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PLANNED CHANGE AND ENVIRONMENTAL EDUCATION : AN IMPLEMENTATION STUDY OF "SALMONIDS IN THE CLASSROOM"

by

Susan Jean Staniforth

B.Sc. (Honours) University of Guelph, 1980

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

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ABSTRACT

Planned change concerns the philosophies and strategies of applying knowledge to human affairs, in order to promote intelligent action and change. Implementation, the process of putting ideas into action, is a central step in the planned change process.

I see environmental education programs as a form of planned change that seeks to address the need for environmentally aware, responsible, and participating citizens. In light of the current environmental problems on this planet, environmental education must be seen as an integral part of modern education. Although there has been a large increase in environmental curricula over the past two decades, there has also been growing concern over the material's actual implementation by classroom teachers.

This thesis investigates the process of implementation, by examining the adoption and use of a supplementary environmental education program, "Salmonids in the Classroom", by the North Vancouver school district, a large, urban district in British Columbia. Several questions are addressed, focusing on the incentives and disincentives from the teacher's perspective for implementing the program, and the external, cultural context of the change process itself.

The study's research design is based on qualitative methodology. Four major categories of influential implementation factors were distilled from the current literature on change, and served as the study's research framework: (1) the adoption process, (2) program attributes, (3) school, district, and external factors, and (4) teacher characteristics and perceptions. In-depth, open interviews were conducted with teachers who were using the program, and with the district's assistant superintendents. Informal classroom observations, and related document analysis were also carried out.

Findings were compared with the current research on change and implementation. In all four areas of investigation, the following major influential factors were identified: (i) substantial district support for the innovation (manifested primarily through the establishment of a resource teacher network that offered help and information to program users), (ii) interaction and communication among program users, (iii) teachers' personal interest in the program, and (iv) the program's percieved value for students. These factors were shown to be interrelated in a complex and unique web of context - specific characteristics and circumstances that culminated in the actual process of change.

" The philosophers have only interpreted the world in different ways; the point, however, is to change it. "

Karl Marx

"The environmental crisis is an outward manifestation of a crisis of mind and spirit. There could be no greater misconception of its meaning than to believe it to be concerned only with endangered wildlife, human-made ugliness, and pollution. These are part of it, but more importantly, the crisis is concerned with the kind of creatures we are and what we must become in order to survive."

Lynton K. Caldwell

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I would like to express thanks and appreciation to my committee, for their assistance, encouragement, and advice throughout all stages of the study. Thanks is also due Dr. Linda LaRocque, who gave generously of her time and talents in helping me navigate the twists and turns of the qualitative research process.

My predispositions, ideas, and reflections concerning environmental education and change have been tempered and sharpened by many friends' contributions. A few deserve special thanks. Leesa Fawcett provided much intellectual stimulus, valuable critical analysis, and relentless support and encouragement. Gloria Snively, Abour Cherif, Carol Smithson, Bob Jickling and Myles Radchenko also contributed ideas, articles, provocative discussion, and helpful critiques.

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- S.J.S.

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CHAPTER 1 : INTRODUCTION AND BACKGROUND TO THE STUDY

A/ INTRODUCTION

Change has always been a part of the earth's condition; indeed, it is perhaps the only constant process this planet knows. Humans, as integral members of the planet are not exempt from being a part of its changes. In addition to the unending processes and cycles of natural change, humans have initiated vast changes in all regions of the planet, through agriculture, industry, technology, and a multitude of other practises.

Human social change, or more specifically, methods of directing social change, has been an intense field of study for decades; with contributers as diverse as Karl Marx, John Dewey, and Paolo Friere. "Planned change" is a specific area in this field, and is defined by Bennis, Benne, and Chin (1966) as "the application of systemic and appropriate knowledge to human affairs for the purpose of creating intelligent action and change" (p.3).

The prevalence of newness, of change itself, has accelerated at an incredible rate; the world, as Oppenheimer once remarked, alters as we walk in it.[1] However, some of these alterations are not for the better. We are a species that has affected the shape of the globe in unprecedented ways. We are also the only

species whose activities put at risk virtually the whole of life as we know it. Current environmental problems are far more complex and wide-spread than the technological creations from which they sprung; acid rain, toxic wastes, Chernobyl's far-reaching consequences, and the "greenhouse effect", to name but a few. At our present rate of "progress" disaster stares us in the face. The roots of the environmental crisis are fundamental, deep, and complex. Based on people's old, unquestioned beliefs and attitudes towards the non-human environment, these roots are difficult to unravel, and much harder to outgrow.

Environmental education is (using Bennis et al.'s words) a form of "systemic and appropriate knowledge" that attempts to increase awareness of the environment, address environmental problems, and examine the entrenched attitudes and values that they stem from. [2.] Over the past two decades environmental education has received increasing attention in the public school system. There are hundreds of environmental programs and curricula that have been developed for use worldwide (Barber, 1982; Bybee, 1984; Perelman, 1976). However, the majority of these programs are supplementary, voluntary curricula, many of which never get implemented, and sit unused on library shelves. In an age where people need to

understand scientific and environmental knowledge as never before, the lack of use of environmental and science-based programs could mean more than just an incomplete education: it could eventually spell environmental and planetary disaster.

Yet why are environmental programs not getting into the schools, and through to the students? In examining the literature on planned change, there are a vast number of studies on the failure of educational innovations. The key process that stands out again and again is implementation - the stage of planned change that moves an innovation from ideas to action. It is no surprise then that the major barrier to the active use of environmental programs in schools also seems to be implementation. The essential process of actually putting environmental education into practise in the classroom often fails.

The purpose of this study is to examine, in detail, the largely ignored complexities that surround planned change and the implementation of environmental education programs. The successful adoption and implementation of the environmental education program "Salmonids in the Classroom" ("SiC") was studied in a large urban school district in Vancouver. I felt that by taking a positive look at implementation, and by investigating an exemplary

implementation process, useful insights concerning the complex, critical change process would be generated.

B/ GENERAL PURPOSE OF THE STUDY

This study investigates the implementation of a supplementary environmental education program "Salmonids in the Classroom" from the teacher's perspective, in order to increase our knowledge of the conditions and factors that influence planned change and implementation.

C/ RESEARCH QUESTIONS

The study will attempt to :

(1) Determine some of the incentives and deterrents, as seen from the teacher's perspective, for adopting and implementing the program.

(2) Review the program's implementation strategy and identify its possible advantages, difficulties, and ommissions.

(3) Determine the teacher's understanding of the program's rationale, goals, and objectives.

(4) Explore some of the decisions teachers make when implementing a supplementary environmental education program; what are their needs and concerns, and the criteria they use to assess an innovation before implementing it?

(5) Assess the components of the program that teachers most often use, and those they omit, and investigate the reasons for these choices.

(6) Determine whether any changes to the program were made by teachers, and document these changes and the decisions behind them.

(7) Explore the role of teacher's beliefs, values, and understanding in the implementation process.

(8) Examine the cultural context of the implementation process to describe how external factors may influence a program's use.

