory study was the implementation of technology, particularly telecommunications and databases, in schools. The Olympic

Data Technology Project was the source of the data used to evaluate the merit of particular implementation strategies. The project provided some selected Alberta schools with access to databases containing the results and general information pertaining to the XV Winter Olympic Games, held in Calgary, Alberta, from February 14 to February 28, 1988. The databases were accessed using computers and telecommunications links. The telecommunications links also provided telecommunications between the schools that were participating in the project.

This study attempted to assess the implementation strategies used during the project, based on the findings reported by the Olympic Data Technology Project Evaluation Report (Bruchal and Romaniuk, 1988), and to relate these implementation strategies to the some theoretical models of change described in the literature. However, because of the short duration of the project, the effectiveness of the implementation strategies can only be evaluated for the initial stages of the change process.

Significance Of The Study

This study may be regarded as important because information technologies are likely to be introduced into schools in the near future. The central focus of this study, the Olympic Data Technology Project, provided an opportunity to assess the success of various implementation strategies, and to relate some theoretical models of implementation and change to an actual situation where implementation of an innovation was occurring. In this way, the perspectives of some theoretical models may be utilized during the planning and implementation stages of technological innovations in the educational environment. However, it should be noted that this was an exploratory study and could not be classified as being comprehensive.

This study was also important because there was opportunity to observe and assess the effectiveness of inter-agency cooperation to realize the goals of the Olympic Data Technology Project.

Delimitations Of The Study

The delimitation imposed upon the study was the short time frame in which the project was operational. The project was fully implemented by February 14, 1988, the beginning of the Winter Olympic Games, and was fully operational for 15 consecutive days until the end of the Winter Olympics on February 28, 1988. The project was terminated another two weeks later on March 14, 1988. Therefore, the measure of success of the implementation strategies employed during the project was only assessed during a one month interval. Although one year later a questionnaire was sent to the project schools to determine how many schools were still using telecommunications, the effectiveness of these strategies to establish a permanent change was not assessed.

Limitations Of The Study

There were three major limitations in this study. First, the participating project schools were arbitrarily selected and the distribution of schools by location, size, and grade level does not represent a random sample selected from the population of Alberta Schools. Further, most of the project schools were selected on the basis of the teachers in these schools being familiar with computers. Therefore, the results of the study cannot be generalized to Alberta schools.

A second limitation of the study was that the data were collected using questionnaires which were predominantly of a Likert-scale format. This type of instrument tends to structure participant responses. Some items were open-ended in

format, but no personal interviews were held with members of participating schools who completed the questionnaires.

Finally, the generalizability of this study was limited by the association of the Olympic Data Technology Project with a high profile event, the Winter Olympic Games. The general widespread interest in the Winter Olympic Games combined with the media exposure of the events of the Games likely increased the interest of students and teachers in the project schools in the Olympic Data Technology Project. This increased interest may have prompted the increased use of telecommunications in the project schools to access the databases containing the results of Winter Olympic Games events and other related information.

Overview

Chapter I presented background information about the interrelationship of technology, education, and society, and attempted to establish the need for schools to permit students and teachers to access telecommunications and remote databases. Next, some of the problems associated with the introduction of innovations were outlined. The problem, significance, limitations, and delimitations of the study were also described. Chapter II introduces different types of change and reviews some theoretical models of change. Chapter II also describes resistance to change, some factors of successful change, and the characteristics of an effective change agent. Chapter III includes a summary of the Olympic Data Technology Project and a description of the instruments, data collection procedures, the sample, and statistical procedures used in analyzing the data. Chapter IV presents a method of grouping the theoretical models of change that are introduced in Chapter II, into three processes of change. Chapter IV also presents an interpretation and analysis of the data, and relates these findings to the

three processes of change. Chapter V discusses the findings and makes recommendations for others who wish to increase the probability of successfully implementing an innovation.

CHAPTER II

REVIEW OF THE LITERATURE

There is an overwhelming amount of literature that pertains to innovation and change. Havelock is one author who has written extensively on the topic of innovation and change. While Havelock (1973) cited 56 references on the topic of innovation and change, excluding journal articles, Havelock (1968) included approximately 4000 relevant sources. Another author on the subject, Peters (1986), identified Van Meter (1984) as another bibliographic source that contains 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 this chapter. Although change and innovation can be described from many different conceptual orientations, for this study a decision was made to review only literature which was based on change and innovation at the organizational level.

Although the models of change that are presented in this chapter are similar with respect to their applicability to change at the organizational level, they vary with respect to political, structural, and social orientations, and with respect to the importance of the individual in the change process.

The first section of this chapter outlines the types of change and innovation that can occur within an organization. An overview of some models of the change process is then provided. The third section discusses factors that are important in understanding resistance to change and innovation. The fourth section describes factors of successful implementation, based on the models of change. Finally, the last section identifies important aspects of the change agent during the implementation of an innovation.

Types Of Change

A number of philosophical approaches to the study of change have been posited. 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. Non-rational aspects of an organization include factors such as practices, beliefs, and existing organizational structures. Like Rosenblum and Louis (1981), 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 (1985) 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. In choosing the most satisfactory approach to change, Shears (1987) stated that consideration should be given to the structure of the organization, the management style, the nature of change, and the individuals involved. The authoritative/democratic view of change was also held by Balistreri (1987). He labelled one approach as "philosophical agreement" and the other approach as "by coercion".

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 it 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. Spontaneous change tends to occur quickly and is a response to natural circumstances and random occurrences. This sort of change is sometimes referred to as revolutionary change in the literature.

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 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 (1971) 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. For example, Peters (1986) described the classification developed by Bennis (1966) as "a somewhat involved classification of change" (p. 27). Peters indicated that although Bennis identified eight types of change, the categories of planned and unplanned change were sufficient. The eight classifications described by Bennis (1966) are 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.

Models Of Innovation And Change

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. According to Lozier and Covert, many of the models are based on a dynamic 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 (1982) 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.

The models of change appear to fall into three orientations: political, social, and structural. Although each model generally emphasizes one orientation, they may also have characteristics of the other two orientations. Figure 2 illustrates where some models of change may lie with respect to their relative emphasis of political, social, and structural orientations.

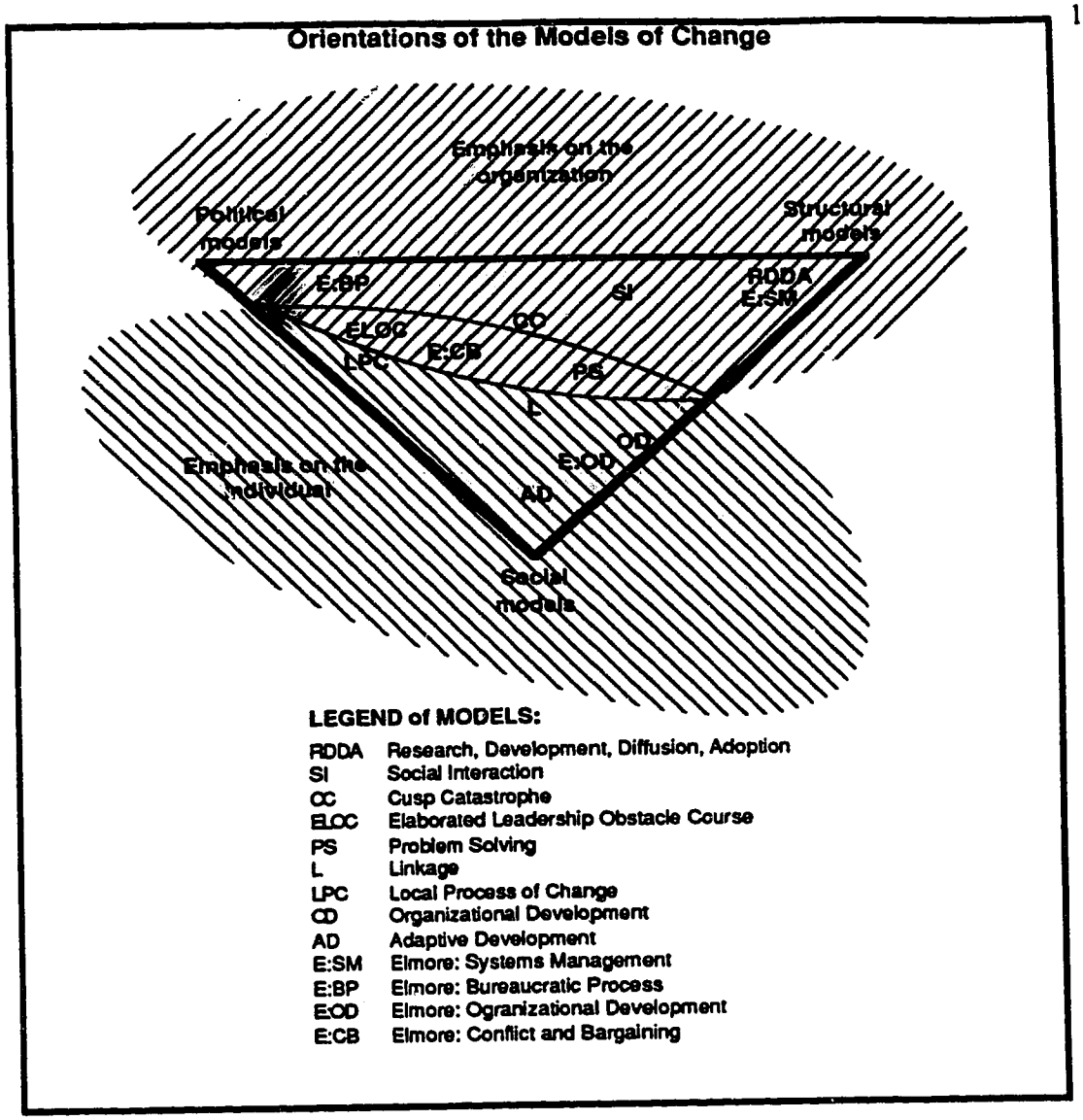


Figure 2. Orientations of the Models of Change

Models of change that emphasize a political orientation, such as the Local Process of Change (LPC) model, appear to view change in terms of the diffusion of information, the persuasion of actors within the organization, and the adaptation of the innovation and the existing organizational structure (Roberts, 1978). Political models appear to be rooted in the view of change, proposed by Rogers and Shoemaker (1971),

which suggests that the change process is dependent on whether the source of the innovation and the awareness of the need for change are externally or internally initiated.

Models of change that accentuate a social orientation, such as the Organizational Development (OD) and Adaptive Development (AD) models, are concerned with effects of the perceptions, fears, needs, and values of the individuals on the change process within the organization (Roberts, 1978). This model type is rooted in the non-rational, limited rationality view of change.

The Research, Development, Diffusion, and Adoption (RDDA) model is an example of a model of change that focuses on a structural orientation, a third orientation. These models are concerned with the effect of the organizational structure on the implementation and adoption of an innovation (Havelock, 1971). The structural model is rooted in the authoritative/democratic view of the change process, which is concerned with the manner in which the innovation is introduced into the organization.

In addition to models of change that tend to emphasize a particular orientation, there are some models of change that consist of sub-models that present various combinations of political, social, and structural orientations. Elmore (1978) proposed a model that consists of four sub-models. Each sub-model presents a unique combination of orientations.

The models, in general, deal with planned change as opposed to evolutionary change, and are usually rooted in the rational view of organizations instead of the natural systems approach, with the exception of the social models. However, it is not possible to evaluate all models on exactly the same basis because each model presents some unique qualities. Therefore each model is first considered separately, and then the

models are compared on some important aspects in a summary (Table 4) presented at the end of this chapter.

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 (1971), 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. The stages are listed below:

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.

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 it 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.

Rogers (1962) noticed that the rate of acceptance of the innovation among members of the social network varied on an individual basis. When he plotted the cumulative percentage of individuals adopting the innovation against time, he discovered an S-curve pattern in which the diffusion of the innovation starts very slowly, followed by rapid diffusion, and again returning to slow diffusion. When addressing the cause for the differential rate of acceptance among individuals of a social structure, Rogers (1962) said:

> The context in which each potential adopter lives is different; his reference groups are different, his perceptions are different, and the norms of the group are interpreted differently by each. Their adopting behavior will, therefore, be different. Not only will their adoption periods be different, but they will also become aware of an innovation at different times. (p. 73)

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 (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. However, a unique characteristic of this model is the recognition that interpersonal relations and

dealing with conflict have an effect on the initiation and implementation stages (Peters, 1986). In addition, 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.

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).

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)

Roberts (1978) reported that Paul (1977) believed that Havelock is widely viewed as responsible for raising the awareness of educators about linkage as a process of change. 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 the internal group. In both the SI and Linkage models, the internal group is rational and actively participates in the development or modification of the innovation and in the change process.

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 (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 model developed by Berman et al. (1977,p. 18):

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 is different from some 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 is 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. Like the LPC model, Mirvis' model has stages that resemble those of the SI model, but the internal group is considered to be non-rational. The LPC and Mirvis models both emphasize implementation and adoption; the change process and the innovation are influenced by the change agent, internal group, and external group. However, the models differ in that the Mirvis' model places less emphasis on the role of the change agent as a linker, and more emphasis on the influence of external groups and factors.

Another noteworthy difference between LPC and Mirvis models is that the process is viewed to be cyclical in the Mirvis model. Lawler, Nadler, and Mirvis (1983) described the implementation and adoption cycle as a dynamic process that starts with program implementation. The next phase is trial adoption. The third phase is an adaptation of the internal group and the innovation. The next phase focuses on an evaluation of the effectiveness of the innovation, and the final phase is institutionalization and diffusion. The process starts again from the first phase. That is, the change process is viewed as being as series of repetitions of the stages of the model. Each successive repetition (cycle) of the stages yields a closer approximation of an effective solution for the organization because the innovation, internal group, and organizational structure are further modified each time through the cycle.

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 (1974) 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). As stated by Elmore (1978), the effectiveness of work groups in an organization is deteriorated because the organizational bureaucracy and routine "...undermine interpersonal competence and group effectiveness, encouraging dependence on and passivity while penalizing openness and risk-taking" (p. 211).

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 and 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.

Elaborated Leadership Obstacle Course Model

The Elaborated Leadership Obstacle Course (ELOC) model is one of many models that focuses on the individual during the change process but it is unique in its concern with the leadership of individuals in the change process. Peters (1986) addressed this issue 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 et al. (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 does not list all the obstacles to innovation that can possibly exist within an organization, but rather it provides a list of the tasks that managers must perform during the change process. Herriott and Gross (1979) summarized the task of management as overcoming staff resistance to change and maintaining conditions that are conducive to implementation.

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. Essentially, the change agent manages the change process.

Cusp Catastrophe Model

Each model of change provides a different perspective of the change process. The Cusp Catastrophe (CC) model is fundamentally rooted in social and political orientations to change and is concerned with the rate of change and the variables effecting the rate of change. The CC model, mathematically developed by John Bigelow, evolved from 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 (1982) 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 the resistance and pressure toward the change, rather than facilitating the adaptation of the innovation, designing change strategies, or acting as a linker for the internal group.

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 in 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 which were described by Lozier and Covert (1982). These factors are emphasized separately in previously mentioned models, but no one model encompasses all five of these aspects. Linkage is also viewed as an important aspect of the change process in the Linkage and LPC models. 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 and 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.

Elmore: Four Distinct Models Of Organizational Change

Elmore (1978) synthesized four models from the many different orientations of innovation and change to assist in the planning and development of strategies for the implementation of an innovation. He stated that "No single model adequately captures the full complexity of the implementation process" (p. 189). His model actually consists of four models (sub-models). All four of his sub-models emphasize the implementation aspect of change.

According to Elmore (1978), the basis of understanding an implementation of an innovation is the comprehension of the structure and function of an organization. "Organizations are simplifiers; they work on problems by breaking them into discrete, manageable tasks and allocating responsibility for those tasks to specialized units. Only by understanding how organizations work can we understand how policies are shaped in the process of implementation" (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. For this reason, Elmore's model contains four models (sub-models). The four sub-models are Systems Management, Bureaucratic Process, Organizational Development, and the Conflict and Bargaining sub-models.

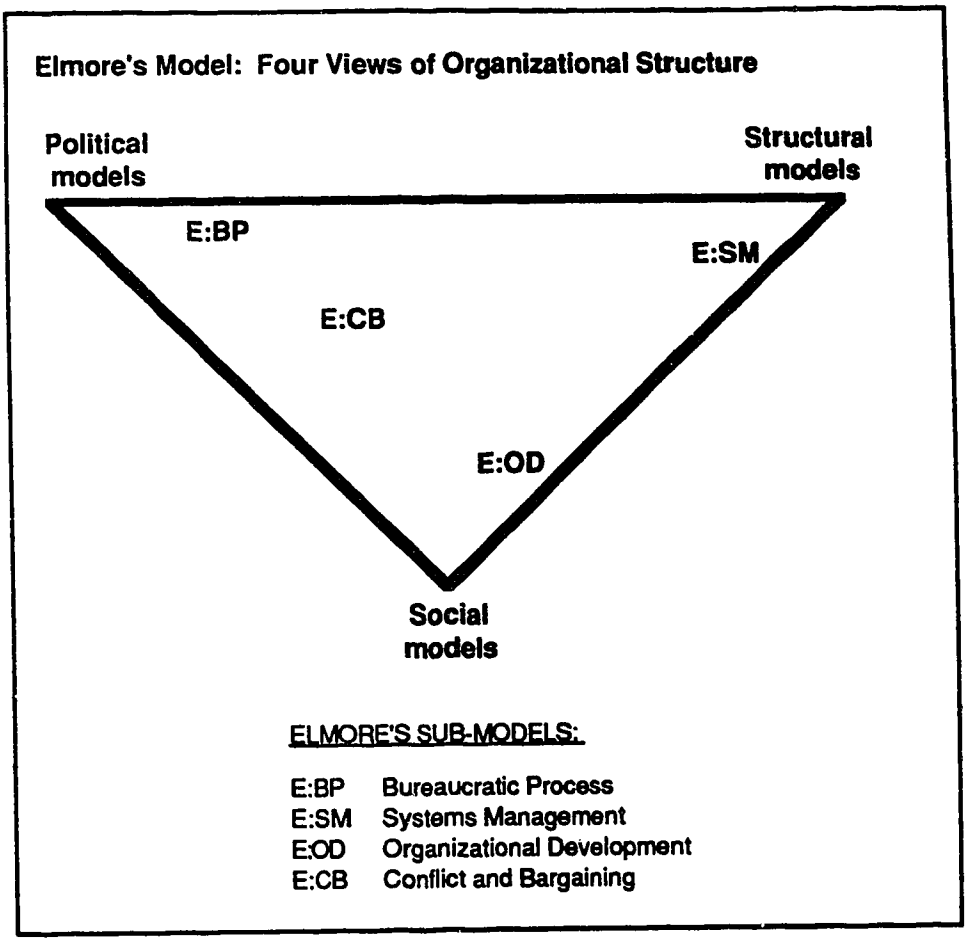


Figure 3. Elmore's Model: Four Views of Organizational Structure

They differ in implementation strategies, since the organizational structure upon which each model is based differs with respect to decision and policy making. Two approaches, the Systems Management and the Bureaucratic Process models, are 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. According to Elmore (1978), "Implementation consists of a complex series of bargained decisions reflecting the preferences and resources of participants." (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. In the Management Systems model, implementation consists of skillful use of management controls to induce implementation and to hold members of the organization accountable for defined standards of performance. Implementation in the Bureaucratic Process model consists of changing work routines of an organization to conform with the the intent of the innovation. In both the Management Systems and Bureaucratic Process models, decisions are made at the top and passed down the organizational hierarchy. In the Organizational Development model, responsibility for the innovation and its implementation is passed to small work groups at lower levels of the organization, and change occurs by consensus. In the Conflict and Bargaining model, implementation occurs without hierarchical control, routine definition, or group consensus. Implementation occurs through a series of "Bargained decisions proceeded by convergence, adjustment, and closure among individuals pursuing essentially independent ends." (Elmore, 1978, p 220). A summary of Elmore's model is presented in Table 1.