D/ RATIONALE

I have divided my justification for this study into three areas, moving from the general to the specific. I begin by discussing (i) the importance of implementation research, followed by (ii) the important role of planned change in environmental education, and conclude with (iii) a rationale for conducting the study from the teacher's perspective.

I/ The Importance of Implementation Research

As research on educational change progresses, the process of implementation is emerging more and more as a central theme. Most recent studies suggest that the outcomes of any attempt at change depend critically on how the change is carried out (Berman & McLaughlin, 1978; Fullan, 1985; Huberman & Miles, 1984). In the large-scale Rand study of programs supporting educational change, a major conclusion stands out clearly: implementation strategies made the difference between success or failure of an innovation, independently of its content or educational method (Berman & McLaughlin, 1978). Implementation is the process of putting into practise the ideas, activities, or programs that make up any change; by putting them into use, the change becomes tangible, and real. As Gross, Giaquinta, & Bernstein

discovered in their acclaimed study: "Innovations introduced into schools are only proposals for change; to achieve their intended effects, they must be implemented." (1971, p.47)

Although the importance of implementation has long been known to educational researchers, it is still a relatively young field of study. Most researchers recognize its debut into the educational research world in about 1970. Yet, in spite of recent advances in studies of educational innovations, specific implementation research seems scarce, (Wang, Nojan, Strom, & Walberg, 1984) and is virtually non-existent with respect to environmental education programs (Johnson, 1980).

Increasing our knowledge of implementation is crucial to further understanding the role of planned change in environmental education. More information is needed about the methods of effectively applying appropriate environmental knowledge to the educational system. As Bennis (1966) states:

> What we know least about - and what continually vexes those of us who are vitally concerned with the effective utilization of knowledge - is implementation. (p.175).

Implementation information is also important to the development, dissemination, monitoring, and evaluation of

environmental education innovations, as will be argued in the following paragraphs.

Implementation and Program Development

Knowledge of the user's worklife, social context, and local environment compels developers to be more precise about the operational components of an environmental education program. Information generated about what affects implementation directly targets areas where users need assistance. In the development of environmental education programs, I believe that the multiple realities and local contexts of program users should be examined and incorporated into the program's implementation. Examining a program's initial change process also provides important information about its actual use - what happens when the program developers and workshop facilitators go home ? (Hall & Loucks, 1975). This type of information can help developers assess user needs and concerns surrounding their initial use of an innovation.

Implementation and Program Evaluation

Before any valid assessment of a program can occur, the extent to which it has been implemented in the first place must be explored (Churchman, 1979; Fullan & Pomfret, 1977; Hall & Loucks, 1975; Wang et al, 1984). "Evaluation research has been dominated by an emphasis on

measuring outcomes." (Patton, 1978, p.152). The problem with outcomes evaluation is that the results give decision-makers very little information upon which to act. Without careful implementation data, it is impossible to analyze the effects of a program, and therefore to draw correct inferences on how to improve it (Charters & Jones, 1973; Weiss, 1972). Hymen, Wright & Hopkins (1962) speak to this common problem in program evaluation:

> The answer to why a program was inneffective may even reduce to the simple fact that it was not in reality operative; it existed only on paper.... when the stimulus is not there, there is no process it can generate. (p. 74-75)

Information on implementation " brings more intelligence to the debate " on evaluating the worth of new programs (Fullan, 1983, p.225). It provides important information for confirming (or disproving) to developers that their programs are effective. It also generates practical data about the program that is useful for discussing its benefits and applications with users and potential users.

II/ Planned Change and Environmental Education

As I have discussed previously in the introduction, the vast changes initiated by humankind have not all been positive ones. The wide range of environmental concerns that is so apparent today provides overwhelming evidence

that this last part of the twentieth century is a crucial period in history for the planet.

We humans, as a species, are often characterized by our mental abilities to think, reason, resolve, and learn. It is obvious that we must all work to apply these abilities to change our basic perspectives and actions towards this planet. Any long-term, lasting changes in our actions towards the natural world must come as a result of changes in our basic attitudes, values, and lifestyles. As Strickland (1979) notes: "The solutions to the complex ecological and environmental problems will not lie in technology alone, but in an alteration of human behavior."

The area of planned social change attempts to consciously employ valid knowledge and change processes to help solve the problems of humans and societies. Most researchers are concerned with the methods of directing social change. These methods must maximize freedom, and limit as little as possible growth, flexibility, and individual input. These methods, and their theories are discussed more fully in Part I of the literature review.

"Normative - re-educative" change strategies[3] focus on society's norms and individual value systems to create intelligent action and change. I believe that environmental education is best used as a form of

normative-re-educative change. The wise application and wide-spread implementation of valid, first-rate environmental programs will produce concrete, tangible and long-term solutions to the current environmental problems facing the planet (Perelman, 1976). In light of what is happening to the environment on a global scale, the paramount task of modern education should be to develop environmentally literate, responsible, and participating citizens (Johnson, 1980; Volk, 1984).

Environmental education seeks to develop a population that is aware of and concerned about the environment, and which has the knowledge, skills, attitudes, and commitment to work individually and collectively towards achieving and maintaining a balance between quality of life and quality of the environment.[4] A large increase in environmental curricula has occurred over the past two decades (Roth, 1976), yet concern has been voiced as to their actual use in classrooms (Johnson, 1980). In order for environmental programs, indeed for any programs to have some influence or impact on students, the programs must first get into the classrooms and be implemented by teachers.

Personally, during my own work in environmental education I became aware of a significant need for practical, tangible information concerning the

implementation of formal and informal environmental programs, materials, and curricula. A vast majority of the studies that examine planned change and implementation deal with programs that are, for the most part, compulsory. Major reviews of the actual use of innovations in schools show their success rate to be discouragingly low (Berman, 1981; Berman & McLaughlin, 1978; Goodlad, 1970; Gross et al, 1971). The supplementary nature of environmental education materials makes them even less likely to be successfully implemented than compulsary innovations, because they possess no "power-coercive" clout such as political, economic, or legal backing, to aid them in navigating the perilous course of adoption and implementation. Therefore, this study attempts to describe the successful implementation of an environmental education program, to provide some much needed insights and examples.

III/ Implementation and the Role of the Teacher

Much of the recent research on planned educational change has focused on the role of the teacher (Leithwood & Montgomery, 1982, p.162). Most recent studies agree that the teacher is the key to implementation. She or he possesses the ultimate autonomy behind the classroom door

with respect to an innovation's successful use (Fullan, 1982).

Doyle & Ponder (1977-78) emphasize the role of "ecological variables" in shaping the way teachers work. They believe that if an effective change strategy is ever to be devised, it must be based on a thorough understanding of the structure and flow of real classroom environments. Sarason (1971) also states that the major actors during implementation are the program's users. A key to understanding implementation then is understanding the teacher's needs and concerns with respect to the actual use of an innovation. Leithwood and MacDonald (1981) clearly emphasized this in a recent study:

> " The effectiveness of implementation strategies depends on knowledge about how and why teachers make certain planning decisions that influence their classroom instruction" (p.103)

The teacher is the final step in the delivery process of any innovation, whether it be a new curriculum, an innovative classroom management program, or a specialized teaching method. A major assumption of this study is that teachers play a critical role in any implementation process. I believe this role is especially crucial in the implementation of environmental education programs.

Environmental education programs in Canada today are primarily non-compulsary, supplemental materials directed

towards science, social science, and sometimes multi-disciplinary use. Their supplementary nature puts even more emphasis on the teacher in terms of their adoption and implementation. Therefore, users of environmental education programs are prime sources of information about implementation and planned change.

E/ RESEARCHER'S PERSPECTIVES AND ASSUMPTIONS

Our value systems and personal constructs shape our images and ways of seeing and explaining the world. Thus, I would like to say a few words about my own perspective as a researcher of planned change and implementation. My view of change tends towards a holistic, interactive orientation; therefore I believe change is best examined using qualitative techniques. (My premise for this choice of methods is explained in Chapter 3, Research Design.)

A quantitative researcher, on the other hand, works from the scientific paradigm, which incorporates logic, reductionism, replication, and statistical analysis into its research perspective. I see change as an individual process, affected by a host of factors, many of them unpredicable. Implementation, a specific stage of planned change, is a complex, multi-dimensional, and continuous process, existing and interacting with individual beliefs and value systems, program variables, cultural influences, and educational system factors. This view is

shared by many other researchers, including Fullan (1982,1983), Hall & Loucks (1975), Leithwood & Montgomery (1982), Wang et al (1984), and Werner (1981). Any researcher's viewpoint is bound to colour and shape their work somewhat; therefore I feel it is advantageous to clarify my perspectives and assumptions from the start.

ASSUMPTIONS OF THE STUDY

(1) I assume the process of implementation to be central to any planned change. Increasing our understanding of implementation will provide new insights into the planning of change, and increase its success.

(2) Implementation is developmental and interactive. I see implementation as a non-linear, continuous process of events, flowing through a loosely-coupled educational system. Therefore, my investigation of implementation tends towards a holistic, qualitative, and descriptive approach.

(3) I assume that the teacher plays a critical role in implementation. The teacher in context will be examined to determine how personal, environmental and cultural factors, and program characteristics affect implementation.

SOME DEFINITIONS

The field of planned change recognizes three broad phases or stages of the change process; adoption, implementation and continuation. Different researchers refer to these stages in different ways, sub-dividing and re-naming them, and adding or omitting steps in the change process. This practise has resulted in some confusion as to the specific meaning of change terminology in differing contexts. In the following section I have defined the terminology used in this study in an attempt to avoid any such confusion.

ADOPTION

I see adoption as the first phase of the change process, also referred to as initiation or mobilization. Adoption consists of the process which leads up to and includes decisions to adopt or proceed with a change. Adoption occurs at both the policy or administrative level, and the practitioner or teacher level. Many external and internal factors are associated with the adoption process, ranging from access to information and availability of resources to an individual's own value system and criteria for adopting a change (Berman & McLaughlin, 1978; Rosenblum & Louis, 1979; Yin, 1982).

"Why change? " and "Should we change?" are questions addressed during the adoption phase of change.

IMPLEMENTATION

Implementation is the second phase of the change process, and begins after the adoption announcement. Implementation, or initial use focuses on efforts to carry out the changes specified by an innovation. In other words, implementation refers to attempts to put a change into practise after it has been adopted. Implementation is affected by a host of factors including the adoption process itself, and occurs in a number of ways with respect to the basic flow of the change process. Implementation occurs at the user or teacher level; it is essentially the "how" of change, and is the major hurdle at the level of practise.

CONTINUATION

The third broad phase of change is continuation, also termed incorporation, routinization, or institutionalization. Continuation refers to long-term, sustained change; whether the change that is implemented becomes an enduring part of the system, or disappears. This phase of change is affected by many factors at both the administrative and practitioner levels, such as budgeting, staffing, advocacy for the change, and the extent of its durability.

Change is a non-linear process, and is never-ending. These three broad categories of change reinforce and delete one another as parts of an interactive, complex and dynamic process.

What follows is further documentation and discussion of the two main areas of study, Implementation and Environmental Education, through a review of the salient literature.

CHAPTER 2 : A REVIEW OF THE LITERATURE

I have divided this literature review into two sections. Part I discusses the literature on planned change and implementation. Part II examines change and innovation in environmental education.

PART I: IMPLEMENTATION & PLANNED CHANGE : A VIEW OF THE LANDSCAPE

INTRODUCTION

> Implementation questions are so complex and subtle that one hardly knows where to begin; or, perhaps more acurately, one feels the need to do the impossible task of starting simultaneously down several paths.
> (Williams, 1976, p.271).

It was with considerable relief that I discovered this statement by Walter Williams, as it concisely captures my own misgivings about this complex yet crucial area of study.

Implementation and educational change are intimately related; indeed, one can envision implementation as an integral and well-developed appendage of educational change research.

Literature on change is vast and voluminous, and implementation, although a younger area of study (most researchers recognize its debut into the educational

research world at about 1970), has made healthy progress, following the example set by it's long-winded parent. Yet, as research on educational change progresses, the process of implementation is emerging more and more as the central force in educational innovation. Most recent studies suggest that the outcomes of any change effort depend critically on how it is carried out (Berman & McLaughlin, 1978; Fullan, 1985; Huberman & Miles, 1984). For it is through implementation that any type of innovation becomes actualized. Implementation is the process of putting into practise the ideas, activities, or programs that make up the change; by putting them into use, the change becomes tangible, and real.

In the following pages, I have attempted to review the relevant literature on educational implementation, focusing on major studies and reviews, and outlining several shifts in the research perspective over the last 2 decades. Much of the literature, however, has its underpinnings in educational change, and three major perspectives on planned change are presented as a framework for the review.

AN OVERVIEW OF IMPLEMENTATION : SETTING THE SCENE

A powerful educational reform movement took place in the United States between 1957 and 1967, sparked

primarily by the launching of the Soviet satellite Sputnik. The federal government, as well as others, saw the launching as a symbol of the U.S.'s technological and educational deficiencies, and pushed for major, legislated reforms in education, geared primarily to the sciences and mathematics. Goodlad & Klein (1970) refer to this period as "the golden age of instructional materials", with the development and use of educational radio and television programs, tapes, records, films, books, inquiry-learning curricula, and much more.

Goodlad & Klein (1970) conducted a large scale study of 158 classrooms in 67 schools across the U.S., to evaluate the results of this decade of educational and curricular reform. One overwhelming conclusion stands out clearly : many if not most of the changes believed to have been taking place in schools were not getting into the classrooms. As Goodlad & Klein (1974) observed: " ... most educational systems are geared to self-preservation, not to self-renewal" (p.100). In almost 60% of the classrooms examined, no implementation of the innovations was found to have occurred.

This prominent study is considered by many (Berman, 1981; McLaughlin, 1978; Williams, 1976; and Yin, 1982) to be the debut of the recognition of implementation as an important educational concept in its own right.

Studies by Goodlad & Klein (1970), Hart (1969) and Jackson (1968) which examined the disillusioning outcomes of these extensive programs, led to the awareness that the interaction between an innovation and its setting can be, and usually is, very uncertain. As Williams so clearly comments:

> Nothing comes across more strongly than the great naivete about implementation. We must learn that the implementation period for complex social programs is not a brief interlude between a bright idea and opening the door for service (1976, p.268).