Table 1

Summary of Elmore's Model of Change

MODEL (sub-model)	IMPLEMENTATION STRATEGY
Management Systems	• Skillful use of management controls to induce implementation. • Hold members of the organization accountable for defined standards. • Decisions are passed down the organizational hierarchy.
Bureaucratic Process	• Change work routines of an organization to conform with the intent of the organization. • Decisions are passed down the organizational hierarchy.
Organizational Development	• The implementation of an innovation is passed to small work groups. • Change occurs by consensus. • Decision making and control of the change is passed to work groups at lower levels of the organization.
Conflict and Bargaining	• Members of an organization have different goals. • Implementation occurs through a series of bargained decisions among members of an organization. • Decisions are bargained at all levels of an organization.

Elmore (1978) did not profess that any single model is suitable for a particular organization, but rather that each model 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" (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 The Models Of Change

Elmore (1978) claimed "...that models can help analysts and decision-makers distinguish among different kinds of problems" (p. 228). Roberts (1978) pointed out that each model of change was developed for a different purpose in response to different organizational needs. Sieber (1972) argued that each model of change is rooted in a unique image of the practitioner, and consequently is distinct from other models in its approach to change, the influence of internal and external groups, and the role of the change agent. Roberts (1978) suggested that each model has a different view of the change process and, therefore, each model recommends different strategies that are inherent to the philosophical basis of the model. Maguire (1970) cautioned that the orientation of a particular model should be carefully considered when selecting an appropriate model of change for a given situation. Elmore (1978) agreed and said that certain problems are more easily resolved when using one perspective as opposed to another.

Havelock and Havelock (1973) reported that at the Michigan Conference on Educational Change Agent Training, held at Clinton, Michigan in 1970, 50 nationally recognized leaders of research and training on educational change were assembled. The experts at the conference were asked to rank four models of change in order of preference. The Linkage model was ranked first, the PS model next, then the RDDA model, and the SI model was the least preferred. Yet a study conducted by Rand Corporation (Berman et al., 1974, 1975, 1977) concluded that, overall, different management strategies had approximately equal effects on project outcomes (Elmore, 1978). The Rand study evaluated 300 projects funded by the U.S. government to encourage innovation in public schools. The literature is inconclusive with respect to the relative effectiveness of the various models of change. Elmore (1978) warned

practitioners of the difficulty in selecting a particular model when he concludes, "The problem is to understand when certain tools of analysis and strategies of action are likely to pay off and when not" (p. 228).

A comparative summary of the models of change presented in this section is provided in Table 4.

Resistance To Change

The models of change provide us with organized approaches for developing strategies and a means by which to overcome resistance in order to implement change. Although the models vary with regard to their important points of emphasis, all models recognize that some aspect of the organization, the internal or external group, or the innovation, will tend to counter the change efforts. In fact, the ELOC model is based solely on the premise that resistance is inherent in the change process. Herriott and Gross (1979) described the ORC model, the basis of the ELOC model, as positing "...that the success or failure of planned organizational change efforts is basically a function of the ability of management to overcome staff resistance to change that exists just prior to, or at the time of, the introduction of the innovation" (p. 31).

Henson (1987) did not agree that resistance to change is a natural occurrence, as is assumed in the ELOC model, but rather that "Humans have no predisposition to favor the status quo over change. On the contrary, almost everyone prefers excitement to monotony and is eager for some kind of change in their lives" (p. 125). Henson did however recognize that resistance to change is present among members of any organization which is in a state of change, and proceeded to identify the sources of resistance as habit, fear, and hopelessness. Habit causes resistance because habitual actions require less cognitive output and, therefore, are preferred to new, unfamiliar

ones. Fear is the result of an individual's feelings of self-doubt, insecurity, and inadequacy. Hopelessness occurs after implementation of the innovation has begun, and is linked to the frustration of members of the organization due to the lack of support, inadequate training, and insufficient funds and resources.

Earlier efforts to classify the forms of rejection of an innovation are presented in Zaltman et al. (1973). They described a classification framework of rejection proposed by Eicholtz and Rogers (1964). The framework is summarized in table 2:

Table 2

Forms of Rejection (Zaltman et al., 1973, p. 101)

Form Of Rejection	Cause of Rejection	State of Subject
Ignorance	Lack of dissemination	Uniformed
Suspended judgement	Data not logically compelling	Doubtful
Situational compelling	Data not materially	Defensive, deprived
Personal	Data not psychologically compelling	Anxious, guilty, alienated
Experimental	Present or past trials	Convinced

The forms of rejection discussed in Zaltman et al. (1973) and the sources of resistance outlined by Henson (1987) focus on the individual members of the organization. However there are other influential factors, some of which are externally controlled, that can act to impede innovation. Dyer (1984) suggested six sources of resistance to educational change; they are parental attitude, teacher attitude, traditional morality, teacher organizations, bureaucratic structure, and school administrators.

Shears (1987) added to the list of sources of resistance and, like Dyer (1984), includes external forces, but with less emphasis on attitude. Shears suggested the following six major causes of resistance to change in education: (1) lack of a reward structure for implementors, (2) need for stability, (3) suspicion of the motives of the external group, (4) authoritarian personality types who accept direction from only dictatorial leaders, (5) lack of involvement in planning change, and (6) reluctance to release funds.

Esterby-Smith (1987) provided a simplified list of sources of resistance that center on the concept of inertia, or status quo. When commenting on the innovation of teaching methods, Esterby-Smith suggested that resistance evolves from a lack of funding for research and development and restrictive funding, resulting in greater pressure to increase teacher productivity and inertia. Inertia is created by the apprenticeship model of teacher training, (Esterby-Smith, 1987). Esterby-Smith stated that the reason why this is a particularly strong force for inertia, is that individuals have probably been academically successful under a particular set of teaching practices in order to become teachers, and they are not likely to change old teaching methods that seem to have been effective for them.

Rogers and Shoemaker (1971) added yet another factor to consider in the discussion of resistance to change. They described resistance to innovation as a function of position and power within an organization. Those organization members at the top of the hierarchy, the 'power elite', are likely to allow only those innovations that will not detrimentally change their position and power. The 'counter elite', those who have little or no power, often desire innovations that restructure the organization. Rogers and Shoemaker (1971) stated that the power elite resist change by screening out potentially restructuring innovations while allowing the introduction of innovations

which mainly affect the functioning of the system. They explain that the anticipations and perceptions of consequences of the innovation directly effect the change process and the success of implementation.

There are at least as many lists of factors that contribute to resistance during the process of innovation as there are models of change. These factors are summarized in the following seven categories:

1. Need

   This includes not only the needs that are defined by the nature of the problem, but also embodies the perceived needs and consequences of the innovation to the members of the organization. As the need, or perception of need, increases, the resistance to change decreases.

2. Attitudes and Perceptions

   Attitudes and perceptions control the manner in which a particular member of an organization will respond to an innovation. Fear of the unfamiliar, habit, frustration, self-concept, and perceptions about the personal and professional consequences of an innovation are contributing factors in this category. These feelings are shaped by internal and external influences, including implementation strategies. The stronger the negative feelings are toward the innovation, the greater the resistance to change.

3. Support

   Support includes funding, training, and provision of resources. The resistance to change generally varies inversely with the extent to which support is lacking.

4. Communication

   Information about the innovation and the change process should be passed vertically as well as horizontally through the organizational hierarchy, and between internal and external groups. Communication can lower resistance to change because it is important in resolving unfounded perceptions, altering attitudes, and identifying potential problems.

5. Involvement

   The greater the extent to which the internal group is participating in the planning and implementation of the change, the less resistance an innovation is encounters.

6. The Organization

   The structure and practices of the organization can effect change. Rigid bureaucratic structure hinders communication and involvement, and promotes negative attitudes and perceptions. Rank, position, and power may influence the choice of an innovation, the style of implementation strategy, and acceptance or rejection of an innovation. Provision of reward structures within organizations tends to increase the cooperation of the internal group. While a rigid bureaucratic structure increases resistance, reward structures decrease opposition to change.

7. The Innovation

   The more complex and/or less adaptable an innovation, the more one can expect resistance to the innovation during implementation.

Factors For Successful Implementation

Many authors on the topic of change have presented recommendations for successful implementation of an innovation (Adams and Chen, 1981; Hart, 1985; Havelock, 1971; Lozier and Covert, 1982; Morrish, 1976; Zaltman et al., 1973). Most of these recommendations were based on a similar set of factors in the change process, however they vary with respect to the application of these factors to an organization during implementation. These variations are due to the different perspectives inherent in the underlying model of change from which the recommendations were derived.

In general, it appears that the change process is best facilitated by careful planning which includes participation of members of an organization, maximizing the knowledge of participants about the innovation and minimizing the various forms of resistance to the innovation. Hart (1985) provided a general prescription for implementing an innovation. He suggested that the following aspects be considered while developing implementation strategies:

1. Recognize that humans have two basic drives that are important in the change process:
   a) People try to make sense on their world and the relationships in it.
   b) People attempt to expand their degree of control over matters effecting them.
2. Two-way communication.
3. Assign people responsively.
4. Recognize the individual.
5. Maintain a talent bank.

Adams and Chen (1981) provided a general set of guidelines to assist in strategy development. However, their focus, was on the problem and the innovation, rather than on the the people involved in the change process. They suggested that the following aspects are important during the development of successful change strategies:

1. The degree to which the problem is identified.
2. The availability of solutions and the appropriate selection of an innovation.
3. The degree to which the innovation is specified.
4. The adequate trialling and evaluation of the innovation.
5. The provision of conditions that are adequate for implementation of the innovation.

The general guidelines provided by Hart (1985) and Adams and Chen (1981) are useful during the development of implementation strategies. However, specific implementation strategies can be found in the literature. Havelock (1971), Lozier and Covert (1982), Morrish (1976), and Zaltman et al. (1973), provided lists of implementation strategies that are important for the successful implementation of an innovation. Like the general guidelines provided by Hart (1985) and Adams and Chen (1981), the perspective of these implementation strategies is dependent on the model that was used to analyze the change process.

Many authors on the subject of change tended to emphasize the importance of a particular aspect of an organization and/or its members during implementation of an innovation. For example, Mirvis (1983) and Levin (1981) emphasized individual leadership during implementation of an innovation and, although Herriott and Gross (1979) presented similar strategies, they emphasized management rather than an individual leader during implementation of an innovation. Lawler et al. (1983) and

Adams and Chen (1981) largely viewed implementation of an innovation in terms of strategy development, with the former stressing cyclical attributes of the process and the latter emphasizing the initial acceptance and persistence of the innovation. Hart (1985) and Roberts (1978) viewed implementation of an innovation predominantly as a function of the people in the organization. The members of an organization are held to be primary factors in the implementation process. However, Hart (1985) suggested strategies that take into account the perceptions of the internal group while Roberts (1978) placed more emphasis on training and support. Henson (1987) elaborated upon the people of an organization and stressed the importance of developing strategies to contend with habit, fear, and frustration during the implementation of an innovation. Rogers (1962), on the other hand, stated that the degree of success during the implementation of an innovation depends on the attributes of the innovation. He noted that attributes such as the complexity, communicability, trialability, and compatibility with existing structures, have a major effect on the implementation of that innovation.

A synthesis of these various lists of recommendations yields eight important factors that effect the success of implementation of an innovation. These factors are: (1) a clearly defined implementation plan, (2) organizational commitment, (3) leadership, (4) communication, (5) support, (6) involvement, (7) rewards, and (8) the innovation.

There are also two additional considerations which prevail in the literature. These are the role of internal groups during the implementation of an innovation, and the existing organizational structure and conditions. A discussion of the eight factors for the successful implementation of an innovation and of the considerations when developing implementation strategies is found in the following two sections.

Important Factors In The Implementation Of Innovations

There are eight factors that are common to the strategies for the implementation of an innovation found in the literature. These factors should be addressed during the development of implementation strategies, tempered with the considerations mentioned in the previous section.

1. An Implementation Plan

   Rarely is any deliberate goal realized without a structured plan to achieve that goal. During the change process, many aspects of the organization must be coordinated and the efforts of external and internal groups must be focused on a common purpose. Generally, a plan must start with a purpose or focus and a statement of objectives. Also included are implementation strategies, scheduling for incremental change, a statement of organizational commitment, and assurance of the availability of required support and resources. The more clearly the plan is defined, the more successful the implementation of an innovation will be.

2. Organizational Commitment

   Organizational commitment refers to the support and dedication of members of the organization to the implementation and adoption of the proposed change. The commitment must be prevalent in all levels of the organizational hierarchy for successful and complete change to occur.

3. Leadership

   Individuals or groups should be selected from the internal group to lead the implementation of the innovation so that members of the organization can see others succeeding with the innovation.

4. Communication

   Communication is an effective method for increasing knowledge about the innovation in the internal group, and for reducing resistance to change caused by mistrust, fears, and negative perceptions. When the aims of the innovation are clearly understood, anxieties will be reduced and greater cooperation will be realized. Communication, individually and in groups, provides feedback so that implementation strategies can be modified, appropriate support can be made available, and areas of difficulties can be identified. Communication is also a means of linking experts, change agents, and the internal group so that information about the innovation is diffused (Havelock, 1971).

5. Support

   Support is required by members of the organization for the successful implementation of innovation to occur. Support may be required in the form of financial resources, equipment, training, information, and access to experts.

6. Involvement

   When the internal group (users) participate in the development of the innovation and in the planning of the implementation of the innovation, the prospect of successful change is increased. Ownership is a concept presented in the literature to describe the commitment that is established when involvement of the internal group is accommodated in the change process (Hart, 1987; Zaltman et al., 1973).

7. Rewards

   Reward structures in an organization provide incentives for the internal group to adopt the innovation. The initial adoptors (implementors of the innovation) are looked upon positively by other members of the internal group when they are rewarded for their efforts to use and adopt the innovation. This creates a desire in other members of the internal group to conform to the change.

8. The Innovation

   Characteristics of the innovation render it more or less acceptable to the internal group (users). The innovation is less acceptable when it is complex, not adaptable, unreliable, is perceived to be a threat to the autonomy and security of organization members, or is thought to invoke more losses than benefits.

Considerations In Developing Implementation Strategies

There are aspects of the organization or its members that cannot be immediately altered by the change agent or the implementors of an innovation. These aspects must be taken into account when designing strategies for the implementation of an innovation. The following should be considered:

1. The Internal Group

   The internal group of an organization effects the rate of implementation and adoption of an innovation based upon their degree of acceptance and cooperation during the change process. Knowledge of the characteristics of this group will help the change agent to design strategies that will make the innovation more acceptable to the internal group and to reduce resistance to

implementation of the innovation. Essential knowledge of the internal group includes motivational levels, skills and abilities, attitudes, values, and perceptions.

2. Existing Organizational Structure and Conditions

   Characteristics of the organization or institution govern the entire change process. Aspects such as size of the organization, availability of resources, openness to new ideas, and readiness for change, effect the rate of implementation of the innovation and development and modification of the innovation. External factors such as culture and religion also effect the organizational structure and, consequently, the change process.

Some aspects of the change process that were mentioned in the literature have not been included in the considerations listed above. Lozier and Covert (1982) suggested that 'burn out' of organization members should be accounted for by planning to replace those people who are implementing the innovation. They also suggested that it is important to ensure that members of the internal group are made accountable for implementation of the innovation. Henson (1987) noted that time scheduling for implementation of the innovation is a factor of successful change. He warned that implementation should proceed at a moderate pace. Hart (1985) stated that support is essential for the successful implementation of an innovation, but management and experts should stay 'remote' so that the internal group develops ownership of the innovation. He suggested that a 'hand-holder' be made available to assist, upon request, individuals in the organization. This person should have knowledgeable with regard to the innovation and should be a member of the internal group. Havelock (1971) stated that the success of the implementation of an innovation can be improved

when the internal group is proximal to the source of the innovation and when the internal group is repeatedly exposed to the innovation. Two unique suggestions by Adams and Chen (1981) were that too much rhetoric used in describing the innovation and improper negotiation protocol are impediments to successful implementation. Mirvis (1983) pointed out that consideration should be given to the previous experiences of the internal group with innovations, and the time and energy output of the implementors or leaders as important factors in the implementation and adoption of innovations.

It is important to be mindful that specific strategies may not apply to all circumstances in which an innovation is implemented, and that it is important to select those implementation strategies which will best suit the innovation, organizational structure, and members of the organization.

The Change Agent

The change agent is either an individual or an agency that facilitates the implementation and adoption of an innovation. The change agent can come from an internal or an external source and performs a vital role in the change process, except in the LPC model, in which a change agent is optional.

Role Of The Change Agent

The various models of change have outlined different roles for the change agent in the change process. In the RDDA, SI, and LPC models the change agent is an expert who provides training and information. However, in the OD and PS models the agent acts as a consultant or human relations expert and the solutions come from within the organization. The change agent is a linker in the Linkage model. A linker provides the

internal group with access to relevant information and experts, and promotes communication between internal and external groups. Havelock (1973) summarized the various roles of a change agent (Table 3).

Table 3

Various Roles of the Change Agent

Role of Change Agent	Function of Change Agent
A Catalyst	To upset the status quo and initiate the problem solving process.
A Solution Giver	To provide solutions and help the client to adapt these solutions to his needs.
A Process Helper	To recognize needs, diagnose the problem, acquire resources, select solutions, adapt solutions, and to evaluate solutions.
A Resource Linker	To bring together people and resources from inside and outside the system to solve the problem.

Havelock (1973) noted that the four roles of a change agent are not mutually exclusive and the specific role of the agent will be defined by the needs of the organization and the nature of the innovation.

Rogers and Shoemaker (1971) suggested only one role for the change agent. They proposed that the change agent is a link between two social systems. The change

agency (external group), and the client system (organization), are the social systems that are linked through the change agent. They stated that seven specific tasks of the change agent are to:

1. Develop the need for change.
2. Establish a relationship with the clients.
3. Diagnose the problem.
4. Create intent to change.
5. Translate intent into action.
6. Achieve a terminal relationship in order to ensure continuance of the innovation without the presence of the change agent.

Another role for change agents is to provide leadership in the change process; the leadership comes from 'leaders' and 'fixers' (Levin, 1981). Leaders, because of individual characteristics and personality, are able to motivate change and gain support for the innovation. Fixers, on the other hand, are task-oriented individuals who relate to others in an instrumental way during the implementation process.

Numerous roles of the change agent were described in this section. The role that the change agent plays during the implementation of an innovation depends on the organization, the innovation, the internal group, and his/her own convictions.

Characteristics Of A Change Agent

Although Rogers and Shoemaker (1971) stated that a change agent often possesses slightly higher social status or is more technically competent than the followers, Havelock (1973) noted that the hierarchical position of a change agent in an

organization is not important, and that the agent may be either external or internal to the organization.

Rogers (1962) made the point that the qualities of the change agent are important to the success of the change process. He cited a study conducted by Nye (1952) in which Nye statistically accounted for 63 percent of the variance of rated success among change agents observed in the study. Nye measured and ranked five variables of the change agent. They were: (1) personality of the change agent accounted for 28 percent of the variance and was ranked as the highest contributor to the varying degrees of success, (2) training of the change agent accounted for 15 percent of the variance, (3) vocational interests contributed 11 percent of the variance, (4) attitudes of the change agent accounted for 9 percent, and (5) learning ability of the change agent made no contribution to the variance of success of implementation of an innovation.

Innovators are often the change agents involved in the change process. Morrish (1976) described the specific qualities of innovators as outlined by Rogers (1965). These generalizations are listed below (Morrish,1976):

1. Innovators are generally young.
2. Innovators have relatively high social status.
3. Interpersonal and cosmopolite sources of information are important to innovators.
4. Innovators are cosmopolite and therefore they travel and relate outside their system.
5. Innovators exercise opinion leadership and therefore they influence others.
6. Innovators are viewed as deviants by their peers and by themselves.

The qualities described by Morrish (1976) emphasize the social and professional networks to which the innovator (change agent) belongs. However, the description provided by Balistreri (1987) accentuates the personal qualities of the change agent. The general qualities of change agents suggested by Balistreri are:

1. The vision to see beyond the present.
2. Capable of conceptualizing needed changes.
3. Dedication to an idea.
4. Energy and persistence to pursue an idea.
5. Knowledgeable about the issues, elements and factors associated with the proposed change.
6. Analytical and objective in his/her thinking.
7. Positive attitude toward change as well as the potentials for change.

Since change agents may assume different roles, depending on the organization and the nature of the innovation, and since there are many different models of change that may be employed in the implementation and adoption of an innovation, it is likely that the qualities of the change agent will vary with the particular circumstance. However, it is also likely that the qualities of change agents as described by Morrish (1976) and Balistreri (1987) recur in various combinations.

Summary

In this chapter, literature relating to five aspects of change was reviewed. First, various types of change were described. Then models that emerged from the conceptualization of types of change were described. Although the models are not entirely conceptually discrete or separate from each other, they provide a basis for an

analytical approach to the process of change. The models provide different orientations and emphasize different aspects of change. Finally, literature relating to the resistance to change, implementation of an innovation, and the change agent was reviewed.

It is clear from the various perspectives and various models of change found in the literature, that no single model or set of rules can adequately prescribe a formula that will successfully implement innovations in every circumstance. Peters (1986) provided a quote taken from Herriott and Gross (1979) that best summarizes the utility of the models and other literature pertaining to the change process:

> ... whether based on case studies or sample surveys, do not and cannot provide a set of precise rules or specifications for the management of educational change efforts. This statement, however, should not be interpreted as implying such investigations are of little value to the educational practitioner. Quite the contrary; studies of this kind can be of great importance and utility to men and women who manage educational innovations because they offer them fresh perspectives, sensitize them to types of variables which otherwise might easily be ignored, and suggest functional ways of conceptualizing the change process. (p 40)

Table 4: Summary of Aspects of the 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 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	??	??	??

CHAPTER III

METHODOLOGY

The central focus of the present study is a formative evaluation of the implementation of a relatively new technology to Alberta schools. This was accomplished through a project known as the Olympic Data Technology Project. Aspects of the project were already underway when this study was initiated. The major parameters governing the Olympic Data Technology Project were not under the control of this researcher. Therefore, this study falls largely into the category of operational research and its purpose is primarily exploratory and formative.

The project was initiated in late 1987. The project Organizing Committee had little time to plan and coordinate the project before the commencement of the XV Winter Olympic Games. The XV Winter Olympic Games were scheduled from February 14, 1988 to February 28, 1988 (15 consecutive days). In spite of the short lead time the project was fully operational throughout the Winter Olympics, and the project ended two weeks after the finish of the Winter Olympics on March 14, 1988 (see Figure 4).

The Focus Of This Study: The Olympic Data Technology Project

Seldom does a large scale educational innovation coincide with a high profile event such as the Winter Olympic Games which were held in Calgary, Alberta, in February, 1988. The Olympic Data Technology Project was such an endeavor. This project was a result of inter-agency cooperation among government, education, and private sector agencies. More specifically, the major participants were Alberta Education, Alberta Government Telephones (AGT), University of Alberta (U of A), Calgary Board of Education (CBE), and a number of Alberta school districts. Data pertaining to the

Winter Olympic Games were furnished for use in the Project through the cooperation of International Business Machines Canada Limited (IBM), the Calgary Olympic Organizing Committee (OCO) and AGT. The Olympic Data Technology Project provided schools in the project, which were geographically located throughout

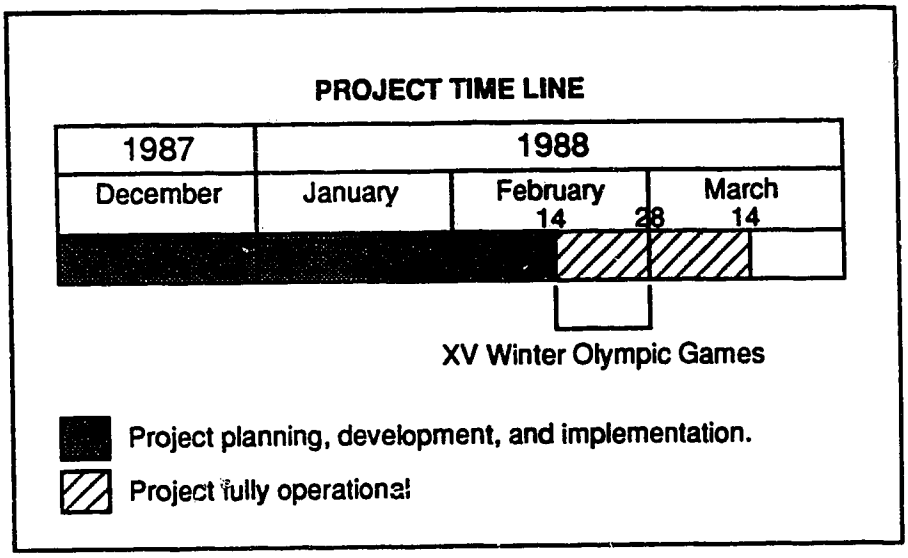


Figure 4. Time Line of the Project

the province of Alberta, with access to data that were extracted from the Winter Olympic Info '88 computer system and other related databases. The Winter Olympic Info '88 computer system was used to tabulate the results of the XV Winter Olympic Games. The games were held in Calgary from February 14 to February 28, 1988. The specifics of the computer and telecommunications systems used in the project are described in Appendix A. The project provided an opportunity to evaluate a variety of factors related to implementing telecommunications in 26 schools, to evaluate the effectiveness of inter-agency cooperation to realize the goals of this project, and to

examine the effect of associating such a project with a high profile international event, the Winter Olympic Games.

A number of variables associated with the Olympic Data Technology Project were evaluated and the findings were discussed in relation to theoretical models of innovation and change, and factors of successful implementation of an innovation. The theoretical models outline methods that can be used to develop strategies to facilitate successful implementation and eventual adoption of innovations. During the Olympic Data Technology Project, two components of information technologies, databases and telecommunications, were implemented in 26 Alberta schools. The Project focussed upon the implementation stage of an innovation. Thus only the initial stages of the theoretical models regarding innovation implementation are applicable to this study.

Purpose Of Project

The main goal of the Olympic Data Technology Project was to develop a process by which students and teachers in 26 selected schools situated in many areas of Alberta could electronically access and share information about the XV Winter Olympics to facilitate educational objectives, to enhance learning by students, and to provide an impetus for the creation of "high-tech" classrooms.

Project Description

The project was the result of the cooperative effort of government, education, and private sector agencies. Some Alberta school districts were asked to participate in the project and through these districts, 26 Alberta schools were selected as the project schools. A software system was developed by AGT which allowed teachers and students of the project schools, using telecommunications, to query a specially designed database, to utilize electronic messaging among the project schools, and to

access an electronic bulletin board containing information posted by other project schools. The database contained the results of Olympic events which were extracted from the Winter Olympic Info '88 system in Calgary, and some information relating to participating athletes and countries.

A teacher from each of the project schools was selected as a school-based project coordinator. The coordinators of the project schools were introduced to the concept of the project, and were provided with in-service training, which included the use of a database and hands-on practice using a VT-100 terminal. The coordinators, in turn, oriented and trained the staff and students of their respective schools.

After February 1, 1988, the project schools were allowed to access the database provided by AGT and to use the messaging and bulletin board features provided by AGT's system. This period (two weeks) provided time for the teachers and students of the project schools to practice using AGT's system, and the computer equipment in the school, prior to the commencement of the Winter Olympic Games on February 14, 1988. The project was in full operation during the Winter Olympic Games, from February 14 to February 28, 1988 (15 consecutive days). The computing system which was operated by AGT remained active and accessible by the project schools until March 14, 1988, at which time the links from the schools to the AGT computer were disconnected (see Figure 4).

In addition to access to AGT's computing system, the project schools were also provided access to INET 2000, a database/messaging/bulletin board system. The access to INET was provided at no cost to the schools, courtesy of AGT, for the period of January 1, 1988 to June 3, 1988.

The Project Committee

The project was overseen by a planning committee composed of representatives from AGT, Alberta Education, U of A, CBE, OCO, and IBM. This committee was responsible for establishing the technical specifications, scheduling, implementation procedures, and selection of school districts for participation in the project.

Inter-Agency Cooperation

The Olympic Data Technology Project was made possible as a result of the joint efforts of Alberta Education, AGT, U of A, CBE, and the participating school districts. The project was facilitated by the cooperation of IBM and OCO. Much of the success of the project was attributable to the cooperation among these agencies of the Alberta Government, education, and the private sector.

Roles Of Participating Agencies

The roles and responsibilities of each participating agency were as follows:

1. Olympic Organizing Committee (OCO)

   The OCO committee approved the release of selected data to the Olympic Data Technology Project.

2. International Business Machines Canada Limited (IBM)

   IBM, while under contract to OCO to create and coordinate the "Info '88" database, provided liaison to the project and some technical support.

3. Alberta Government Telephones (AGT)

   AGT was the host of the database service and provided dedicated manpower support for planning and technical implementation. AGT

provided the liaison between OCO and IBM for system development.

4. Alberta Education

   The department provided liaison with the participating schools and communicated project requirements to in-school coordinators.

5. Calgary Board of Education (CBE)

   CBE was responsible for identifying the specification for the contents of the database and the planning of student activities. Lord Beaverbrook High School provided the student-designed database (athlete biographies and other information relating to the Olympics) and data input.

6. University of Alberta (U of A)

   The University provided the coordination of activities that related to the Olympic Data Technology Project within four schools from the Othello Project. Telecommunications equipment was provided to AGT. The University conducted the project evaluation.

7. School Districts

   The participating school districts implemented the project at the local level.

8. Project Management Committee

   The Project Management Committee provided the overall direction and guidance for the project.

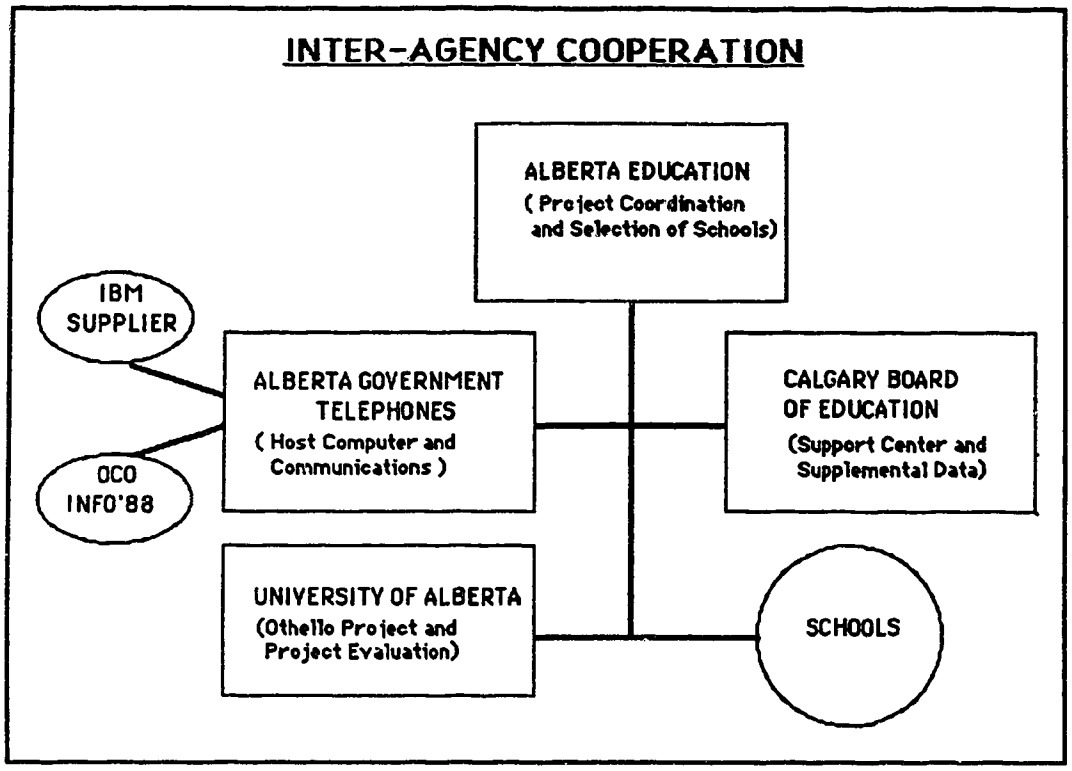


Figure 5. Roles of Participating Agencies

Technical Specifications

Microcomputers in the project schools were linked via standard telephone lines to AGT's IBM 9370 host computer by using a modem, telecommunications software, and a toll free 800 long distance telephone number. Of the 21 project schools that responded to the Post Games questionnaire, 13 schools had to acquire modems in order to participate in the project (item #16 of the Post Games questionnaire). The host computer contained specially designed software to support the use of the system by the students and teachers of the project schools, and to store the data files which the students could access. The database which was stored on the host computer came from three different sources. The major input came from the OCO's INFO '88 information system. An IBM 3270 PC which was linked to both the INFO '88 system and to the

host computer, through a toggle switch, regulated data transmission between these two systems. Data were transferred from the INFO '88 system to the IBM 3270 PC, and then to the AGT host computer. The PC was used to interrogate the INFO '88 system in the same way as was done by other OCO accredited users. The IBM 3270 PC transferred the results of the interrogations as data screens to the host computer.

The second source of information was the Calgary Board of Education. Students from Lord Beaverbrook High School obtained supplemental data relating to the Olympics and input the information into the AGT host computer. Some of the topics which were stored included biographies of past Canadian Olympic medal winners, information about participating countries, and information about social functions for the athletes during the Games.

The third source of information was provided by the users from the project schools who wished to share information of interest with others by means of an electronic bulletin board or messaging system.

The telecommunications controller which was provided by the U of A, was another component of the system. The telecommunications controller allowed a maximum of 25 users to simultaneously access the host computer.

For a more complete explanation of the system, refer to Appendix A. The information in Appendix A was extracted from the technical documentation provided by AGT. Included is a schematic of the system layout, screen types, parameters for the modem, log-on procedures, a list of included sporting events, and examples of screens from the database.

Research Design

The intent of this research project was to observe and document, in an evaluative manner, the implementation and use of computerized telecommunications and databases in 26 Alberta schools during the Olympic Data Technology Project. Because of the relatively recent introduction of telecommunications technology into Alberta schools and the diversity of schools involved in the Olympic Data Technology Project, there were no available research models upon which to base this study. Borg and Gall (1983) defined this type of research as *responsive evaluation* and state that:

> Unlike the other types of evaluation research...responsive evaluators do not specify a research design at the outset of their work. Instead, responsive evaluators use emergent designs, meaning that the design of the research changes as the evaluator gains new insights into the concerns and issues of the stakeholders. (p. 765)

Due to time limitations, implementation occurred almost simultaneously with planning during the Project. A committee of experts, known as the Evaluation Committee, determined the evaluation criteria and techniques, in response to the ongoing activities of the project and the apparent needs of the participating agencies.

The Instruments

In each project school, a teacher was appointed to coordinate the project within the school. Data were collected from the coordinators using four questionnaires: a Pre-Games questionnaire which was distributed prior to the Winter Games, two Post Games questionnaires which were issued shortly after the Winter Games were completed, and an Impact Assessment questionnaire which was distributed one year after the project had concluded. Although the coordinators were not asked to place their names on the questionnaires, the school names were obtained.

Before the Winter Games commenced, a Pre-Games questionnaire was sent to the coordinator at each of the 26 project schools. The questionnaire was designed to estimate the coordinator's level of computer knowledge and telecommunications expertise, to collect facts about each school, and to establish expectations the coordinators held concerning the project.

One of the Post-Games questionnaires was completed by the project schools coordinators immediately after the Winter Olympics were concluded. A Post Games Addendum was sent to the project schools following return of the Post Games questionnaire. The purpose of these questionnaires was to assess any changes in telecommunications activity within participating schools, and to determine the nature of difficulties experienced during the project.

In addition to the 26 schools selected to participate in the project, an attempt was made to match each of the project schools with a cohort school. The cohort schools were selected on the basis of the similarity of locality, size of student population, and grade levels. A questionnaire which matched the Pre-Games questionnaire was distributed to the cohort schools. The intent of the questionnaire was to establish a reference level of telecommunications activity in similar schools to those which participated in the project. However, the attempt to establish a base-level of information from the cohort schools was unsuccessful; these schools generally did not respond to the questionnaire. This may have been due to the fact that they were not actively using telecommunications or databases.

On March 13, 1989, one year after the completion of the Olympic Data Technology Project, the project schools were sent an Impact Assessment questionnaire. The purpose of the questionnaire was to establish the extent to which the project

schools were still using remote databases and telecommunications. Copies of the questionnaires are included in Appendix B.

1. Development Of The Instruments

A major consideration relating to instrumentation was the limited time frame within which the instruments were to be developed. The Olympic Data Technology Project was already near the implementation stage when this study was initiated. Instruments had to be developed quickly to facilitate data collection at appropriate times throughout the project. The time constraints were too limiting to establish the reliability and validity of the instruments. However, an Evaluation Committee, consisting of experts, provided input and constructive feedback during instrument development.

In all, five questionnaires and covering letters were developed. Development of the questionnaires was guided by five factors.

1. Meetings with members of the Olympic Data Technology Project Organizing Committee provided information regarding the purpose of the undertaking, the agencies involved, and project scheduling. This information was important in establishing the number of instruments needed and the time lines to be followed for the distribution of the questionnaires.
2. Discussions with coordinators of the project schools revealed both positive and negative aspects of the project and its implementation. These aspects were acknowledged during the design of questionnaire items.
3. The categorical basis upon which items for the questionnaire were developed provided a blueprint for the overall design and focus of the instruments. These categories are (a) knowledge of the coordinators, (b) utilization of telecommunications and databases in the project schools, (c) documentation for

the use of software, (d) in-service training and support, (e) the project start-up, and (f) computer equipment and modems used in the schools during the project.

4. Borg and Gall (1983) made format recommendations for the development of questionnaires. The following recommendations were given consideration during development of the instruments:
   a) Use colored paper to make the questionnaire attractive. This also provided color coding to quickly distinguish between the five questionnaires.
   b) Organize and lay out questions so that the questionnaire can be easily completed.
   c) Number the questionnaire items and pages.
   d) Include brief, clear instructions, printed in bold type.
   e) Group similar questionnaire items and organize these in a logical sequence.
   f) Begin the questionnaire with non-threatening items.
   g) Short items are preferable to long items.
5. The four member Evaluation Committee was comprised of representatives of AGT, Alberta Education, the U of A, and a project school in the Edmonton Catholic School District. The Committee's review of the questionnaires during the development phase was important to the overall design and validation of these instruments.