Several authors of implementation studies and reviews have succeeded in bringing some order to the literature by describing three perspectives or dimensions of implementation that represent the ways researchers view the process. Berman (1981) identifies the (i) managerial, (ii) learning and (iii) bargaining perspectives, while House (1979) refers to the technological, cultural and political views of implementing innovations. Taking a broader perspective of planned change, Chin & Benne (1976) use a three-way classification of current strategies of change: (i) empirical - rational, (ii) power - coercive, and (iii)normative - re-educative strategies. Fullan & Pomfret (1977) classify studies into categories defined by fidelity, mutual adaptation, and processes, while Lieberman & Miller (1984) speak of the policy, managerial, and teacher perspectives on

change. I have liberally borrowed from these categories, changing them somewhat, in order to provide a framework for the literature review.

THE TECHNOLOGICAL-MANAGERIAL PERSPECTIVE

During the 1960's and early 1970's, many of the efforts at studying implementation assumed that educational innovations were "technologies" that could be effectively replicated by schools or districts in much the same way as products and practises in agriculture, manufacturing, and medicine were. The history of this technological view of innovation goes back once again to the launching of Sputnik, and the ensuing attacks on the school curriculum by university scholars. This perspective can be viewed as an empirical - rational strategy for change (Chin & Benne, 1976). Empirical-rational strategies are rooted in the assumption that humans are rational, and will do what is rationally "best" for them, once it is revealed to them. New and "better" school curricula and learning methods had only to be researched and tested, and schooling could be improved.

New educational products were seen to be replicable; consequently, research focused on how to get users to adopt these "validated" innovations. Implementation was assumed to follow the adoption process directly.

Practitioners were bound to use these "better" innovations, as long as they had information and access to them (Berman, 1981). This view of innovation was directly tied to society's view of progress. To be modern was to be innovative, and the good life was built on technology.

Sarason's (1971) detailed and insightful look at the introduction of the New Math into U.S. schools highlights this philosophy, and shows that this change effort, like most other efforts initiated in this way, showed almost no implementation in the long run. The broader organizational variables of the school system were not considered, much less the individual needs and experiences of the program users. Bennis (1972), in his description of efforts to change an entire university, touches on many of the same problems.

Gross and associates (1971) studied an inner-city elementary school attempting to implement a major organizational change in the role of the teacher. The innovation was a total "package", introduced by the district administration and federally funded. This classic study was one of the first to analyze the stages of the implementation process (Fullan, 1972).

The authors were primarily interested in the process of implementation, and the extent to which teachers actually

changed their behavior as required by the innovation. Prior to the introduction of the program, conditions seemed optimal to acceptance of change. It was an experimental school with strong administrative and community backing, plentiful resources and enthusiastic, receptive teachers. Yet, six months after the change was introduced, the staff were still behaving in the traditional way, devoting very little time to trying to implement the change, and generally had an unfavorable attitude towards it.

The authors suggest four basic reasons why the change did not succeed: the teachers' lack of clarity or understanding about the change, their lack of skills and knowledge plus an absence of support structures to aid in learning the new roles, the unavailability of necessary materials, and a lack of motivation to participate in the change, due mainly to an absence of any active role for teachers in its adaptation and formulation.

Research, Development, and Diffusion

By 1968, educational innovation was dominated by the research, development, and diffusion paradigm (R,D,& D) (House, 1979, and Fullan, 1982). This approach is based on a rational sequence of activities, large-scale planning, and a division of labour. A widely recognized

R,D,&D model was developed by Clark & Guba (House, 1979). Their model recognized four stages in the change process: research, development, diffusion and adoption. Havelock (1971) expanded upon this model, including communication links and problem-solving techniques to formulate his linking model of educational change.

However, as several authors note (Berman, 1981; Fullan, 1982; House, 1979; and Sarason, 1982), the R,D,& D approach has not worked very well. As is evident from Clark & Guba's four stages, implementation is not seen as a part of the change process, or rather, it is implicit in the adoption stage. This omission seems to be the major downfall of the R,D,& D paradigm, and a main reason for the lack of use by teachers of the thousands of educational products created by federal R,D,& D laboratories.

The approach assumes a passive " consumer " at the end of the R,D,& D chain, who will unquestioningly adopt and use the innovation, hook, line, and sinker. However, as Sarason so descriptively portrays, teachers are not passive consumers, but actively involved in local environments and sub-cultures.

Zaltman, Florio & Sikorski (1977) provide us with a more current example of the technological perspective of change . In their book Dynamic Educational Change, the

authors develop a very rational, linear view of the change process. They outline several categories for change process models. These models emphasize locus of authority, group processes, decision-making, problem-solving feedback mechanisms, and R,D,& D. Change planners select a strategy, or combination of approaches to change, to best fit their situation. The primary focus for the change process is therefore at the planner-managerial level.

In spite of much criticism, and limited success, the technological-managerial perspective and the R,D,& D approach survive and flourish in our society. Empirical task analysis, measurable objectives, and competency-testing are but a few current examples of its present status in the field of education.

THE POLITICAL - BARGAINING PERSPECTIVE

During the early 1970's, another educational paradigm emerged. House (1974), in his book The Politics of Educational Innovation, proposed a political view of innovation, where change is based on conflicts and compromises among different factions such as developers, administrators, teachers, and parents. Advocacy groups are essential for securing resources, supporting

implementation and providing rewards. Innovation is portrayed as a hierarchy, with the people 'at the top' (administrators and innovators) gaining the most from innovation, and the major burdens and problems falling to those at the bottom: the users.

House's view of change is similar to the bargaining view proposed by Berman (1981). Power is the central factor, focusing on hierarchies in schools and school districts, as well as advocacy groups and external resources. Chin & Benne's (1976) category of power-coercive approaches to change also describes this perspective. These strategies are distinguished by the ways in which power is generated. The most common forms of power are political, economic, and moral, and strategists use this power to further their specific change goals.

The political-bargaining perspective views implementation as a process where conflict and negotiation among various stake-holders define what occurs and how. Implementation is a by-product of conflict resolution. Negotiation between the different groups involved in a change process is crucial. As House (1979) pointed out:

> ... the gap between practitioners and critics is not the result of miscommunication, but of negotiations the developers must conduct to survive. (p.6)

Baldridge (1972) also proposes a political systems approach to change, based on five central assumptions : (1) conflict is natural, and to be expected in any organization, (2) many power blocs will try to influence an organization, (3) small groups of political elites govern most major decisions, (4) decisions must be negotiated compromises among competing groups, and (5) external interest groups can exert alot of influence. Change is viewed as a dynamic political process, and the theory of power is seen as central to its understanding.

Williams (1976) proposes a slightly different version of the political - bargaining view of implementation. He sees implementation as the major hurdle to better social programs, as opposed to monetary or political difficulties. However, instead of rational, logical approaches to the study of implementation, Williams proposes a more holistic view. He describes the "weak linkages" between the actors and bureaucratic layers of an organization, in much the same fashion as Karl Weick (1976) defines educational organizations as "loosely-coupled " systems (Weick, p.4). These links, or loose couplings, are difficult to identify, yet account for much variability and unpredictability in systems, as well as localized autonomy. Williams makes a case for

investigating change using naturalistic, qualitative techniques.