2. Organization Of The Instruments

The items of the questionnaires focussed on several areas. The first section of the Pre-Games questionnaire was designed to establish the knowledge level of each project school coordinator, and other teachers in the project schools, with respect to databases and telecommunications. The second section assessed the extent to which the coordinators had expected the database and telecommunications system to be used in

their schools. The third section obtained factual information that related to the project school, and the fourth section allowed opened-ended responses regarding problems and interesting features that were encountered during the project, prior to the commencement of the Winter Olympics. The questionaire sent to the cohort schools (Computer Utilization Survey) was similar to the Pre-Games questionnaire.

Many of the items on the Post-Games survey were matched to items on the Pre-Games questionnaire. One section of the questionnaire collected information about the actual use of telecommunications and databases, so that this information could be compared to the expectations of the coordinators as obtained from the Pre-Games survey. Another section of the questionnaire required open-ended responses that related to features and difficulties experienced during the project, so that these could be compared to similar information collected on Pre-Games survey. Other groups of items were designed to collect data that related to the expected future use of telecommunications in the school, the value of having associated the project with the Winter Olympic Games, and the types of hardware and software that were used at the different project schools.

The purpose of the Post Games Addendum was to obtain information about the adequacy of the in-service training and the software documentation provided during the project. The Addendum also collected suggestions for improving the implementation of telecommunications.

The Impact Assessment questionnaire was distributed one year after the project had concluded. The purpose of the items on this questionnaire was to establish the extent to which the project schools were still using telecommunications and remote databases.

The questionnaires consisted of several question formats: 'Likert scale' items that had a response scale that ranged from 1 to 5 (where 1 represented 'Not At All' and the 5 represented 'Very Much'), 'Yes' or 'No' response items, and some open-ended response items. In addition, the Post-Games questionnaire also contained a few questions that required the respondents to enter percentage values.

Description Of The Sample

The sample for this study consisted of 26 Alberta schools.

1. Selection Of The Sample

The participating school districts were selected by the Organizing Committee of the Olympic Data Technology Project. A letter was sent to each school district asking them to participate in the project. These school districts then selected a school from within their respective districts to become involved in the project. The method or criteria by which the school districts selected schools to participate in the project is not known. However, it is most probable that the project schools were selected on the basis of the availability of computer expertise, computer equipment, and modems within the schools.

The 26 school sample of Alberta schools did not represent a random sample. The sample was arbitrarily selected, and the sample was not evenly stratified by grade level, by geographical location, or by urban/rural classification. It was also apparent that there were more Calgary schools in the sample, than from any other locality. A complete list of the schools in the sample and their locations is included in Appendix C.

2. Distribution Of The Questionnaire

All five of the questionnaires used in this study were distributed and collected by representatives of Alberta Education. This procedure was necessary due to the large number of participating school districts, and the protocol that was required to obtain permission from each school district for inclusion the project school in this study.

The questionnaires were delivered to Alberta Education where a covering letter from that department was attached. The questionnaires were then mailed to the project schools.

Statistical Procedures And Analysis

The responses to items on the questionnaires were either Likert scale integers that ranged from 1 to 5, 'Yes' or 'No' responses, percentages that were estimated by the respondents, or responses to open-ended questions. Borg and Gall (1983) stated that in cases where the data are categorical in nature, frequency analysis provides a suitable method of representing the data. Therefore, frequencies and/or percentages were used to summarize the responses of the open-ended questionnaire items, and mean frequency values were calculated for items where the responses were of the Likert scale format. Mean values were also calculated for items where the responses were coordinator estimated percentages.

Although a factor analysis procedure was performed, the results were not statistically reliable because of the low power of the analysis due to the small number of sample schools.

CHAPTER IV

ANALYSIS AND PRESENTATION OF RESULTS

This chapter is divided into four sections. The first section provides an explanation of how the various models of change can be grouped into three categories (or processes), and how these categories can be related to each other. The second section provides a summary of the questionnaire response rate. In the third section, the success of the project implementation strategies is considered with respect to the processes of change which were derived from the models of change. The fourth section relates those aspects of change that appeared to be important in the Olympic Data Technology Project and also in the categories (processes) of change.

Categorization Of Models Of Change

The various models of change have many similarities. However, when attempting to apply the models to actual situations it was advantageous to consider the models in broad categories rather than as individual models. Table 4 (Chapter II) lists the models according to their similarities, and gives the characteristics of each model. This table formed the basis for grouping the individual models of change into categories of change.

Categories

Three categories of models of change were derived when the models were compared according to the following characteristics: control of the change, communication within the organization, the innovation, the role of the internal group, and the role of the external group. The three categories, autocratic, bureaucratic, and adhocratic, are depicted in Figure 6 and can be thought of as processes of change:

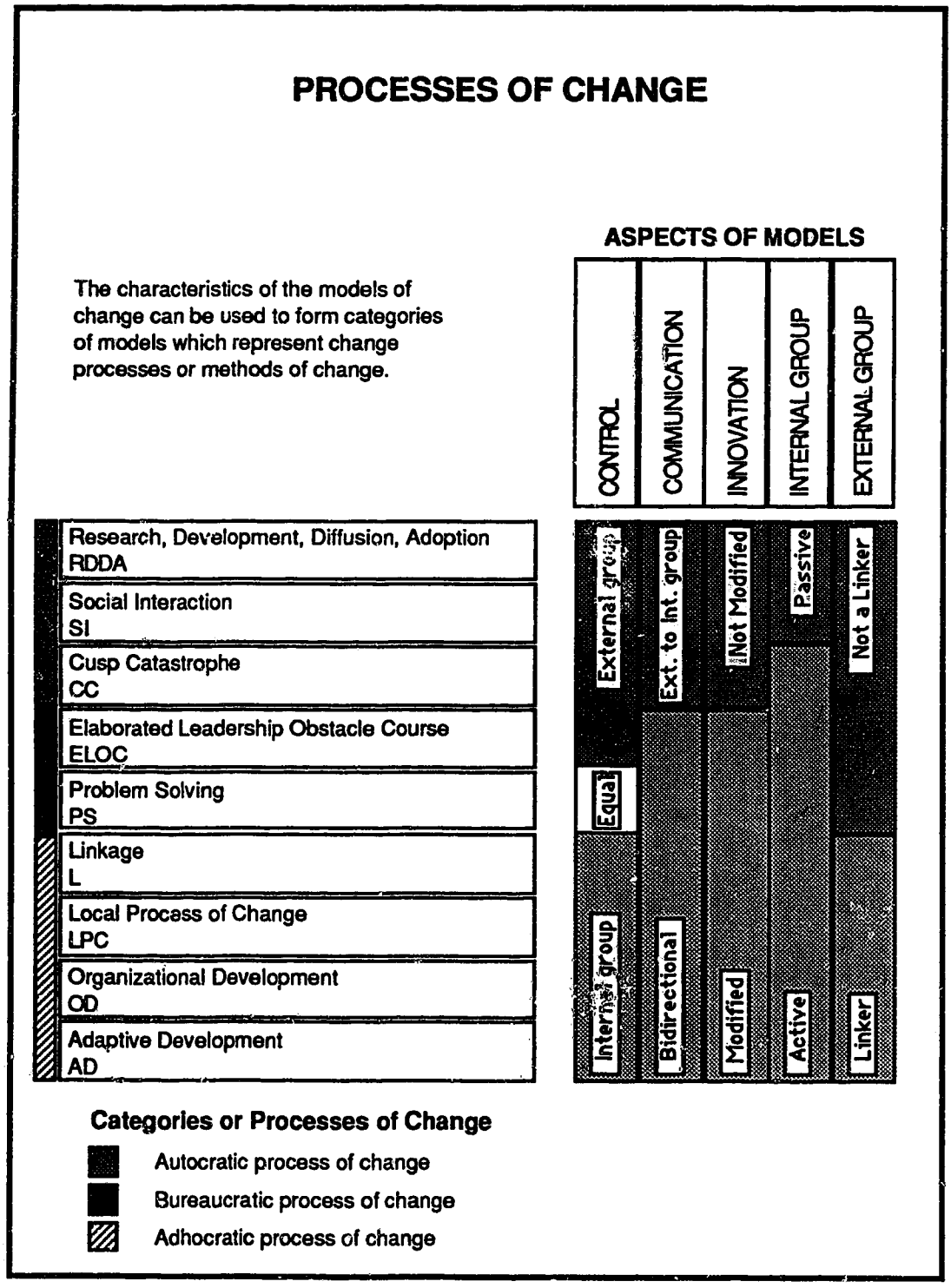


Figure 6. Processes of Change

The characteristics of the models are explained in detail in Chapter II. Below are definitions of the characteristics of the models of change:

Control: This refers to the group that controls the change process. Two groups are referenced; internal group and external group. The external group can be either management (Administration), depending on the organizational structure, or a group outside of the organization. The internal group consists of the persons within the organization that use the innovation and is directly effected by the implementation process.

Communication: Communication refers to the direction of information flow in an organization. External to internal communication is an information flow that moves hierarchically downward from management, or from a group outside the organization, such as consultants, to the internal group. This type of communication is typically unidirectional, or 'top-down'. Bi-directional communication allows information to flow both up and down the hierarchy, and also into and out of the organization.

Innovation: The innovation is the thing or process that is being implemented. If the innovation is not modified, then it is accepted and adopted exactly as provided by the external group. If the innovation is modified, then it has been changed by either the external and/or internal groups, to better meet the needs of the internal group and the organization.

Internal Group: The internal group is the group within the organization that uses the innovation and is most effected by the innovation. If the internal group is generally passive, then this group does not have much control or involvement in the development

or modification of the innovation or the change process. Conversely, if the internal group is active, then the group tends to participate in the change process, but not necessarily in the development or modification of the innovation. The internal group is typically less involved in the change process and the development of the innovation in the autocratic process of change than in the bureaucratic process of change. The internal group tends to be most involved in the adhocratic process of change.

External Group: Depending on the structure of the organization, the external group refers to either management or a group from outside of the organization. Regardless of whether the external group comes from within or from outside of the organization, the external group can perform two different functions in the change process: consultant, or linker. If the external group operates in a consultative fashion, it provides the internal group with the innovation and directs the process of change. The internal group passively accepts the innovation and begins implementation of the innovation according to the directions of the external group. When the external group acts as a linker (or facilitator), it provides the information and expertise that the internal group requests. The internal group develops or modifies the innovation, and controls the process of change.

Each category reflects a particular organizational structure and each requires that external and internal groups fulfill specific roles during the change process. In this way, the categories may be thought of as processes of change. For example, in the autocratic process of change, either an individual or a small group at the top of the hierarchical organizational structure maintains control. The communication of ideas and information moves unidirectionally from the top of the hierarchy down to the internal group. When communication is directed downward, the internal group at the bottom of

the hierarchy has little effect on the innovation or the change process. In such circumstances, the internal group is considered mainly passive and the innovation is not modified during implementation. The external group usually provides the internal group with the innovation and always directs the change process. The process of change cannot be considered cyclical in nature because the innovation is not modified. Autocratic change is characterized by the external group controlling the change process and communication following an external to internal ('top-down') pattern.

The second category or process of change is called bureaucratic change. In this category, change may be externally controlled or control may be equally shared by the internal and external groups. This category reflects an atmosphere where communication is bi-directional and the internal group can have an effect on the implementation of the innovation. Often the innovation is modified, to fulfill the needs of both the organization and the internal group. However, the external group, although accepting feedback and suggestions from the internal group, still possess unique knowledge pertaining to the innovation and, therefore, performs a consultative role. The external group is mainly responsible for directing implementation and change. In this category of change the process of change is more flexible and dynamic than in the autocratic process and, unlike autocratic change, it can be cyclical in orientation. This type of change is different from autocratic change in that communication is bi-directional, the internal group is active in the change process, and the innovation is modified.

The last category in which the models of change can be grouped is the adhocratic process of change. Adhocratic organizations are described by Robbins and Stuart-Kotze (1986). In the adhocratic process of change, the internal group has more knowledge about the needs of the organization and the type of innovation required than

does the external group. In this category, the external group functions as a linker. The linker provides the internal group with the equipment, the information, and the expertise required to compliment the skills of the internal group during the development or modification of the innovation and during the implementation of the innovation. Therefore the internal group has more control in the change process than does the external group and is far more active in the change process than is the internal group in the bureaucratic process of change. As is the case in the bureaucratic process, communication and information flow is bi-directional within the organization and the innovation can be modified. The adhocratic process of change differs from the other two processes of change because the extra knowledge possessed by the internal group gives it greater control over the development and the implementation of the innovation. The role of the external group becomes that of a linker rather than a consultant or administrator.

Table 5 provides a summary of the characteristics of the processes (or categories) of change. Characteristics that are used to distinguish the category or process are printed in outline type instead of normal type.

Table 5

Characteristics of the Processes of Change

Characteristics	Process of Change		
	Autocratic	Bureaucratic	Adhocratic
control of change	**external group**	External or equal	**Internal**
communication	**external to internal**	**bi-directional**	bi-directional
innovation	not modified	**modified**	modified
role of internal group	mainly passive	**active**	active
role of external group	consultant or director	consultant or director	**linker**

NOTE: Characteristics that are printed in outline type make that particular process distinctive from the other processes of change.

Generalization

Several generalizations can be made regarding the processes of change (T[illegible] [illegible]hocratic process of change where the internal group has more [illegible]ge process than the external group, the internal group is active, [illegible]-directional, the innovation is modified, the process can be cyclical [illegible]rnal group performs the role of a linker. These characteristics [illegible]he internal group has more knowledge about the innovation than [illegible] group, the internal group is more likely to be actively involved in the change process. The increased involvement of the internal group will promote more communication between the internal and external groups. The increased upward movement of information and ideas from the internal group to the external group will increase the influence that the internal group has on the innovation and the change process. However, the internal group typically uses the innovation whereas the external

group typically does not. Consequently the internal group may more easily recognize the deficiencies of the innovation or its implementation than the external group, and is therefore more likely to suggest modification of the innovation or its implementation. In this manner, the internal group exerts greater control over the change process than the external group. When the performance of the internal group is sufficient to control the change process, the external group is more likely to act as a linker rather than a consultant or director. However, the adhocratic process of change actively involves more people in the development of the innovation and in the implementation of the innovation than in the autocratic process. Therefore the adhocratic process of change is slower than that of the autocratic or bureaucratic processes, and the change process might be thought of as an evolutionary process as opposed to a revolutionary process.

The autocratic process of change characteristically possesses aspects that are quite different from those of the adhocratic process of change (Table 5). In the autocratic process, the internal group is typically not actively involved in the change process. This may occur because of either the limitations imposed by the organizational structure, or a prevailing lack of knowledge or concern about the innovation in the internal group. Regardless of the reason for the decreased involvement of the internal group, information and ideas tend to move unidirectionally from the external group to the internal group. Therefore, in the autocratic process of change the development of the innovation and the implementation of the innovation is primarily the responsibility of the external group. The external group must provide solutions and direction to the internal group in a consultative manner. However, the external group may not be aware of the effectiveness of the innovation since this group usually does not use the innovation. In addition, communication tends to be downwardly unidirectional in the autocratic process and information pertaining to the adequacy of the innovation or the

implementation of the innovation tends not to be communicated to the external group from the internal group. Therefore, in the autocratic process of change the innovation is typically not modified and the change process tends not to be cyclical in nature. Since the development of the innovation in the autocratic process of change involves only a few people of the organization, the change process tends to be faster than the in the adhocratic process of change, and the change process may sometimes be thought of as a revolutionary process as opposed to an evolutionary process.

The bureaucratic process of change has characteristics that are transitional between autocratic and adhocratic processes of change. The internal group tends to be active, communication is bi-directional, and the innovation is typically modified. However, the external group usually assumes a consultative role, and the external group either controls the change process or shares control with the internal group.

The processes of change may be thought of as a continuum, ranging from the autocratic process to the adhocratic process of change, in which the involvement of the internal group increases, the probable modification of the innovation increases, control of the change process shifts from the external to internal group, and the role of the external group changes from consultative to linker.

Response Rate

In all, four different questionnaires were distributed to all 26 participating schools in the project. This process spanned a one year period. Also, a Pre-Games questionnaire was sent to an additional 23 cohort schools. Table 6 contains a summary of the number of schools that responded to each of the questionnaires:

Table 6

Response Rate to Questionnaires

SUMMARY OF QUESTIONNAIRE RESPONDENTS			
Questionnaire	**Date**	**Responses (Out of 26)**	**Response Rate**
Pre-Games	January 10, 1988	22	85 %
Cohort Schools	January 10, 1988	10	43 %
Post Games	March 15, 1988	21	81 %
Post Games Addendum	March 20, 1988	21	81 %
Impact Assessment	March 13, 1989	14	54 %

The Cohort School questionnaire was designed to establish a reference level of telecommunications activities in those schools which did not participate in the project. However, the response rate from the cohort schools was too low to be useful. This was likely due to the fact that the cohort schools were not included in the project. The questionnaire probably had no significance to the personnel at these schools. The response rate of the project schools to the Impact Assessment questionnaire was also lower than desired. This questionnaire was sent to the project schools one year after the project had been terminated.

The Project And The Processes Of Change

The processes of change outlined earlier in this chapter (Figure 6) can be related to an actual instance of change based upon the data collected during the project. An analysis of the project reveals the process of change which was used during the development of the innovation and the implementation of the innovation.

A brief review of the project follows. The project Organizing Committee consisted of representatives of Alberta Education, AGT, the University of Alberta, and the Calgary Board of Education. The Organizing Committee developed the parameters for the project, the implementation strategies, and directed the implementation of the project. AGT personnel developed the software required to link the project schools to a database which contained data from the Winter Olympic Games, and electronic bulletin boards and messaging systems software. Each project school was expected to provide its own personal computer, printer, modem, and telecommunications software. Information and directives were passed from the Organizing Committee to Alberta Education for distribution to the school boards, and then to the participating schools. Information was also passed from teachers in the schools to the Organizing Committee. On the basis of this information, AGT made modifications to the software when it was appropriate. During the project, telecommunications and remote electronic databases were introduced to teachers within the participating schools.

When the five characteristics used to categorize the models of change were used to assess the project, the project was placed within the framework of the three processes of change: autocratic, bureaucratic, and adhocratic. The innovation consisted of introducing teachers and students within the project schools to:

- telecommunications
- electronic bulletin boards
- electronic messaging
- the access of remote electronic databases

The teachers and students in these schools are referred to as the internal group. The external group included the Project Organizing Committee and the school board

administrators, since these project participants were not the intended users of the innovation. Information flowed in a bi-directional manner between the internal and external groups. Components of the innovation were modified; for example, the computer software developed AGT was modified by AGT during the project based upon information received from the schools. The internal group was active in the change process since implementation at the school level was the responsibility of the coordinating teachers in the project schools. The external group functioned in a consultative role by providing the innovation, solutions to problems, implementation strategies, and directed the project. The Table 7 summarizes the characteristics of the project.

Table 7

Summary Characteristics of the Olympic Data Technology Project

Characteristic	Orientation
Control	External
Communication	Bi-directional
Innovation	Modified
Internal group	Active
External group	Consultant/director

When these characteristics were matched to the process of change criteria chart (Figure 6), the process that most closely resembles the one used during the project is the bureaucratic process, and more specifically, the ELOC model. This is shown graphically in Figure 7.

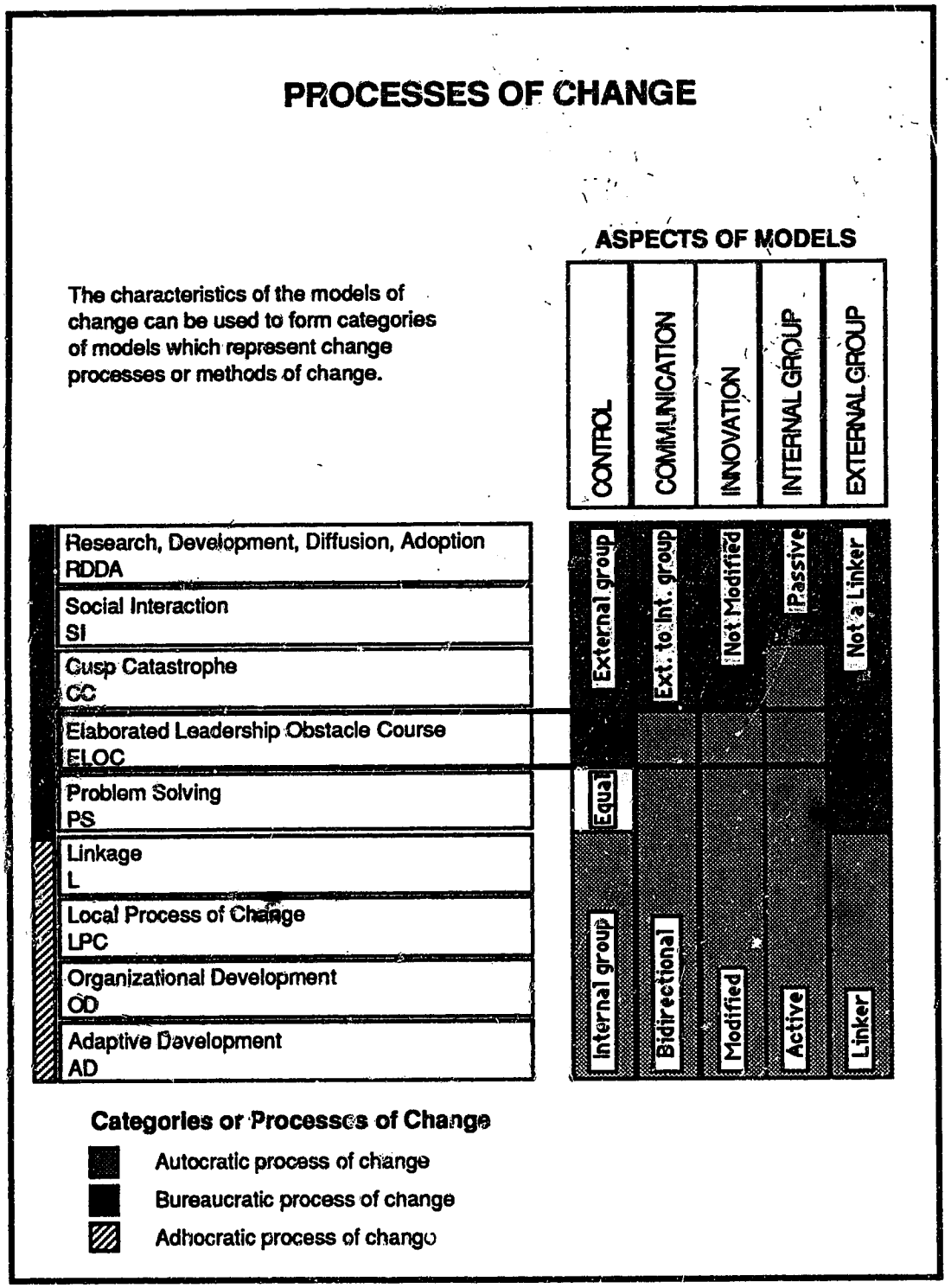


Figure 7. The Project in Relation to the Processes of Change

Implementation

One of the first aspects to be considered in attempting to determine whether an implementation of an innovation has been successful is to examine the amount of use made of the innovation. The amount of use of the telecommunications software during the project was determined by several methods. Firstly, during the project, AGT maintained a record of the number of schools connected to the AGT computing system. In addition, since it was possible for a school to be connected to the computing system but not actively using the system, AGT randomly sampled the system to determine the number of schools which were not only connected to the computing system but were also actively using the computing system. As one would expect, the number of schools actively using the system was always less than the number of schools logged on (connected to) the system. Also, the number of schools connected to the system and the number of active schools peaked during the Winter Olympic Games.

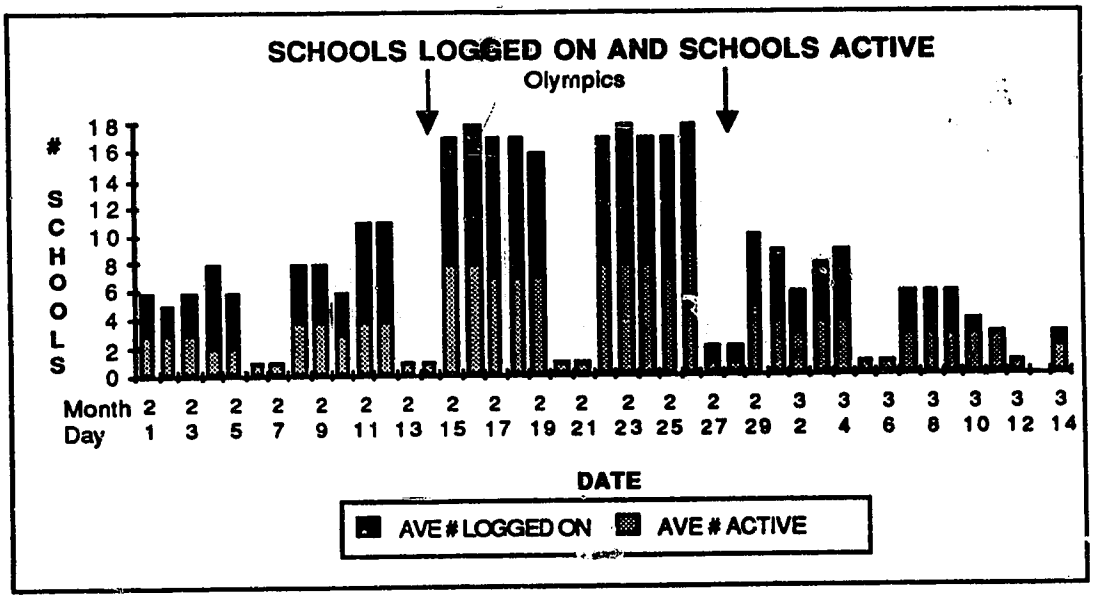


Figure 8. Schools Logged on During the Project

Another measurement of the amount of use of the innovation was obtained from question #11 of the Post Games questionnaire. Coordinators from the participating schools were asked to provide a percentage estimate of the amount of time the computing system was used relative to the time available. From these data, it appears that the system was used 85.5 % of the time (Figure 9).

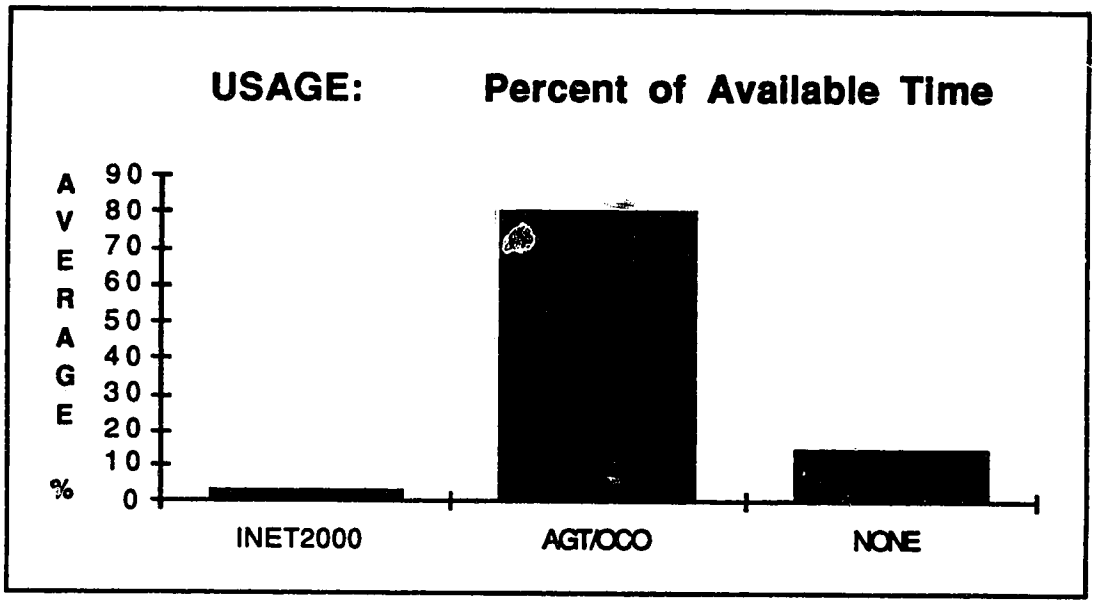


Figure 9. Use of Telecommunications During the Project

Coordinators at the participating schools were also asked to report the number of teachers and the number of students that had used the telecommunications system during the project (see the Post Games Questionnaire items #14 and #15). Of the student population in the project schools, the average number of students who had used telecommunications at least once during the project was 20.6 %. Of the total number of teachers in the project schools, the average number of teachers that had used telecommunications at least once during the project was 23.4 %. Prior to the start of the

project, only four of the 21 schools (that had responded to the Post Games Questionnaire item #16) had the equipment which was necessary to enable access to telecommunications. Therefore, use of the telecommunications was generally a new experience to these schools.

Another factor that relates to the success of implementation concerns the best and worst features of the project, as rated by the coordinators in the project schools. Electronic messaging was rated highest (best feature) among the responding schools. The experience of using telecommunications was rated second highest by students and teachers, and using the remote electronic database was rated the third best feature. The worst features of the project were, in order of ratings, using the telecommunications (modem) software, the delayed updating of the Olympic database information, and the short start-up time allowed to begin the project. The two edited lists depicting these features are shown in Table 8 and Table 9.

Table 8

Best Features of the Project*

Question # 20 Best feature of the project	(n=21)
Responses	**Tally**
communication with other schools (student messaging)	10
students and teachers experience telecommunications	7
students and teachers experience using a data base	5
feeling as part of the Olympics because of access to data base	4
AGT software - user friendly	2
	TOTAL 28

* Only responses with frequencies of 2 or more are reported here.

Table 9

Worst Features of the Project*

Question # 21 Worst feature of the project	(n=21)
Responses	**Tally**
using the telecommunications software	5
None: There were no negative features	4
Olympic data [illegible] to-date	2
short start-up	2
	TOTAL 13

The number of responses describing the best features of the project (33) exceeded the number of responses describing the worst features (19). This is illustrated in Figure 10.

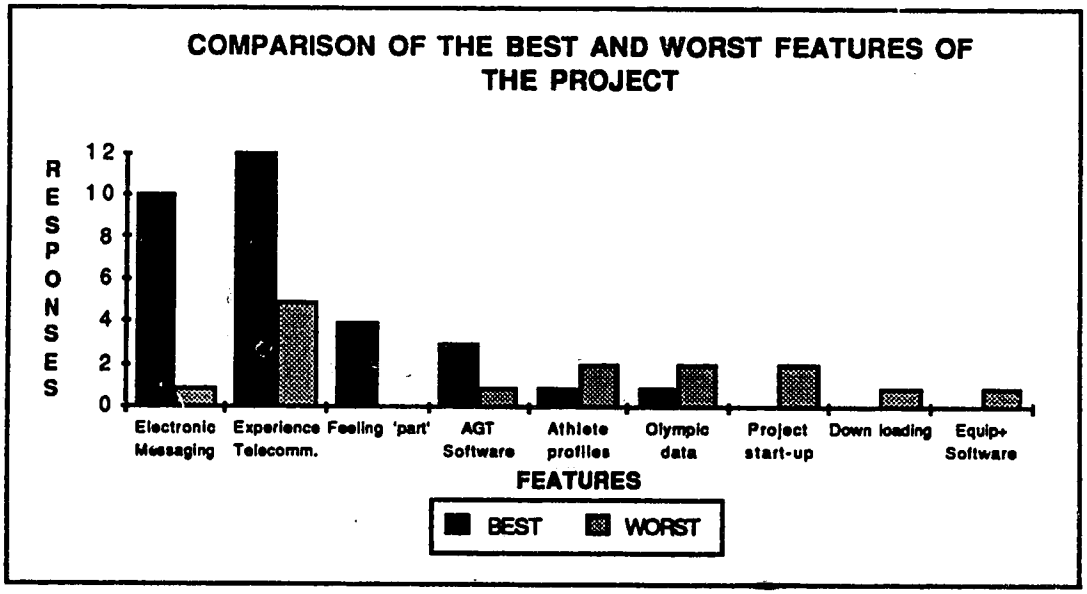


Figure 10. Best vs Worst Features of the Project

* Only responses with frequencies of 2 or more are reported here.

The telecommunications software to operate the modem consisted of either externally purchased or free public domain software. This part of the innovation was not designed by AGT. The telecommunications software was again mentioned as being problematic when coordinators were asked to list the difficulties they experienced (from both item #38 of the Pre-Games questionnaire and item #19 of the Post Games questionnaire). An edited list is provided in Table 10.

Table 10

Difficulties During the Project

TYPE OF DIFFICULTY	PRE-GAMES (Out of 57 RESP.)		POST GAMES (Out of 44 RESP.)	
Telecommunications Software and Hardware	25	(43.9%)	19	(43.2%)
AGT Software	17	(29.8%)	15	(34.1%)
Utilization/Implementation Within Schools	2	(3.5%)	5	(11.4%)
Project Support	5	(8.8%)	3	(6.8%)
Preparation of Coordinators	2	(3.5%)	1	(2.3%)

The computer software developed by AGT was rated as the second most problematic aspect of the innovation. AGT did modify the software to rectify some of the problems encountered by users during the project, but it is evident from the list of difficulties expressed by the coordinators in the project schools that additional modifications were required to improve the software. One method by which the appropriate modification of the innovation might have been achieved was through greater involvement of the internal group (coordinators, teachers, and students in the project schools) in the development and modification of the innovation. Essentially, if the internal group had been given more control over the change process, then it is likely that the internal group would have played a more active role in the development and

modification of the innovation. In addition, difficulties (see Table 10) associated with the utilization of telecommunications activities within the educational framework, and the need for additional classroom activities involving telecommunications, electronic databases, or electronic messaging, also suggested the need for the internal group to have more control over the development of the innovation. The need for greater control of the development of the innovation and the change process by the internal group as the project proceeded suggested that later in the project it may have been beneficial to adopt implementation strategies that more closely resemble those that characterize the adhocratic process of change. In the adhocratic process, the internal group exercises greater control over the change process and the development of the innovation than in the autocratic and bureaucratic processes of change. Perhaps it is beneficial to review implementation strategies during the process of change, and to continuously modify the implementation strategies, to allow the internal group greater control over the change process. In this way, the implementation strategies could possibly become progressively more similar to those that characterize the adhocratic process of change.

Training and support are necessary aspects during of the processes of change. The overall rating by coordinators of the project schools of the in-service training (Figure 11) indicated that support and in-service training of coordinators were adequately provided during the implementation phase of the project. However, support for the project schools during the project, and the preparation of the coordinators were listed as difficulties (Table 10). A closer examination of these aspects of the project revealed that training and support could have been improved.

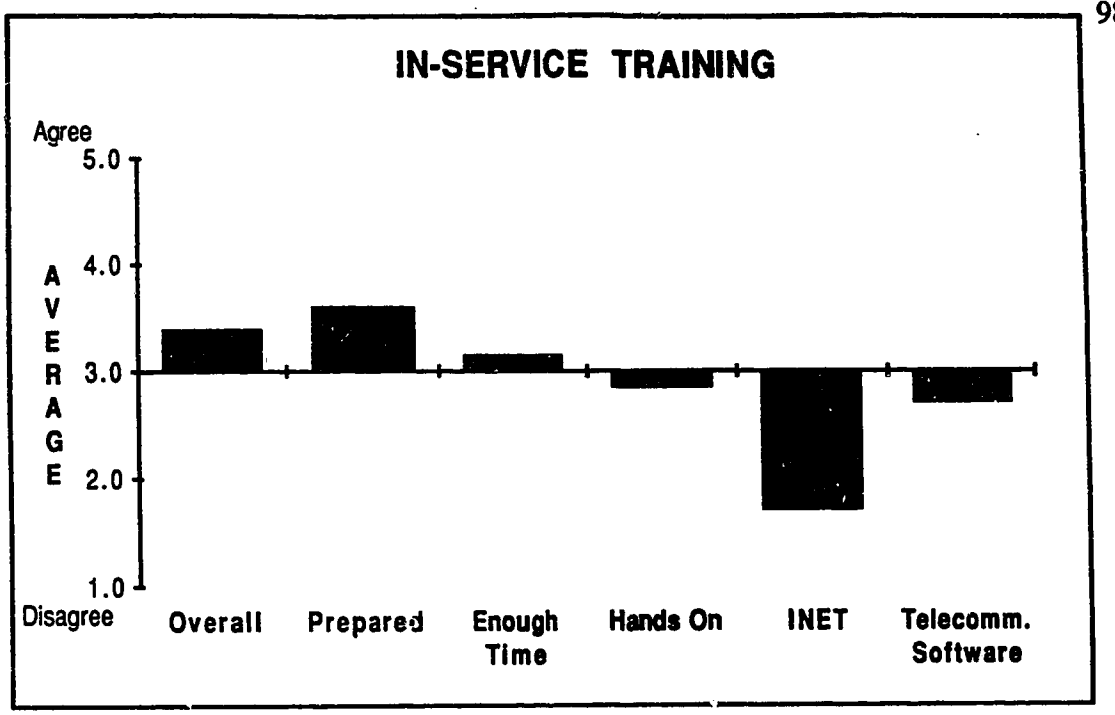


Figure 11. In-service Training

Figure 11 provides a summary of data from items on the Post Games Addendum questionnaire relating to in-service training and support. The responses of the coordinators of the project schools were collected on a Likert scale of 1 to 5 with a score of 3 being neutral, greater than 3 being positive, and less than 3 being negative. The overall mean rating of the in-service training was 3.4. The coordinators felt relatively prepared (3.6). They also felt the training time was sufficient (3.2), that there was not enough hands-on training (2.9), and that training for the use of INET was inadequate (1.7).

A number of factors suggested that the use of implementation strategies which were consistent with the bureaucratic process of change lead to successful implementation of the innovation during the project. One such factor was the extent of the activity levels of the project schools and the great amount of time that the schools

were connected to the electronic database system through the use of telecommunications (Figure 8). These data indicated that the project schools were using the innovation. A second factor supported this notion. The response of the coordinators indicated that, on the average, the telecommunications systems were used 85.5% of the available time (Figure 9). A third factor that indicated successful implementation of the innovation was the list of best features of the project (Table 8). However, data suggest that some aspects of the implementation could have been improved. The list of the worst features of the project and the data regarding in-service training indicated that in-service training of coordinators, and support of the internal group within the project schools could have been improved during implementation of the innovation.