The Rand Change Agent Study

The Rand Study (Berman & McLaughlin, 1978), one of the most significant research studies on educational change, can also be categorized as having a political perspective on innovation, although with quite a different approach. The study's major conclusions , including democratic participation and mutual adaptation, are based in political theory, yet approach the change process from the user's perspective.

From 1973 to 1978 the Rand Corporation, under contract with the U.S Office of Education, conducted a large-scale examination of federally funded programs designed to introduce innovative practises in public schools. Federal policies and "seed money" were found to have a major effect in stimulating local education agencies to adopt innovative projects. However, adoption of projects did not insure their implementation or long-term use. Successful projects depended primarily on <u>how</u> school districts implemented their projects, not on the type or amount of federal funding.

A major conclusion stands out clearly : implementation dominates the innovative process and its outcomes. Implementation strategies made the difference between

success or failure of an innovation, almost independently of its content or educational method. Berman & McLaughlin (1978, p.viii) define implementation strategies as "...the local decisions and choices, explicit or implicit, on how to put the innovation into practise." Effective strategies focused on the teacher as the key to implementation, and emphasized teacher needs, learning, participation in project decisions, and extended training and support. Projects which promoted adaptation, participation, and peer interaction were far more successful in eliciting the support and continued committment of teachers.

A second major conclusion of the study concerns mutual adaptation, " the process by which the project is adapted to the reality of its institutional setting, while at the same time teachers and school officials adapt their practises in response to the project." (Berman & McLaughlin, p. viii). The authors state that the key to successful implementation is allowing modification and negotiation at the user level. As House (1979, p. 5) states: "Mutual adaptation between federal agencies and local schools is definitely a political concept." The Rand Study also emphasizes the importance of strong administrative support, professional incentives, and the

need to include all those involved with the change in building a large and varied constituency.

The Rand Study, although based in the political perspective, took a more organizational look at the change process. The study's findings represent a major shift in implementation policies, from a primary focus on the delivery system, to an emphasis on the deliverer (McLaughlin, 1978, p.31).

A SHIFT IN PERSPECTIVE

> We thought naively, that with appropriate incentives and enablers, across a variety of organizational settings, and for any and all innovations, the same kinds of people would do the proposing, and the same kinds of others, the adopting.
> Neat, simple, precise, and predictable, - but wrong. (Daft & Becker, 1978, p.98).

Beginning in the early 1970's, yet another perspective began to emerge in educational change research. This orientation represented a clear break from most of the technological and political perspectives of the time, as it developed out of a growing disenchantment with current methodologies, and out of studies that charted the many failures of the 1960's reform movement. Many authors have documented this shift in perspective, from focusing on the innovation, to the innovation-in-context, and finally, to the importance of the context itself.

This perspective falls under Chin & Benne's (1976) normative-re-educative category of change. Normative-re-educative change emphasizes the individual in the change process, and stresses participation, clarification, and re-education. A major assumption of this strategy is that change will only occur when all those involved change their normative patterns, and develop committments to new ones.

House (1979) traces the development of this "cultural" perspective on innovation, using as a backdrop the changing norms and values of society. The cultural perspective emerged from the political view of an innovation-in-context. Context itself is stressed, as separate parts of a system are seen as more different than alike. School, classroom, and teacher cultures have been studied, and the understanding of separate groups' individual values and norms are fundamental to this orientation.

Kritek (1976), Fullan & Pomfret (1977) and Yin (1982), in their reviews of implementation, all stress the development of the user's perspective as the central focus of implementation. The user's behavior ultimately determines the innovation's outcome; therefore, user needs, priorities, incentives and understanding of the

innovation must be addressed to ensure adequate implementation.

Finally, Berman (1981) and Williams (1982) also document a dramatic transition over the last 10 years in the focus of change studies. Instead of concentrating on fixed treatments, replicable products, and a quest for rational models, the entire change process has been emphasized and explored.

THE CULTURAL - LEARNING PERSPECTIVE

The central theme pervading all studies concerned with this perspective is the description of schools as having specific social and cultural characteristics.

Seymour Sarason, in his book The Culture of the School and the Problem of Change (1971) was one of the first researchers to stress the importance of viewing schools within a wider social and political environment. He also recognized the need to focus on the roles and resources of all participants in the change process. Sarason sees most change agents and teachers as coming from two different worlds, and believes this to be a major cause of the failure of the 1960's educational reform movement. Reformers were university scholars, and had little contact with public schools. They tended to ignore the harsh realities of the classroom and school organization, and viewed teachers as passive technicians who were unwilling to change, but could be "dispensers" of the newly developed curricula to students.

Sarason views implementation as central to understanding the nature of social change. Successful implementation requires knowledge of the change process, its effects on all individuals involved, and opportunities for these individuals to develop the

skills, understanding, and knowledge that their new roles require.

In order to better understand innovation, Smith & Keith (1971) conducted an intensive study of the establishment of a new, experimental elementary school. The new school was to be an ideal teaching and learning environment, "the new elementary education of the 1960's" (p.23). Its mandate featured open-concept classrooms, staff-created curriculum, team-teaching, and open, collaborative teacher roles. However, by the end of the first 18 months, frustrations and problems had driven over half the original teachers away, as well as the principal.

The authors specify lack of attention to the process of implementation as the major reason for the school's downfall. Although the school's educational goals included an organizational plan and structure, the teachers were not able to work out the operational implications. The "why, and what to change?" were elaborated upon in great detail; the "how to change?" was hardly addressed at all.

In all of the problems outlined by Smith & Keith, there was a failure to cope with two underlying factors in the implementation process: the inevitable uncertainty of users learning new, complex roles, and the necessity for

time and support systems to be built into the process to allow this new learning to occur.

The two studies just described were the first to address the school as an organization having a distinctive culture and community of its own. They are the forerunners of a deluge of cultural-learning perspective studies that grew throughout the 1970's, and which includes the majority of present-day implementation and innovation studies. These studies are far too numerous to review in any detail. Instead, I have focused on the major bodies of research, and refer to others as similarities arise.

THE TEACHER AS THE FOCUS OF IMPLEMENTATION

Throughout the development of the cultural-learning perspective, the user has emerged as the key to implementation. In Fullan's (1972) words: "effective change will never occur until the role of the user in the process is radically altered so that he is intimately involved in all stages of the innovative process" (p.43).

In The Meaning of Educational Change, Fullan (1982) lists 15 main factors affecting implementation. (p.56) They fall into four categories: characteristics of the change, the school district, the school, and the external environment. All of them, in whole or in part, center on

the user's interactions with the change, or on the social conditions of change. Fullan states that: "educational change depends on what teachers do and think - it's as simple and as complex as that." (p.107)

Fullan contends that planned change fails because of reformer's lack of commitment to the change process, and their unwillingness to deal with the multiple realities of the participants. In chapter 7, he summarizes the sociologist Lortie's (1975) study of what teachers do and think. According to this widely quoted study, a teacher's role is characterized by isolation, uncertainty and guilt as to the value of what he/she does, the frustrations of lack of time and unwanted interuptions, the complexity of the teaching act, management problems, isolated joys of reaching individual students, and a lack of flexibility in the daily required routine. These realities of teaching are essential to address when implementing a change.

Fullan lists three criteria that teachers use when assessing any given change :

1. Does the change potentially address a need? Will students be interested?
2. How clear is the change in terms of what the teacher will have to do?

3. How will it affect the teacher personally, in terms of time, energy, new skills, and interference with existing priorities? (p.113).

Doyle and Ponder's (1977-78) "practicality ethic" parallels these three criteria. They speak of the teacher's search for practicality, and list three aspects of this ethic. "Congruence" refers to the teacher's estimate of how the innovation fits their teaching style, and how the students will react to the change. "Instrumentality" is defined as an innovation's "instrumental content" (p.7), that is, specifically how it is to be used in practise. "Cost" concerns the amount of personal investment of time and energy, in proportion to the "returns" or incentives to use the innovation. Therefore, from the perspectives of individual teachers, the balance of incentives and detterents helps to explain the outcome of change efforts.

Rosenblum & Louis (1981), in their well-known study of the Rural Experimental Schools (RES) program, used a systems-oriented version of the cultural-learning perspective. Two major themes influenced their research methodology: an attempt to define and measure the outcomes of the change process, and the concept of "system linkage" - the manner and degree to which parts of the school system are linked. The authors' findings

suggest that the nature and strength of the ties or links between various parts of an educational system are critical elements in influencing implementation. A thorough knowledge of the school system, continuous in-service training, and user participation in planning and coordination are cited as important factors for managing change.

Innovation Up Close

One of the largest and most recent studies of educational change is the study of Dissemination Efforts Supporting School Improvement (DESSI), completed by Crandall and associates in 1983. In their book Innovation Up Close, Huberman & Miles (1984) describe one component of the DESSI project, a field study of significant change efforts in 12 elementary and secondary schools across the U.S. The authors spent over three years studying innovation in these schools, using ethnographic, qualitative research methods. They examined elements such as user and administrator motives to change, attitudes towards the innovations, the role of assistance, and factors affecting stabilization.

The authors revealed that nearly half the users adopted the new programs primarily because of administrative pressure (a contradiction of Zaltman et al's (1977)

theory of performance gaps as being major influential adoption elements). Sustained user assistance was seen to be critical in the implementation process: "Large-scale, change-bearing innovations lived or died by the amount and quality of assistance that their users recieved once the change process was underway" (p.273). This assistance supported user's practise mastery of the new programs, an important factor in later stabilization.

It is interesting to compare the findings of this prominent study with those of the Rand Study (Berman & McLaughlin, 1978). Fundamentally, the theories underlying their concluding remarks are similar, yet they arrive at them via quite different routes and perspectives.

Berman & McLaughlin stress implementation strategies, and mutual adaptation as the two critical factors in the change process. Huberman & Miles see sustained, high-quality assistance as the fundamental component of successful innovations. Their more specific, descriptive study stresses collaboration and communication between administrators and teachers at all stages of the change process. They also emphasize the importance of user commitment to the innovation, but more as a result of mastery of the new program than through adapting it to their circumstances.

Lieberman & Miller, in their book Teachers, Their World, and Their Work (1984), summarize the major studies on change and implementation, and combine the findings with their own experience and research to vividly portray the social realities of teaching. Through examinations of elementary and secondary schools, school leadership, and school improvement efforts, the teacher is highlighted once again as the central factor in any change process:

> Teachers are at the core of any improvement effort. We must pay particular attention to their needs, their longings, their personal and professional concerns, and the ways in which they function as a separate culture...(p.53).

Lieberman & Miller outline the major problems experienced by the classroom teacher. They also explore in detail the "... fine interplay among context, substance, teachers, and staff member's interactions with each other and with the change itself" (p.59). To be successful, the authors believe that any change must consider the practical, social realities of teachers, and they build a strong case for looking at change with a teacher's perspective:

> The process of implementation - that is, actually doing something different in the classroom and finding it to be more effective - is the critical process for teachers (p.103).

These major works are referenced extensively throughout later studies on change and implementation. However, I feel they ignore for the most part the role of teacher's

individual beliefs, and the intrinsic value of an innovation. Is the new program better than what is now being used? Is the change seen as valuable, well-proven, and of good quality? It is difficult to promote a product people do not believe in.

Fullan (1982) discusses the realities of teaching, yet mentions teacher characteristics only briefly, with respect to efficacy in using an innovation. He omits any discussion of the teacher's personal beliefs, interests, goals, and orientations, and how these affect the change process. Doyle & Ponder (1977-78) speak of the teacher's need for practical innovations. Individual differences and perspectives on practicality are bound to affect how "need" is defined, yet the authors do not discuss them. Huberman & Miles (1984) begin to address the issue of teacher attitudes, in terms of motivational factors for teachers to adopt innovations. However, it is an area that has received relatively little attention, especially considering the more recent research shift to the innovation user.

Several authors have specifically explored the effects of teacher constructs and belief systems on program adoption and implementation (Elbaz, 1981; Harootunian, 1980; Olson, 1980; and Werner, 1981). These studies are based on the premise that all innovations are developed

with implicit and explicit assumptions and beliefs, shared by their developers. These operating assumptions are not always shared by teachers, or are unfamiliar to them; therefore, innovations are often changed, or rejected altogether.

Lehman (1972), Little (1984), Schmidt & Buchmann (1983), and Tornatzky (1980) also conducted case studies using qualitative techniques to explore teachers' perspectives on implementation and change. These researchers see the main challenge in implementation to be the development of a shared understanding of a new program amongst all its users.

This body of research also includes sociological and anthropological reviews of the culture of teachers (Lortie, 1975; Wolcott, 1977). As well, many studies have concentrated specifically on the teacher's perspective of change. Stephens (1974) and Pincus (1974) studied the rewards and incentives for teachers to innovate, and found that very few exist in our school systems. De Landsheere (1974), Doyle and Ponder (1977-78), Hall (1976), Klein (1976), and Leithwood & MacDonald (1981) analyzed teachers' resistance to change, and examined criteria teachers use to make decisions and evaluate innovations.

I share these researchers' basic premise that teachers' attitudes towards an innovation are a critical factor when studying implementation. The actual purpose of a program, its 'raison d'etre' or meaning for a teacher, and its implicit value, are bound to affect a teacher's adoption and implementation decisions.

Some of this research is examined further in subsequent chapters, as it relates to the methodology and findings of this study.

Summary Remarks

In the preceding review I have attempted to describe and categorize the major studies and articles dealing with implementation and planned educational change. I also traced the dramatic transition that research on educational innovation has undergone over the last few decades, from the simpler views of change prevalent in the 1950's, to the complex, multi-site, qualitative studies of the 1980's.