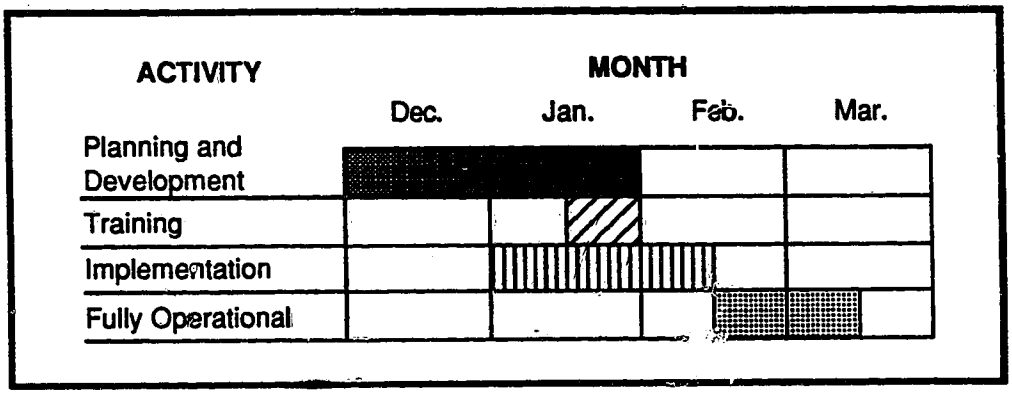
There is another aspect of the project that should be considered when reviewing the extent to which the implementation strategies were successful during the project. The project had to be fully operational at the start of the Winter Olympic Games. This restriction imposed a short, four month time frame in which to plan, develop, and implement the innovation in the project schools (Table 11). The innovation included the use of telecommunications, remote databases, and electronic bulletin boards. Implementation of the innovation in the project schools occurred from January 1, 1988 to February 13, 1988 (six weeks). The project was in full operation from February 14, 1988 to March 14, 1988 (four weeks). The compressed time frame of the project dictated the need for stategies that could instigate change rapidly.

The bureaucratic process of change occurs more rapidly than the adhocratic process but more slowly than the autocratic process of change. Perhaps the use of implementation strategies that were consistent with the bureaucratic process of change facilitated the development and implementation of the innovation within such a short

time period, and that the use of implementation strategies consistent with the adhocratic process may not have facilitated fast enough implementation of the innovation.

Table 11

Time Line of the Project



The Impact Of Implementation Of The Innovation

The Olympic Data Technology Project concluded on March 14, 1988, after only one month of full operation (February 14 to March 14, 1988). From the data presented in the previous section it appears that the implementation of the innovation was successful, in spite of the limited time period. However, a question remains as to whether the strategies of the bureaucratic process of change were successful in causing changes in the schools which participated in the project. The coordinators of the project schools were asked if they would continue using telecommunications if the telecommunications equipment and software remained available to their schools (Post Games Questionnaire item #9). The average response obtained on the five point Likert scale was 4.6. This indicated that, at the end of the project, the project coordinators were strongly in favor of continuing to use the innovation.

An examination of the data revealed that the implementation of the innovation had caused change in some of the project schools. Only 21 of the 26 schools in the project responded to both the Pre-Games and Post Games questionnaires. Of these 21 schools, 14 returned the Impact Assessment questionnaire which was distributed to the schools one year later (a response rate of 67%). The results of this survey indicated that 10 of the 14 responding schools were still using the innovation. Although five of these schools were actively using computers before the project began, only three of these were using telecommunications (Pre-Games questionnaire items #1-#7 and Post Games questionnaire item #16). Consequently, the innovation was new to seven of the 10 schools that were still actively using telecommunications one year later. In addition, of the 14 schools which responded, four were not using telecommunications because these schools did not have the equipment required for telecommunications (Impact Assessment questionnaire #1), and would have preferred to use telecommunications if the equipment were available in their schools (Impact Assessment questionnaire item #2). This indicated that the project caused change in at least 33% (seven of the 21 responding schools) of the project schools, and 19% (four of the 21 responding schools) would have liked to use the innovation (telecommunications). The status of the other 12 project schools is unknown since these schools did not return the Impact Assessment questionnaire. The data is compiled in Table 12.

Table 12

Summary of the project Schools and the Use of Telecommunications

Legend:
1. This category represents the schools, of the 14 that responded to the Impact Assessment survey, which were actively using the innovation (telecommunications) before the project, and had all the equipment required for telecommunications.

2. This category represents the schools, of the 14 that responded to the Impact Assessment survey, which were actively using computers before the project but were not using the innovation (telecommunications) because they did not have a modem.

3. This category represents the schools, of the 14 that responded to the Impact Assessment survey, which were not actively using the innovation (telecommunications) or computers before the project.

Telecommunications one year after the project.	Schools out of 14	1	2	3
Actively using	10	3	2	5
Would like to be using	4	0	0	4
Would not like to use	0	0	0	0

Implementation Strategies

The importance of in-service training was discussed in the previous section when presenting the difficulties which were listed by the coordinators of the schools (Table 10). All processes of change require the provision of in-service training during the introduction of an innovation. The coordinators made there views clear when asked by the Post Games Addendum questionnaire to suggest methods that would improve the preparation of individuals for an undertaking such as the Olympic Data Technology Project (question item #13). Table 13 shows the edited responses that occurred for those responses with frequencies greater than one.

Of the 27 suggestions provided for improving the preparation of individuals, 12 (44%) related to in-service training and, more specifically, to hands-on in-service training. The coordinators felt that the in-service training which was provided to them was adequate, and they gave the in-service training an overall average rating of 3.4 on a Likert scale of 1 to 5 (Figure 11). The data indicate that many of the coordinators thought that more training should have been provided. This view supports the notion,

presented by the autocratic, bureaucratic, and adhocratic processes of change, that in-service training is crucial in the change process.

Table 13

Suggestions for Improving the Preparation of Coordinators

Question #13 Suggestions for improving the preparation of individuals within the project.	
Responses	**Tally**
hands-on training with the equipment used in the schools	12
information on down loading and printing	3
standardized software and hardware for the project schools	2
longer start-up period	2
INET workshop	2

Table 14

Suggestions for Future Projects

Question # 22 Suggestions for future projects	
Responses	**Tally**
strong support center	4
hands-on training using equipment used in individual schools	3
careful selection of standardized telecommunications software	3
longer project start-up time	3
standardized equipment	2
suggestions for telecommunications activities that involve many schools	2
more classroom activities that employ telecommunications	2

A similar question was asked of the coordinators by the Post Games questionnaire. The coordinators were asked to list any suggestions which they thought might improve the success of a future endeavor such as the Olympic Data Technology

Project. The edited responses with frequencies of greater than one are given in Table 14.

The provision of strong support for the internal group was listed most frequently (four out of 27 responses). In-service training was listed next most frequently (three out of 27), along with the careful selection of communications software, and a longer implementation period. The data were consistent with the processes of change since support is an important factor in all of the processes. The autocratic and bureaucratic processes require a consultant or expert, while the adhocratic process suggests the use of a linker during the change process.

Table 15

Variables Used in the Factor Analysis

The variables are:

CRD.EXP	1. Experience of coordinator with telecommunications, databases, and computers.
LOG ON	2. Log on time and activity.
#TCH.USG	3. Number of teachers in the school using the telecommunications system and data base.
#TCH	4. Number of teachers in the school.
ANTIC.	5. An index (from questionnaires) of how much the coordinator anticipated the telecommunications system and data base would
SCH.EXP	6. Experience of teachers in the school with telecommunications, data bases, and computers.
LOCALITY	7. Locality of the project school, urban or rural.
#STD.USG	8. Number of students in the school using the telecommunications system and data base.
#STD	9. Number of students in the school.

A factor analysis (Principle Component Analysis) with an orthogonal transformation was performed on the data collected from the project. The nine variables chosen for the analysis, with there abbreviations, are listed in Table 15.

Although the power of the factor analysis was low because of the small number of schools in the sample (n=21), the analysis was useful in that the analysis provided inferences with respect to some factors that were important during the implementation of this innovation. The loading of each of the nine variables on each of the three factors (Orthogonal Transformation Solution-Varimax) and the eigenvalues are given in Table 16 and 17.

Table 16

Orthogonal Transformation Solution-Varimax: Factor Loadings

VARIABLE	FACTOR 1	FACTOR 2	FACTOR 3
CRD.EXP	- .066	.059	.877
LOG ON	.558	.333	- .207
#TCH.USG	.882	- .015	- .041
#TCH	.138	.854	.128
ANTIC.	.666	- .228	.289
SCH.EXP	- .507	.540	.185
LOCALITY	.003	- .318	- .701
#STD.USG	.820	.338	- .081
#STD	.137	.914	.208

Table 17

Eigenvalues and Proportion of Original Variance

FACTORS	EIGENVALUES	VARIANCE PROP.
1	2.695	.299
2	2.351	.261
3	1.186	.132
4	0.893	.099
5	0.663	.074

An examination of the values in the Orthogonal Transformation Solution-Varimax revealed the factors given in Table 18.

Table 18

Some Factors That Contribute to the Successful Implementation of an Innovation

FACTOR	CONTRIBUTING VARIABLES
FACTOR 1	a) The number of students and teachers who access the system. b) The coordinators anticipation of using the telecommunications system and database.
FACTOR 2	a) The size of the school (number of students and the number of teachers). b) The telecommunications, database, and computer experience of the teachers in the school.
FACTOR 3	a) The telecommunications, database, and computer knowledge of the coordinator.

Factor 1 implied that the coordinator's expectation to use telecommunications was related to the number of people who were actively using telecommunications. Factor 2 suggested that the population size of the school was positively related to the general knowledge that teachers in the school possessed regarding computers, telecommunications, and databases. Factor 3 indicated that the school coordinator's knowledge of computers, telecommunications, and databases contributed to the overall use of the telecommunications system by teachers and students in the school. If these factors are generalized the following inferences can be drawn:

1. The expectation of the internal group contributes to the overall use of the innovation.

2. The size of the internal group is related to the overall knowledge and experience of the group. The more the internal group knows about the innovation, the more the innovation will be used.
3. The knowledge of the consultant or (linker) contributes to use of the innovation.

Essentially, factor 3 indicates that it is important to provide support for the internal group during the implementation of an innovation. The recommendations of the three processes of change are in agreement with the view that support is important.

Factor 2 implies that it is beneficial to increase the knowledge of the internal group through training. This factor appears to coincide best with the bureaucratic and adhocratic processes of change, in which the knowledge of the internal group about the innovation is an important aspect during the implementation of an innovation. However, in the autocratic process of change, the internal group must also have some knowledge about the innovation for change to occur in the organization. Therefore, although the three processes of change vary with respect to the degree of training of the internal group that is necessary, the three processes agree that training is important for successful implementation.

Factor 1 indicates that the internal group will accept the innovation more readily if its members see some benefit in using the innovation. That is, the implementation of the innovation will be more successful if the internal group expects to use the innovation. This notion is consistent with the processes of change. In the autocratic process of change, the internal group must be convinced of the value of the innovation for the internal group or the organization. In the other two processes of change (bureaucratic and adhocratic), the internal group must not only be convinced that the innovation has some merit, but it must also be involved in the development or

modification of the innovation. However, the bureaucratic and adhocratic processes differ with respect to the degree of involvement of the internal group which is necessary during the development of the innovation. In the bureaucratic process, the internal group is sufficiently involved for successful implementation if they are active in modifying the innovation. The adhocratic process stipulates a greater degree of involvement of the internal group. In the adhocratic process, internal group is sufficiently involved for successful implementation if the internal group has greater control over the development of the innovation and the change process than the external group.

CHAPTER V

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This chapter is divided into two sections. The first section contains a discussion of the analysis contained in Chapter IV and the second section presents conclusions and recommendations.

Discussion of Results

The first part of this discussion addresses the success of the change strategies used during the Olympic Data Technology Project within the context of the processes of change. The remainder of the discussion presents aspects of implementation procedures that appear to be important when viewing the data collected during the project and from strategies suggested by the models of the processes of change.

Implementation and Change in the Project and the Processes of Change

In the previous chapter, it was established that the characteristics of control, communication, the innovation, and the internal and external group in the project, closely conformed to those described in the bureaucratic process of change. Analysis of the data collected during the project indicate that this process of change was effective. In spite of the limited time available for the implementation of telecommunications in the 26 project schools, the system and the schools were fully operational when the XV Winter Olympic Games commenced. The amount of time that the telecommunications system was used, especially during the Winter Olympics, was documented by AGT (see Figure 8). The successful use of the system was confirmed by the school coordinators; the mean estimates of usage indicate that the system was used 85.5% of the time that it was available for access (see Figure 9).

Shears (1987) classified change strategies as authoritative or adhocratic. Authoritative change involves only a few elite decision makers at the top of an organizational hierarchy and change can be more rapidly accommodated since fewer people must be consulted with respect to the change strategies and the innovation. Adhocratic change, however, is slower since the strategies and the innovation are the result of the consensus of many people at many levels within the hierarchy of the organization. The autocratic and adhocratic processes of change are analogous to authoritative and adhocratic change described by Shears (1987). However, the bureaucratic process of change is slower than authoritative change and is more rapid than adhocratic change. Strategies that align with those of bureaucratic process were effective during implementation of this project, since the time needed for implementation was limited and decisions had to be made rapidly. However, extremely rapid change can also be unsuccessful (Bigelow, 1982) and, conversely, slower change is more likely to be successful. In addition, the bureaucratic process of change allows for more participation by the members of the internal group in the development of implementation strategies than does autocratic change. Participation improves the probability of successful implementation (Hart, 1985).

Other data collected during the project confirms that implementation was successful. Telecommunications with other project schools and the experience obtained in using telecommunications were respectively the first and second most frequent responses when coordinators were asked to describe the best feature of the project (Table 8). The coordinators were also asked to describe the worst features of the project. However, these responses were out numbered, 33 to 19, by responses which described the best features (Figure 10). Coupled with the response obtained from the Post- Games questionnaire (4.6 on a Likert scale of 1 to 5) indicating the wish of

coordinators to continue using telecommunications, the data suggest that the coordinators generally felt comfortable with the innovation and had some desire to continue using the innovation. All the processes of change, although to a lesser degree in the autocratic process, require that the internal group believe that the innovation has some usefulness. Perhaps the overall feeling of the internal group in the project was that the innovation served some useful purpose and the desire of the internal group to use the innovation indicated that implementation had been successful.

Data from the Impact Assessment Questionnaire most strongly suggest that the implementation was successful. These data suggest that, one year after the project termination date, 10 of the 14 schools that responded to the questionnaire were still using telecommunications, and that seven of the schools had never used telecommunications prior to the project.

Support and In-Service Training During Implementation

All models of change require that some level of support and training be provided to the users for successful implementation to occur. However, the nature of support may vary with the process of change. Models that fall within the autocratic process of change seem to emphasize support that provides the internal group with direction and solutions to problems. Support and training is limited in this process of change. The adhocratic process, on the other hand, requires support that provides funds, expertise, and leadership. In this process, extensive training and support of the internal group, and the provision of a linker are necessary for successful change. The bureaucratic process of change has training and support requirements that are not as rigorous as the adhocratic process, but are more extensive than those of the autocratic process.

In the Olympic Data Technology Project, some initial training occurred prior to the commencement of the Winter Olympic Games. However, this training was held in a central location (AGT in Edmonton and Calgary) rather than in the project schools, and did not occur on the equipment that was used in the schools during the project. Later, this caused some confusion when the coordinators attempted to use the telecommunications equipment (modem) and software in their schools. The original intention was to have each project school use the same equipment and telecommunications (modem) software in training as was available in their respective schools, so that the provision of training and support could be adequately provided in a central location, due to the time constraints of the project. However, standardization of equipment and telecommunication software was not feasible. Funds and expertise, varied greatly among the school districts, and some school coordinators expressed a desire to use computer equipment and modems that were already installed in their schools.

The Central Project Support Center was only partially operational throughout the duration of the project. This, of course, decreased the level of support available to the project schools. The provision of support was also hindered by the wide variety of computers, modems, and telecommunications (modem) software used by the project schools. It was difficult to provide operational instructions and solutions to problems when so many different types of equipment and software were being used.

The effectiveness of the support and training provided during the project was evaluated using only the data which were collected. The mean ratings by the school computer coordinators of the overall training, training time, and preparation were 3.4, 3.2, and 3.6 respectively (on a Likert scale of 1 to 5). Although the results indicated that training was sufficient, other data suggest that the school computer coordinators

would have preferred more training and support. When the coordinators listed some of the difficulties experienced by them during the project (Table 10), the use of the telecommunications (modem) software was the most frequently listed (43.9 % of the responses on the Pre-Games questionnaire). Training regarding the use of telecommunications software was not provided and was, again, the most frequently listed response on the Post Games questionnaire (43.2 % of the responses). In addition, the most frequently listed 'worst feature' of the project was using the telecommunications (modem) software (Table 9). One would expect that the use of this type of software would create less difficulties as implementation proceeds, since knowledge of the innovation in the internal group should increase. Thus, training the coordinators how to use this software would have greatly improved the implementation.

The operation of the AGT software (electronic database and messaging) was the second most frequently listed difficulty. Training on the use of this software was provided, but the data suggest that this training may not have been adequate. Support for the project schools during the project was ranked third on the Pre-Games list of difficulties experienced and fourth on the Post Games list.

Other data also suggest that the training offered may have been inadequate. Suggestions obtained for improving coordinator preparation (Table 13) indicate that the coordinators desired more hands-on training with the type of equipment and telecommunications (modem) software that was used in their schools during the project (12 of 27 suggestions). Suggestions collected from the coordinators for improving future projects (Table 14) agree with this view. The provision of a strong Support Center was the most frequent suggestion (4 of the 27 responses), followed by hands-on training on the equipment and software used in the project schools

(3 of the 27 responses), and the selection of standardized telecommunication (modem) software (3 of the 27 responses).

An underlying concept of the ELOC model, in the bureaucratic process of change category, is that resistance to change is an obstacle in the change process. Peters (1986) listed some of these obstacles. Skill deficiencies of organization members, ignorance of the innovation, and inadequate materials and equipment are some of the obstacles that Peters(1986) specified. Roberts (1978) stressed the importance of support and training of the internal group to facilitate successful implementation. It is possible that more attention to support, training, and equipment and software standardization may have improved implementation during the project.

Support and directives for the coordinators came from the Project Support Center and the Organizing Committee. However, the coordinators provided support and training for teachers and students within the project schools. Rogers and Shoemaker (1971) suggested that an individual or group functioning in this way is a change agent. Havelock (1973) described the role of the change agent as a catalyst, a solution giver, a process helper, and a linker. However, Havelock (1973) cautioned readers that the role of the change agent is defined by the needs of the organization and the nature of the innovation.

The data were also factor analyzed to isolate factors that were important during implementation (Tables 16 and 17). Three key factors were derived from this analysis (Table 18). The first factor revealed that the coordinator's anticipation of using the innovation, and the number of teachers and students accessing the system is important to the implementation. The anticipation of the coordinator to use the system may be related to the attitude, energy, and knowledge of the coordinator. It may, however, also be related to the support (equipment and funding) that the coordinator received from the

school district. The number of teachers and students accessing the system suggests that the intent and attitude of the internal group was to use the innovation, but this cannot be confirmed by this analysis. However, Mirvis (1983) noted that the time and energy of the implementors, or change agents, is important for successful implementation. Balistreri (1987) stated that the energy and attitude of the change agent is important during implementation, and Rogers (1962) cited a study by Nye (1952) that indicated the personality of the change agent was a most important aspect of the change agent, and attitudes a fourth most important, ranked behind knowledge (training) and vocational interests. Perhaps the attitude, enthusiasm, or energy of the coordinator served to motivate teachers and students of each project school to use the innovation.

The second and third factors of the analysis relate to knowledge about the innovation. The second factor is associated with the knowledge and experience pertaining to the innovation. Implementation was effected by the teacher's knowledge regarding the innovation in the project school and the size of the population of the school. The association of these two variables is not surprising since the student population of the school determines the size of the teaching staff. As the size of the staff increases, the more likely it is to find teachers with some knowledge of telecommunications, databases, and computers. Increasing the knowledge of the internal group about the innovation tends to increase the success of implementation by reducing anxiety and frustration. Henson (1987) noted that by developing strategies to contend with habits, fear, and frustration of the internal group the implementation will be more successful. Perhaps knowledge about the innovation reduces the fears and frustration of the internal group. If this is so, implementation will likely be more successful if knowledge about the innovation can be provided to the internal group by way of support and training. The data collected from this project supports that notion.