After examining these numerous studies of implementation, no single theory, 'right way', or magic formula emerges. Studies of successful implementation are not mirror opposites of studies that document unsuccessful attempts. Furthermore, as Berman (1981) states, examples of successful program implementation seem almost fragile, consisting of people, circumstances,

and ideas in the right place at the right time. The number of conditions, significant and unpredictable variables, and elusive context details seem too numerous and complex to attempt any development of theories, or recipes for change. However, what does emerge from the literature is an array of 'learnings': salient factors and influences that have made significant impacts on the process of implementation in many of the major research studies. These factors form the basis for my research design, as themes from which I investigated the process of change from the teacher's perspective. The study's four main research themes are displayed in Figure 1. The influential implementation factors from the literature are summarized in Table 7, and compared with my findings from this study.

I whole-heartedly agree with Berman when he declares the implementation literature to be a "non-cumulative hodge-podge" (1981, p.254). Berman goes on to cite several reasons for these confusing findings: differing objectives and perspectives of different studies leading to non-comparability, different definitions of success, and differing units of analysis, such as the teacher, the school, the local system, etc. He concludes that this inconsistency of research findings probably reflects educational reality, and not simply inadequate

methodology, or differing opinions of researchers. I also believe that some variation in the findings of change studies is to be expected. Perhaps we need to rethink our measures of 'successful' implementation of an innovation, and employ different definitions under different circumstances.

Over the last three decades, many studies have documented the complexities of educational implementation, and consistently challenged the possibility of clear-cut generalizations. Although no dominant framework for implementation has emerged, I believe that significant progress has been made in ways of thinking about educational change. Much of this research centers on the context of implementation and the user, the areas which are investigated further in this study.

REVIEW OF THE LITERATURE

PART II : IMPLEMENTATION AND ENVIRONMENTAL EDUCATION

Research in the area of planned change and implementation in environmental education is virtually non-existent, even though this area has recieved increased attention in educational research (Johnson, 1980). I could find only one study that dealt specifically with assessing the implementation of an environmental education program. Several researchers have looked at factors influencing teacher's use of environmental materials and the outdoors, while other studies examined the importance of environmental education training for teachers with respect to their use of environmental programs in their classrooms.

Worthing (1983) evaluated the actual use of the British Columbia environmental education program ENCORE, as compared to its intended use as stated by the program's developers. Leithwood's (1981) model for developing a profile of an innovation was used to describe ENCORE, and Hall & Louck's "Levels of Use" model (1975) was used to assess the program's implementation. Six dimensions of the program were identified: its platform, objectives, materials, teaching strategies, content and time frame; and were used to develop a questionnaire. Questions

focused on what parts of the program teachers were using, and the extent of its implementation.

The study concluded that ENCORE was being implemented with its general intent preserved. However, very little information was gained as to the factors that influenced implementation, any changes teachers may have made to the program and the reasons for the changes, or specific details concerning the users themselves.

Johnson (1980) looked at factors that influenced elementary teachers to teach environmental studies. Using focused interviews, he developed 14 descriptive teacher profiles of users and non-users of environmental education materials. Teachers who taught environmental education used textbooks as their primary source of matrial, although outdoor experiences and having plants and animals in the classroom were both stressed as being important elements. Teachers spoke of a variety of reasons for their interest in environmental education, but personal interest and concern for the environment were seen to be the most important. Factors seen to hinder the teaching of environmental education included inadequate training, inadequate resources and information, the constraints of a full teaching day and the prescribed curriculum, excessive preparation time, and a lack of administrative support.

Hall & James (1981) studied the concerns of science teachers implementing a new science curriculum. The "Stages of Concern" model was used to study the implementation concerns and needs of teachers. Personal concerns as to what the innovation would mean to their daily teaching and preparation time were foremost. Prolonged in-service training and a broad-based support system were recommended to facilitate implementation by addressing teacher needs.

Bedwell (1984) ranked the environmental education attitudes of biology students, teachers, and administrators, to determine the relative emphasis each group gave a social/ environmental goal. Out of five goals for biology education, the social/ environmental goal was ranked fourth by all groups. The study points to the gap that environmental educators must fill for environmental education to become a central focus for biology and science instruction. More emphasis is needed on social and environmental issues at all levels of education and teacher training.

Mirka (1973) examined factors which influenced elementary teacher's use of the outdoors in teaching. Using a mailed questionnaire, Mirka surveyed a large, urban school district, and classified respondents as users and non-users. Teachers who used the outdoors were

influenced by four main factors; the value of these experiences to children, the availability of outdoor areas, knowledge and understanding of relevant subject matter, and personal feelings about the outdoors.

Teachers who did not use the outdoors in their teaching cited the unavailability of outdoor areas, insufficient knowledge of subject matter and activities, the unavailability of curriculum, and lack of resource people and support as major deterrents.

One interesting conclusion was that teachers with the same outdoor areas available to them viewed them in two very different ways. Mirka called for improved pre-service and in-service environmental education courses for teachers, as well as improved environmental education materials and facilities.

This study does not address teachers' underlying reasons, perspectives and incentives for using the outdoors. Mirka's recommendations would provide training and materials for teachers, yet do not speak to how and why teachers take environmental education courses, or use environmental materials made available to them.

McCaw (1979-80) conducted a similar study to determine the extent that teachers used the outdoors, and their priorities regarding environmental education as an integral part of the school curriculum. Teachers tended

to use indoor sites more frequently than outdoor, due to problems of transportation, cost, liability, and lack of knowledge concerning outdoor use. McCaw states that teacher in-service training must be considered a basis for effective environmental education programs. However, in order to be supported by a majority of teachers, administrators, and the public, environmental education must be shown to be relevant and able to enhance all areas of the curriculum.

This study points to teachers' need for practical, well-designed environmental programs that can be used with a minimum of resources. Again, however, McCaw omits the whole aspect of teachers' personal understanding of the outdoors, and of the environment. Experiences, beliefs, attitudes and values play a large role in the use of supplemental environmental education programs, yet researchers seldom examine these elements.

Arbuthnot (1977) looked at the roles of personal attitudes and values in individual's perceptions of and behavior towards the environment. Individuals who showed pro-environmental behavior were generally more knowledgeable about environmental issues, and more environmentally aware. Personal beliefs and concerns about the environment are important factors in environmental awareness and behavior. Education is seen

to have a critical role to play in increasing awareness, and gaining behavioral commitments and pro-environmental actions from the public.

Jaus (1978) studied the effects of environmental education instruction on teachers' attitudes towards teaching environmental programs. His study showed that teachers who were trained in both the content and methodology of environmental education were more willing to teach it than teachers who recieved no training in the area. This study concurs with Doyle & Ponder's "practicality ethic" with respect to adopting innovations; a program that teachers feel familiar and confident with, and that corresponds to their teaching style is more likely to be used. Jaus also calls for an increase in pre-service and in-service environmental education courses for teachers. This study supports the findings of Mirka and McCaw: lack of knowledge and training in environmental education seem to be a major reason stated by teachers for not teaching it:

> If two major goals of education are to develop children's attitudes towards the environment and to transmit environmental knowledge to children, a logical first step toward achieving these goals is to produce teachers who are willing to teach environmental education in their classrooms (Jaus, 1978, p.83).