The third factor obtained in the analysis was the school coordinator's level of knowledge pertaining to the innovation. The role of the coordinator in the project school was that of a change agent. Nye (1952) ranked knowledge of the change agent as the second most important aspect for successful implementation. Balistreri (1987) also considered knowledge of the change agent about the innovation to be an important factor for successful implementation. Possibly the knowledge possessed by the coordinator about the innovation increases the coordinator's ability to provide support within the project school, thereby reducing fear and frustration that would otherwise inhibit the implementation of the innovation.

In summary, all processes of change recognize the importance of support and training, but vary with respect to the requirements. The data from the project appears to support the view that the provision of support and training are important. Perhaps the implementation of an innovation will be more successful through training of the internal group and the provision of support during implementation. The results of the factor analysis appear to indicate that the attitude and expectations of the internal group and the change agent (coordinator) are also important, and that the provision of a linker (change agent) can improve support. However, not all of the processes of change place the same importance on this aspect. Thus, it is least important in the autocratic process and most important in the adhocratic process of change.

Involvement of the Internal Group

The internal group plays a role in all of the processes of change. In the autocratic process the internal group is rational and passive, and the role of the group tends to be that of passive acceptance of the innovation. The adhocratic process of change is quite contrary to the autocratic process. In the adhocratic process, the internal

group actively participates in the implementation process and may develop or modify the innovation. The bureaucratic process is transitional between the other two process with respect to the role that the internal group plays in implementation and development or modification of the innovation. However, even the autocratic process requires minimum involvement of the internal group before implementation can be successful. In the SI model, for example, the internal group must be aware of the innovation and have interest in the change process before implementation can occur (Rogers and Shoemaker, 1971). Rogers and Shoemaker (1971) concluded that anticipations and perceptions of the internal group relating to the innovation also effect the change process. Lack of awareness, anticipations, and perceptions may unnecessarily hinder successful implementation. If members of the internal group feel anxiety due to the change of habit, or feelings of fear or hopelessness, they may resist the change (Henson, 1987).

The mechanism of support and training are probably the minimum involvement requirements for successful implementation of an innovation. These mechanisms tend to create awareness, reduce anxieties about the innovation, and provide skills to cope with changed performance criteria. This reduction in resistance to the change may be adequate and facilitate implementation in the autocratic process. However, even in the SI model, which is in the autocratic process category of models, communication, although unidirectional, assists in reducing resistance by diffusing information about the innovation (Havelock, 1971). Further, Hart (1985) suggested that two-way (bi-directional) communication is an important aspect of implementation. Two-way communication provides a mechanism of monitoring implementation and modifying implementation strategies during the process of change. Other researchers suggested that the success of implementation increases when the internal group participates in the

development of the innovation and the planning of implementation (Hart, 1987; Zaltman et al, 1973). Lozier and Covert (1982) noted that an involvement of this extent will develop ownership of the innovation in the internal group. Ownership is the internalization of the innovation in the organization. Internalization suggests that change has successfully occurred.

The internal group in this particular project consisted of teachers and students in the project schools. The coordinator in each project school was provided with training and support, and communication was bi-directional between the Organizing Committee and the internal group. The internal group was active during the implementation phase and also throughout the duration of the project. The suggestions of the internal group effected implementation strategies, the uses of the innovation (telecommunications, databases, bulletin boards, and messaging), and, to a small degree, the modification of the software developed by AGT. In this way, the involvement of the internal group of the project was congruent with the involvement strategies prescribed by the bureaucratic process of change. The internal group was active in the implementation phase and, to some degree, in the modification of the innovation. However, the control of the process and the development of the innovation lies within the external group (Organizing Committee).

Initially, the extent of involvement of the internal group was sufficient to foster successful implementation, however later in the project it appeared that more involvement was necessary to improve the success of implementation. Two pieces of data support this notion. Firstly, the AGT software remained the second most frequently mentioned difficulty from the Pre-Games to Post Games questionnaire (Table 10), constituting 29.8% of the Pre-Games responses and 34.1% of the Post Games responses. Although the software was modified, it was still not acceptable to

the internal group. More extensive modifications were required. Secondly, the internal group became increasingly more concerned about how the innovation was to be utilized within the context of curricula in the project schools. Of the difficulties listed, 3.5% of the Pre-Games responses and 11.4% of the Post Game responses related to the utilization of the innovation (Table 10). Overall, utilization of the innovation ranked as the third most frequently mentioned difficulty. If the project had been active for a longer period of time, use of the innovation would probably have decreased due to the unsuitability of the innovation to the curricula. If other such projects are to be successful on a long term basis, it is important to include the internal group, specifically teachers, in the development and modification of the innovation. In this way, the unique knowledge and specialized skills of the internal group may be utilized to develop an innovation which the internal group will find more appealing and useable and, thereby, will likely prevent a decrease in the use of the innovation.

Although it was initially appropriate to adopt implementation strategies congruent with the ELOC model of the bureaucratic process, it was perhaps desirable to modify these strategies later in the project to allow more involvement by the internal group. For instance, more participation by the internal group would have been facilitated had the strategies proposed by the PS model of the bureaucratic process category, or a model of the adhocratic process, been adopted. Any model below the ELOC model (Figure 7) places more emphasis on and involvement by the internal group.

Summary

The literature in the area of change generally concludes that change is best facilitated by thorough planning of the implementation and the change process, maximizing the knowledge of participants about the innovation, minimizing resistance to the innovation by reducing fear and anxiety, and by involving the members of the organization in the change process. In the Olympic Data Technology Project the Organizing Committee established a detailed implementation plan. However, support and training, although provided, could have been improved to increase users' knowledge about the innovation in the internal group and thereby improve the likelihood of successful implementation. If the value of the innovation is better understood by the internal group, through training, there may be less resistance to the implementation of the innovation (Bigelow, 1982). The internal group was active during the implementation phase of this project. However, as the project continued, it became apparent that there was need for additional involvement by the internal group, as the internal group became more concerned about the utilization and modification of the innovation. Therefore, implementation would potentially have been improved by changing the implementation strategies to align them more with those prescribe by models of the adhocratic process of change.

Conclusions and Recommendations

This was an exploratory study. Its purpose was to assess various implementation strategies that were used during the project and to relate these implementation strategies to theoretical models of change.

During the study, it became apparent that various models of change had similarities. On the basis of the control of the change, the direction of information flow

(communication), the modification of the innovation, and the role of the internal and external groups, the models could be grouped into three categories. These categories formed three processes of change; autocratic, bureaucratic, and adhocratic.

Various implementation strategies used in the project were assessed to determine how successfully they facilitated implementation of the innovation. Then these strategies were compared to those found in the literature to determine if the findings of this study were consistent with strategies suggested by some theoretical models of change. Both the organizational structure of the project organization and the implementation strategies that were used during the project, appeared to be consistent with the structure and strategies of the bureaucratic process of change. Therefore, some of the aspects of the theoretical models, which were grouped into the bureaucratic process of change, were related to the implementation strategies of the project.

Overall, the implementation of the innovation was successful, but some implementation strategies could have been improved. Most importantly, the theoretical recommendations appeared to be consistent with the information derived from the data obtained from the project, and some strategies may more successfully implement an innovation. A number of aspects seem to be important for the successful implementation of an innovation:

1. Planning

   A structured plan is essential for successful implementation and permanent change. A plan will focus the attention of members of an organization on particular goals or objectives. Generally, a plan must start with a purpose or focus and a statement of objectives. Also included are implementation strategies, scheduling for incremental change, a statement of organizational

commitment, and assurance of the availability of required support and resources.

2. Communication

   Communication ensures the flow of information. The flow of information between the internal (users) and external groups plays an important role in the change process. This two-way flow of information is called bi-directional communication. This sort of communication facilitates the adjustment of ineffective implementation strategies and the modification of an unsuitable innovation. In addition, communication reduces mistrust and fears, thereby reducing resistance of the internal group to the change. Communication is also a means of linking experts, change agents, and the internal group so that information about the innovation is diffused.

3. Support

   Support is required by members of the organization for the successful implementation of innovation to occur. Support may be required in the form of financial resources, equipment, training, information, and access to experts.

4. Training

   Often innovations necessitate the development of new skills in the user group. The internal group should be adequately trained to use the innovation. Insufficient training may result in the internal group rejecting the innovation due to fear or confusion, or because the capabilities of the innovation are not understood.

5. Involvement

   The involvement of the internal group facilitates bi-directional communication and stimulates commitment to successful implementation of an innovation. When the internal group (users) participate in the development of the innovation and in the planning of implementation of the innovation, the prospect of successful change is increased.

6. A linker or 'hand-holder'

   A linker provides the internal group with access to relevant information and experts, and promotes communication between internal and external groups. A 'hand-holder' is an individual that is available to the internal group for assistance and encouragement. As the internal group gains proficiency with the innovation, the 'hand-holder' must progressively withdraw support in order that the internal group will develop ownership of the innovation.

The results and limitations of this study lead to suggestions for further research. First, this study was exploratory. A controlled study should be conducted using a sample that is randomly selected and larger than in this study. Second, this project was linked to a high profile event (Winter Olympic Games) and the internal group was aware that the innovation would only be used for a short time period. The effect of these factors on the success of implementation strategies is unknown. A study should be conducted to examine the implementation strategies that were investigated in this study under different conditions. That study should include the implementation of an innovation for purpose of long term change, and should not have the implementation strategies linked to a high profile event. Third, a study should be performed which

compares the success of implementation strategies to theoretical strategies suggested by models within the autocratic and adhocratic processes of change.

In summary, this study has revealed that models of change can be grouped into processes of change, that some implementation strategies are more successful than others, and that some implementation strategies found in the literature can be effective in practice.

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Appendix A
Specifications of the Project Telecommunications System

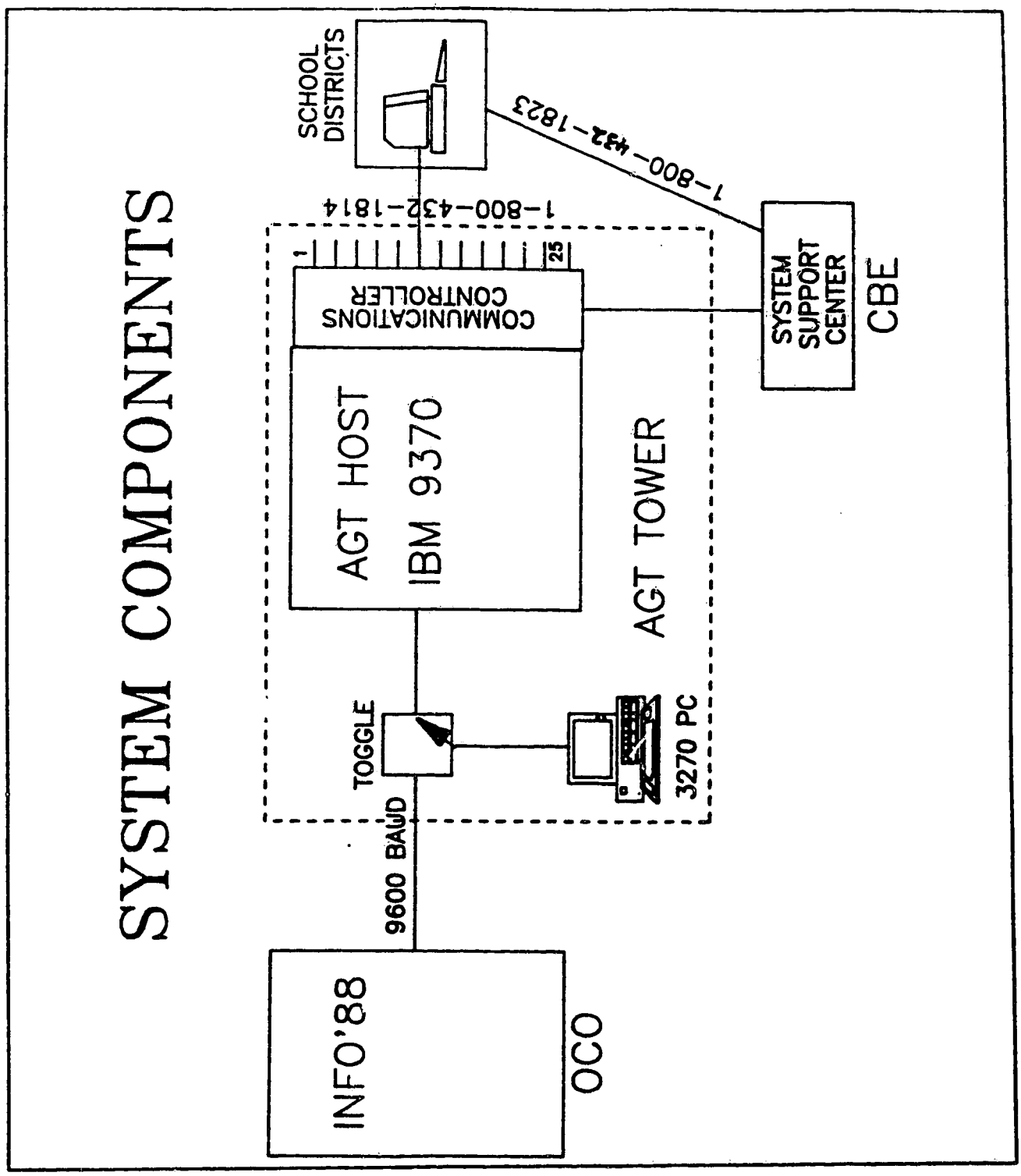


Figure 1. System Components: This diagram shows each of the component parts of the Olympic Data Technology Project for Alberta Schools.

Appendix B
Questionnaires

OLYMPIC DATA TECHNOLOGY PROJECT

Pre-Games Information

Evaluation Form 1.0 **January 10, 1988**

Principle Evaluators:

Dr. E. Romaniuk	**University of Alberta**	**(403)**	**432-4245**
Terry Bruchal	**Edmonton Catholic Schools**	**(403)**	**426-2010**

SCHOOL NAME: _____

NUMBER OF CLASSROOMS (HOMEROOMS): _____

For each statement below you are given a set of values representing a range. Circle one value from the range that best indicates your response to the statement. Responses are neither correct nor wrong. If no suitable response is listed, indicate your preferred alternative. The word 'project' is to be understood as a reference to the Olympic Data Technology Project.

1. I have used a computer prior to the project.

not at all				very much
1	2	3	4	5

2. I have used a data base prior to the project.

not at all				very much
1	2	3	4	5

3. I have used a modem prior to the project.

not at all				very much
1	2	3	4	5

4. I have used an electronic bulletin board prior to the project.

not at all				very much
1	2	3	4	5

5. I have used an electronic computer messaging system prior to the project.

not at all				very much
1	2	3	4	5

6. I have used INET2000 or ATANET prior to the project.

not at all				very much
1	2	3	4	5

7. I have used a local area network prior to the project.

not at all				very much
1	2	3	4	5

8. My teaching time is occupied with computer related activities.

not at all				very much
1	2	3	4	5

9. Some teachers in my school have used data bases prior to the project.

not at all				very much
1	2	3	4	5

10. Teachers in my school have used electronic bulletin boards and/or electronic messaging systems.

not at all				very much
1	2	3	4	5

11. I anticipate that teachers and students in my school will use the electronic messaging system provided by AGT during this project.

not at all				very much
1	2	3	4	5

12. I anticipate that teachers and students in my school will use the electronic bulletin board system provided by AGT during this project.

not at all				very much
1	2	3	4	5

13. I anticipate that teachers and students in my school will use the electronic data base containing information about events, athletes, and general information, made available by this project.

not at all				very much
1	2	3	4	5

14. I anticipate conflicts in scheduling classes for the facilities required to use the project data base, bulletin board, and messaging system.

not at all				very much
1	2	3	4	5

15. I anticipate that teachers in my school will implement classroom activities that relate to the olympics and will not use the project data base and/or electronic messaging system.

not at all				very much
1	2	3	4	5

16. I anticipate that teachers in my school will implement classroom activities that relate to the olympics and will utilize the project data base and/or electronic messaging system in these activities.

not at all				very much
1	2	3	4	5

17. I anticipate that many classes, other than computing classes will utilize the project data base and/or electronic messaging system.

not at all				very much
1	2	3	4	5

For questions that provide response categories, circle the appropriate category. For questions requiring a YES or NO response, check either the YES or NO box.

18. How many teachers are employed at your school ?

Number of Teachers Employed					
under 10	10 to 20	21 to 30	31 to 40	41 to 50	over 50

19. How many students are enrolled in your school ?

Number of Students Enrolled				
under 200	200 to 400	401 to 800	801 to 1000	over 1000

20. Do you personally own a computer ?

YES ☐ NO ☐

21. Does your school have a local area computer network ?

YES ☐ NO ☐

22. Is the telecommunications computer and modem you are using in this project set up in a computer lab ?

YES ☐ NO ☐

23. Are you a computer consultant or a computer facilitator in your school ?

YES ☐ NO ☐

24. Are computer classes offered in your school ?

YES ☐ NO ☐

25. Does your school have a computer lab ?

YES ☐ NO ☐

If you answered YES in the question above, answer questions 26 through 32. If you answered NO skip these and go to question 33.

26. How many computer labs are in your school ?

Number of Computer Labs				
1	2	3	4	over 5

27. What is the average number of computers in each lab ?

Average Number of Computers Per Lab				
under 5	5 to 10	11 to 20	21 to 30	over 30

28. Programs such as data bases, word processors, and spreadsheets are applications. Give an overall rating that describes the extent to which applications taught in computer related courses ?

not at all				very much
1	2	3	4	5

29. Give an overall rating that describes the extent to which programming is taught computer related courses ?

not at all				very much
1	2	3	4	5

30. Give an overall rating the describes the extent to which telecommunications is taught in computer related courses ?

not at all				very much
1	2	3	4	5

31. Do classes other than computer classes use the computer lab ?

YES ☐ NO ☐

32. To what extent are the computer labs occupied with classes prior to the project ?

almost never				almost always
1	2	3	4	5

33. Have you written computer programs ?

YES ☐ NO ☐

If you answered yes in the question above, answer questions 34 and 35. If you answered NO skip these and go to question 36.

34. Indicate the number of lines in the longest program you have written.

Number of Lines in Your Longest Program				
under 10	10 to 30	31 to 50	50 to 100	over 100

35. Place an 'X' beside each programming language that you have used to write programs.

Programming languages:

APL _____
Basic _____
C _____
Cobol _____
Fortran _____
Pascal _____
Other _____

36. Place an 'X' beside each type of computer that you have used.

Types of computers:

Apple II _____
Amiga _____
Atari _____
Commadore _____
IBM _____
(or Compatible)
Macintosh _____
a mainframe or mini computer _____

The following questions may require written responses.

37. Did your school have the computer equipment required for the project?

YES ☐ NO ☐

If you answered yes in the question above, specify what equipment

was acquired below:

_____

_____

_____

_____

38. List any problems, related to the project, that you have encountered:

_____

_____

_____

_____

_____

_____

_____

39. If there are classroom activities occurring in your school that relate to the olympics but are unrelated to the project, list them (maximum five activities):

_____

_____

_____

_____

_____

COMPUTER UTILIZATION SURVEY

Evaluation Form 1.0 **January 10, 1988**

Principle Evaluators:

Dr. E. Romaniuk	**University of Alberta**	**(403)**	**432-4245**
Terry Bruchal	**Edmonton Catholic Schools**	**(403)**	**426-2010**

SCHOOL NAME: _____

NUMBER OF CLASSROOMS (HOMEROOMS): _____ _____

For each statement below you are given a set of values representing a range. Circle one value from the range that best indicates your response to the statement. Responses are neither correct nor wrong. If no suitable response is listed, indicate your preferred alternative.

1. I have used a computer .

not at all				very much
1	2	3	4	5

2. I have used a data base .

not at all				very much
1	2	3	4	5

3. I have used a modem.

not at all				very much
1	2	3	4	5

4. I have used an electronic bulletin board.

not at all				very much
1	2	3	4	5

5. I have used an electronic computer messaging system.

not at all				very much
1	2	3	4	5

6. I have used INET2000 or ATANET.

not at all				very much
1	2	3	4	5

7. I have used a local area network.

not at all				very much
1	2	3	4	5

8. My teaching time is occupied with computer related activities.

not at all				very much
1	2	3	4	5

9. Some teachers in my school have used data bases.

not at all				very much
1	2	3	4	5

10. Some teachers in my school have used electronic bulletin boards and/or electronic messaging systems.

not at all				very much
1	2	3	4	5

11. I anticipate that teachers and students in my school would use an electronic messaging system if it was available in the school.

not at all				very much
1	2	3	4	5

12. I anticipate that teachers and students in my school would use an electronic bulletin board system if it was available in the school.

not at all				very much
1	2	3	4	5

13. I anticipate that teachers and students in my school would use an electronic data base containing information about Olympic events and athletes, and general information relating to the Olympics, if it was available in the school.

not at all				very much
1	2	3	4	5

14. I anticipate that conflicts in scheduling classes for the facilities would arise if a data base, a bulletin board, and a messaging system were made available in the school.

not at all				very much
1	2	3	4	5

15. I anticipate that teachers in my school will implement classroom activities that relate to the olympics.

not at all				very much
1	2	3	4	5

16. I anticipate that teachers in my school will implement classroom activities that relate to the olympics and will utilize a data base and/or electronic messaging system in these activities.

not at all				very much
1	2	3	4	5

17. I anticipate that many classes, other than computing classes would utilize a data base and/or electronic messaging system if these facilities were available in the school.

not at all				very much
1	2	3	4	5

For questions that provide response categories, circle the appropriate category. For questions requiring a YES or NO response, check either the YES or NO box.

18. How many teachers are employed at your school ?

Number of Teachers Employed					
under 10	10 to 20	21 to 30	31 to 40	41 to 50	over 50

19. How many students are enrolled in your school ?

Number of Students Enrolled				
under 200	200 to 400	401 to 800	801 to 1000	over 1000

20. Do you personally own a computer ?

YES ☐ NO ☐

21. Does your school have a local area computer network ?

YES ☐ NO ☐

22. Is the telecommunications computer and modem you are using set up in a computer lab ?

YES ☐ NO ☐ Don't have one ☐

23. Are you a computer consultant or a computer facilitator in your school ?

YES ☐ NO ☐

24. Are computer classes offered in your school ?

YES ☐ NO ☐

25. Does your school have a computer lab ?

YES ☐ NO ☐

If you answered YES in the question above, answer questions 26 through 32. If you answered NO skip these and go to question 33.

26. How many computer labs are in your school ?

Number of Computer Labs				
1	2	3	4	over 5

27. What is the average number of computers in each lab ?

Average Number of Computers Per Lab				
under 5	5 to 10	11 to 20	21 to 30	over 30

28. Programs such as data bases, word processors, and spreadsheets are applications. Give an overall rating that describes the extent to which applications taught in computer related courses ?

not at all				very much
1	2	3	4	5

29. Give an overall rating that describes the extent to which programming is taught computer related courses ?

not at all				very much
1	2	3	4	5

30. Give an overall rating the describes the extent to which telecommunications is taught in computer related courses ?

not at all				very much
1	2	3	4	5

31. Do classes other than computer classes use the computer lab ?

YES ☐ NO ☐

32. To what extent are the computer labs occupied with classes ?

almost never				almost always
1	2	3	4	5

33. Have you written computer programs ?

YES ☐ NO ☐

If you answered yes in the question above, answer questions 34 and 35. If you answered NO skip these and go to question 36.

34. Indicate the number of lines in the longest program you have written.

Number of Lines in Your Longest Program				
under 10	10 to 30	31 to 50	50 to 100	over 100

35. Place an 'X' beside each programming language that you have used to write programs.

Programming languages:

APL _____
Basic _____
C _____
Cobol _____
Fortran _____
Pascal _____
Other _____

36. Place an 'X' beside each type of computer that you have used.

Types of computers:

Apple II _____
Amiga _____
Atari _____
Commadore _____
IBM _____
(or Compatible)
Macintosh _____
a mainframe or mini computer _____

The following question requires a written responses.

37. If there are classroom activities occurring in your school that relate to the olympics, please list them (maximum five activities):

_____

_____

_____

_____

OLYMPIC DATA TECHNOLOGY PROJECT

Post-Games Information

Evaluation Form 1.0 **March 15, 1988**

Principle Evaluators:

Dr. E. Romaniuk	**University of Alberta**	**(403)**	**432-5245**
Terry Bruchal	**Edmonton Catholic Schools**	**(403)**	**426-2010**

SCHOOL NAME: _____

For each statement below you are given a set of values representing a range. Circle one value from the range that best indicates your response to the statement. Responses are neither correct nor wrong. If no suitable response is listed, indicate your preferred alternative. The word 'project' is to be understood as a reference to the Olympic Data Technology Project.

1.11 The teachers and students in my school used the electronic messaging system provided by AGT during this project.

not at all				very much
1	2	3	4	5

2.12 The teachers and students in my school used the electronic bulletin board system provided by AGT during this project.

not at all				very much
1	2	3	4	5

3.13 The teachers and students in my school used the electronic data base containing information about events, athletes, and general information, made available by this project.

not at all				very much
1	2	3	4	5

4.14 The conflicts occurred in scheduling classes for the facilities required to use the project data base, bulletin board, and messaging system.

not at all				very much
1	2	3	4	5

5.15 The teachers in my school implemented classroom activities that related to the olympics and they did not use the project data base and/or electronic messaging system in these activities.

not at all				very much
1	2	3	4	5

6.16 The teachers in my school implemented classroom activities that related to the olympics and they did utilize the project data base and/or electronic messaging system in these activities.

not at all				very much
1	2	3	4	5

7.17 Many classes, other than computing classes did utilize the project data base and/or electronic messaging system.

not at all				very much
1	2	3	4	5

8.00 In your opinion, did the association of the Olympics with the Project increase the the use of the telecommunications facility in your school?

not at all				very much
1	2	3	4	5

9.00 If telecommunications were permanently available in your school, would you continue to use the facilities ?

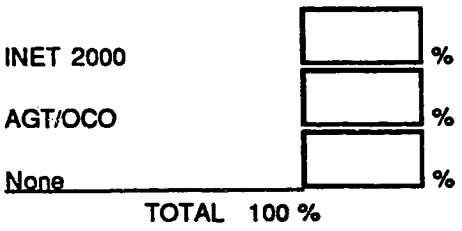
not at all				very much
1	2	3	4	5

10.00 In your opinion, rate the overall success of the project ?

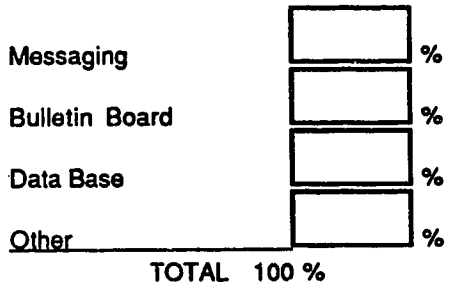
not successful				very successful
1	2	3	4	5

Provide an approximate percentage for each category in the following questions. The total percent in each question should equal 100 %.

11.00 Of the available time during the project, estimate the percentage of time the facility was used for the following:



12.11 Of the available time during the project, estimate the percentage of
.12 time the facility was used for the following:
.13



If you placed a percentage of greater than 0 % in the category OTHER above, please specify:

_____

_____

13.00 Of the available time during the project, estimate the percentage of time the facility was used by groups of the following sizes:

Individuals (1)	____ %
2 to 10 persons	____ %
10 to 30 persons	____ %
TOTAL 100 %	

The following questions require written responses:

14.18 Estimate the number of different teachers in your school that have used the telecommunications facilities during the Project.

Number of teachers ____

15.19 Estimate the number of different students in your school that have used the telecommunications facilities during the Project.

Number of Students ____

16.37 List the equipment that was used for telecommunications during the Project. Indicate if the equipment was acquired specifically for the project by checking YES/NO.

EQUIPMENT	ACQUIRED FOR PROJECT YES	NO
Computer _____	___	___
Modem _____	___	___
Communication Software _____	___	___
Telephone Connections _____	___	___

17.00 If you had permanent access to data bases, what types of information would you like to be able to search ?

_____

_____

_____

_____

18.00 If you intend on using a data base, indicate which one(s).

_____

_____

_____

_____

19.38 List some of the problems you have encountered during the project.

_____

_____

_____

_____

_____

_____

_____

20.00 In your opinion, what was the best feature (the most positive aspect) of the Project ?

_____

_____

_____

21.00 In your opinion, what was the worst feature (the most negative aspect) of the Project ?

22.00 List any suggestions that you think would improve the success of such a Project in the future, or any comments that you wish to make.

OLYMPIC DATA TECHNOLOGY PROJECT

Post-Games Information Addendum

Evaluation Form 1.0 **March 20, 1988**

Principle Evaluators:

Dr. E. Romaniuk	**University of Alberta**	**(403) 432-5245**
Terry Bruchal	**Edmonton Catholic Schools**	**(403) 426-2010**

SCHOOL NAME: _____

For each statement below you are given a set of values representing a range. Circle one value from the range that best indicates your response to the statement. Responses are neither correct nor wrong. If no suitable response is listed, indicate your preferred alternative. The word 'project' is to be understood as a reference to the Olympic Data Technology Project.

1. Rate the adequacy of the provided inservicing and training to prepare you for participation in the project.

very poor				very good
1	2	3	4	5

2. Overall, I felt prepared to handle the tasks necessary to use the AGT/OCO data base, the electronic messaging system, and the electronic bulletin board.

disagree				agree
1	2	3	4	5

3. Enough time was allocated for the inservicing and training provided.

disagree				agree
1	2	3	4	5

4. Enough hands-on inservicing and training was provided.

disagree				agree
1	2	3	4	5

5. The inservicing and training provided by AGT was sufficient to prepare me for the operation of the AGT/OCO data base, the electronic messaging system, and the electronic bulletin board.

disagree				agree
1	2	3	4	5

6. The inservicing and training provided by AGT was sufficient to prepare me for the operation of INET 2000 (ATANET).

disagree				agree
1	2	3	4	5

7. The inservicing and training provided by AGT was sufficient to prepare me for the operation of my modem, telecommunications software, and my computer as a terminal linked to the AGT computer.

disagree				agree
1	2	3	4	5

8. The documentation provided by AGT for the use and operation of the AGT/OCO data base, the electronic messaging system, and the electronic bulletin board was sufficient for my needs.

disagree				agree
1	2	3	4	5

9. The documentation provided by AGT for the use and operation of INET2000 (ATANET) was sufficient for my needs.

disagree				agree
1	2	3	4	5

10. The documentation provided by was sufficient to prepare me for the operation of my modem and telecommunications software.

disagree				agree
1	2	3	4	5

11. The documentation provided by was sufficient to prepare me for the operation of my computer as a terminal linked to the AGT computer.

disagree				agree
1	2	3	4	5

The following questions require written responses:

12. What information, if any, relating to the operation of hardware and software would have been helpful to you during this project ?

13. What might you suggest to improve the inservicing and preparation of individuals for participation in a project, such as the Olympic Data Technology Project, or a similar project that introduces telecommunications ?

OLYMPIC DATA TECHNOLOGY PROJECT

Impact Assessment Questionaire

Evaluation Form 1.0 **March 13, 1988**

Principle Evaluators:

Dr. E. Romaniuk	**University of Alberta**	**(403)**	**432-5245**
Terry Bruchal	**Edmonton Catholic Schools**	**(403)**	**426-2010**

SCHOOL NAME: _____

Circle your response for each question you are asked to answer. Responses are neither correct nor wrong. If no suitable response is listed, indicate your preferred alternative. The word 'project' is to be understood as a reference to the Olympic Data Technology Project.

1. Are there telecommunications facilities in your school (computer with modem connected to a phone line) ?

YES NO

If you answered yes to question #1 then go to question #4 and complete the rest of the questionaire. If you answered no then answer question #2 and #3. Do not complete the rest of the questionaire. Return it in the self-addressed envelope.

2. If telecommunications facilities were available in your school, which of the following would you use (circle your selections) ?

- Electronic Bulletin Boards
- Electronic Messaging
- Remote Databases
- I wouldn't use the facilities

3. Are electronic databases being used in your school ?

YES NO

4. Which of the following are used in your school (circle your selections)?

Electronic Bulletin Boards	Specify:
Remote Databases	Specify:
Other	Specify:

- Electronic Messaging
- None

5. Does your school use electronic messaging to communicate with other schools ?

YES NO

6. The following relate to how the telecommunications facilities in your school used:

a) Of the available time, estimate the percent of the time are the telecommunications facilities used? (including messaging, databases, and bulletin boards)

Percent of Time Used				
<10%	25%	50%	75%	>90%

b) Of the time that the telecommunication facilities are used, estimate what percent of the use is by individuals rather than groups?

Percent of Time Used by Individuals				
<10%	25%	50%	75%	>90%

c) On the average, estimate how many different sessions occur per day that use the telecommunications facilities (include both groups and individuals)?

Average Number of Sessions Per Day									
<1	2	3	4	5	6	7	8	9	>10

7. Would your school participate in another project like the Olympic Data Technology Project?

YES NO

8. Would another project, such as the Olympic Data Technology Project, increase the use of remote databases, electronic messaging, or electronic bulletin boards in your school beyond the duration of the project?

YES NO

Don't forget to return the questionaire in the self-addressed envelope by March 31, 1989. Thank you.

Appendix C

Project Schools

All of the schools are located in the province of Alberta.

School	Address	City
Alexandra Junior High School	477-6 Street, S.E.	Medicine Hat
Britannia Junior High School	16018-104 Avenue	Edmonton
Chris Akkerman Elementary School	5004 Marbank Drive, N.E.	Calgary
Coalhurst High School	General Delivery	Caolhurst
Father J. A. Turcotte OMI School	8553 Franklin Avenue	Fort McMurray
Gibert Paterson Community School	2109-12 Avenue, S.W.	Lethbridge
Harry Ainlay Composite High School	4350-[illegible] Street	Edmonton
Hay Lakes School		Hay Lakes
J. Percy Page High School	22707 Millwoods Road	Edmonton
Jack James Secondary School	5015-8th Avenue, S.E.	Calgary
Lord Beaverbrook High School	9019 Fairmont Drive, S.E.	Calgary
Mountain View Elementary School	2031 Sable Drive, S.E.	Calgary
Nickle Junior High School	2500 Lake Bonavista Drive, S.E.	Calgary
Ridgevalley School		Crooked Creek
Sam Livingston Elementary School	12011 Bonaventure Drive, S.E.	Calgary
Sexsmith Secondary School		Sexsmith
Sir Alexander MacKenzie School	61 Sir Winston Churchill Avenue	St. Albert
St. Albert High School	33 Malmo drive	St. Albert
St. Cecilia School	8830-132 Avenue	Edmonton
St. Joseph Composite High School	10830-109 Street	Edmonton
St. Mary's High School	111-18 Avenue, S.W.	Calgary
St. Paul Elementary School	429 Ross Haven Drive	Fort McMurray
St. Stephen School	10910 Elbow Drive, S.W.	Calgary
T. A. Norris Junior High School		Peace River
University Elementary School	3035 Utah Drive, N.W.	Calgary
West Park Junior High School	3310-55 Avenue	Red Deer

Appendix D

Survey Letters to Project School Coordinators

(Letter that was sent to the project schools with the Pre-Games questionnaire)

Attention: Project Contact Person

As was mentioned during the meeting in January at AGT, the Olympic Data Technology Project will undergo an evaluation. Some information is necessary in order to establish the effect of the project and to formulate guidelines for assessment. The 'Pre-Games Information' document will provide general information relating to the activities and experience of personnel within the schools of the project. This information will be used to assess the extent to which project objectives have been met and will help to determine the nature of improvements for future implementation of computer technologies.

Since project time lines are tight, your cooperation in completing and returning this document by Monday, February 22 will be appreciated.

The Olympic Data Technology Project holds implications for the future direction of computer technology education in Alberta. You play a significant role in the development of that direction. Thank you very much.

(Letter that was sent to the cohort schools)

Attention: Computer coordinator, consultant, or facilitator .

Computer technologies are rapidly becoming an integral part of education.
A current project has introduced electronic data bases, electronic bulletin boards, and electronic messaging systems into 24 schools across Alberta. This project will provide valuable information regarding the implementation of these technologies into Alberta's educational system.

In order to evaluate the project some baseline data must be obtained. Your school has been selected for this data collection because it is similar to another in which telecommunications has been introduced. The information collected by the survey will be used to assess the extent to which project objectives have been met and will help to determine the nature of improvements for future implementation of computer technologies.

The computer coordinator, consultant, or facilitator in your school should respond to the survey questions in the 'Computer Utilization Survey'.
Since project time lines are tight, your cooperation in completing and returning the document by Monday, February 22 will be appreciated.

Your participation in this project serves a vital role in the assessment of the project and in shaping the future direction of Alberta's education. Thank you for your cooperation.

(Letter that was sent to the project schools with the Post Games Addendum questionnaire)

RE: Olympic Data Technology Project
Inservicing, Training, and Documentation.

As the project is drawing nearer to a close, we are speedily compiling information that will be used to evaluate aspects of the project. The evaluative process consumes time and energy of the project participants, coordinators, and of course members of the evaluation committee. However, thorough evaluations are mechanisms that facilitate improvements and therefore become necessary.

During the course of discussion between the participating agencies, thoughts have turned to other initiatives similar in nature to the present project. It has become necessary to acquire vital information relating to the preparation of participants through inservicing, hands-on training, and documentation. As you are aware, the preparation of participants may well determine the success of any project. Therefore, it is important to the success of future initiatives that your views of how well you were prepared for tasks involve in this project are known.

Please complete and return this last questionaire to Alberta Education in order that future projects can benefit.

I hope that your participation in this project has been an enjoyable experience and that you find it suitable to continue using telecommunications to enhance personal and classroom activities.

Thank-you.

Sincerely,

Terry Bruchal

(Letter that was sent to the project schools with the Impact Assessment questionnaire)

«DATA Schools
Terry Bruchal
10830 - 109 Street
Edmonton, Alberta.
T5H 3L1

March 13, 1989.

«Sir title» «FirstName» «LastName»
«School»
«Address»
«City», Alberta.
«Postal Code»

Dear «FirstName»,

On behalf of the AGT, Alberta Education, and the University of Alberta, I would once again like to thank you for your participation in the Olympic Data Technology Project. Your cooperation and commitment made the Project a success.

A careful analysis of scheduling and implementation of the Project was completed in June, 1988, and it has provided useful guidelines for future initiatives. However the Evaluation Report did not assess the long term impact of the Project on the school environment. As you are aware, it has been one year since the project was completed, and it is now possible to make an assessment regarding the lasting effect of the implementation of telecommunications, electronic databases, and electronic messaging in participating schools. Once again, your cooperation is required.

Included with this mailing is a brief questionaire that we are asking school project coordinators to complete. This survey attempts to gather information that pertains to the present telecommunications activity levels in the Project schools, and it assembles data required to finalize the comprehensive Evaluation Report. The information collected will be used only by members of the Evaluation Committee to complete the evaluation.

Please complete the questionaire (Impact Assessment) and return it in the self-addressed envelope by March 31, 1989. Thank you for your cooperation.

Yours sincerely,

Terry Bruchal
Primary Evaluator, Evaluation Committee.