Towler (1980) conducted a cross - Canada survey to determine how many teacher training institutions offered

courses in environmental education. He found that very few courses are available to prospective teachers, and that the courses in existence primarily emphasize content: ecology, outdoor education, and biology. Towler states that the spirit of environmental education in Canada is strong, but the institutions and trained people are too few to make significant strides forward in the field.

Recent studies on teacher's perceptions and use of EE programs document several important influencing factors. Knowledge and experience in the subject area are major factors which influence environmental education program use. Several studies point to positive personal beliefs towards the environment as being necessary factors for teaching environmental education. Available materials, resources, and adequate support for environmental programs are also important considerations. All the studies which examined the use of environmental programs in schools call for increased and improved pre-service and in-service environmental education training for teachers, and prolonged program support.

These studies support the findings of the major research studies on implementation, which state that a good knowledge base in the subject matter, and a wide -

ranging support system are critical factors in the successful implementation of any new program. However, in-service courses, and 'better' environmental programs are only half the battle. Researchers must also concern themselves with teachers; the program users and in-service participants, and their experiences and beliefs about the environment. What are some of the factors that influence a teacher who is (in Jaus's words) "willing to teach environmental education in their classrooms"? We must take a harder look at teachers' attitudes and environmental values, as well as their related skills and knowledge.

CHAPTER 3 : RESEARCH DESIGN

I. RATIONALE FOR THE STUDY'S METHODOLOGY

The study's research design draws from several areas of implementation evaluation, but remains based in qualitative, context-rich theory and techniques. What follows is a brief outline of qualitative research, a rationale for the study's methodology, a description of the influential literature, and the study's research framework and procedures.

In recent years, qualitative research has become a much more accepted and prevalent method of inquiry; indeed, current authors state that qualitative researchers have moved beyond the need to defend the legitimacy of their craft (Herriott & Firestone, 1983; Miles & Huberman, 1984a, 1984b). Having noted this encouraging trend, I have nonetheless included a brief history of the development and usefulness of qualitative research, to reflect on the field's origins, and strengthen the case for my choice of this method of inquiry.

THE CHANGING NATURE OF RESEARCH

The Merriam-Webster Dictionary defines "research" to be a "...studious and critical inquiry and examination aimed at the discovery and interpretation of new knowledge". Perspectives and methods of "studious

inquiry" have undergone some marked changes over time. I begin this discussion of qualitative research with a brief look back at its history.

In the 15th and 16th centuries, "science" as a recognized discipline was born. Its subsequent wide adoption led to an almost blind faith in reason, which was equated with a faith in science. "Science was proclaimed to be the way of understanding the world" (Filstead, 1979, p.35). "Scientific inquiry" was developed and moulded by countless researchers, into a large and firmly established foundation of beliefs and premises. The scientific or rationalistic method of inquiry, is based in realism and logical positivism, and incorporates objectivity, reductionism, value-free observations, and generalizability.

Qualitative or naturalistic research traces its origins to the 18th and 19th centuries, when scholars began to question the appropriateness of the scientific method for studying humans, and other living systems. In 1927, Werner Heisenberg dealt a severe blow to rationalistic inquiry when he formulated his Uncertainty Principle. He showed that there is no such thing as an objective, non-participating observer, and that the presence and consciousness of any observer alters the experiment. We can no longer simply observe reality; we participate in

reality, and are an inseparable part of it. "What we observe," said Heisenberg, "is not nature in itself, but nature exposed to our method of questioning" (from Berman, 1981, p.145).

Qualitative data are made up of detailed descriptions, direct quotes, and in-depth documentation; they consist of words and not numbers. According to Lofland:

> ...qualitative methods represent the participants in their own terms... it is the observer's task to find out what is fundamental or central to the people or world under observation (Lofland, 1971, p.4).

Patton (1980) describes qualitative research as being holistic, inductive, and naturalistic. The holistic approach assumes that understanding a program's context is essential for understanding the program; i.e. "...the whole is greater than the sum of its parts" (p.40). An inductive research strategy allows important dimensions to emerge without the researcher imposing pre-existing theories on the research setting. "The theory emerges from the data; it is not imposed on the data" (p.278). Qualitative inquiry is naturalistic in that the researcher does not try to control or change the research setting in any way.

Increasingly, researchers are realizing that the nature of the change process includes specific, local circumstances, unique, internal program dynamics, and

individual user differences, all factors that are impossible to represent using uni-dimensional, quantitative scales. As Pine argues:

> The ecology of teaching, the ecology of implementing educational innovations, and the ecology of initiating change requires an emphasis on hypothesis generating and qualitative methodology (Pine, 1981, p.7).

Many researchers support naturalistic inquiry as the only viable way to explore the complexities of planned change (Bussis, Chittenden & Amarel, 1976; Doyle & Ponder, 1977-78; Fullan, 1972, 1982, 1983; Gross et al, 1971; Guba & Lincoln, 1982; Lofland & Lofland, (1984), Olson, 1980; Patton, 1980, to name but a few.) As for studying implementation, Patton states that "...qualitative methods are ideally suited to the task of describing program implementation" (Patton, 1980, p.70).

II. INFLUENTIAL IMPLEMENTATION RESEARCH

This study is an investigation of the implementation process, and so does not attempt a structured evaluation of program implementation. However, I have drawn from several areas of implementation evaluation as a basis for my research methodology. These areas will be briefly described, along with their relationship to my research design.

Several researchers have outlined three basic types of implementation evaluation: (1) the effort approach, which documents the program's attributes, and their quality and quantity, (2) the process approach, which focuses on the program's actual operations, usually through program users' perceptions, and (3) the product approach, that examines the effects produced by a program (Patton, 1978). These approaches are not mutually exclusive. Effort and process evaluation methods form a background for my methodology, in terms of sequencing my investigation, and focusing on both program attributes and actual use.

Two stages of inquiry are identified by most recent implementation evaluation methodologies, and also serve to structure my research: (1) Defining and describing the essential components of the innovation, or, in other words, describing what the fully implemented innovation would look like in practise, and (2) assessing the actual use of the innovation to determine how it compares with intended use (Fullan, 1983; Hall & Loucks, 1975; Leithwood & Montgomery, 1980; Patton, 1978; Scheirer & Rezmovic, 1983).

Both Hall & Loucks' " Levels of Use " (LoU) framework (1975), and Leithwood & Montgomery's (1980, 1982, 1986) Innovation Profile evaluation methodologies also

influenced my research design, in terms of their perspectives on the change process, their focus on innovation users as the primary source of data about its implementation, and their use of the focused interview as the major data collection instrument. I also used their basic sequence of preliminary study, innovation description, instrument development, and investigation. However, I found that most implementation evaluation methods, including Innovation Profiles and LoU research describe specific degrees of program use: the "what" of implementation, in a formalized, structured sense. And, as Fullan (1982, p.221) states:

> Level of implementation as an explanatory factor is only a first order explanantion. The immediate next question is what factors account for differences in implementation in the first place.

As well, these evaluation methods were designed to examine the use of prescribed innovations, and not the implementation of supplementary, voluntary environmental education programs. With virtually no implementation guidelines, minimal resources, and no compulsary clout to aid motivation, supplementary environmental programs seem to be used in a sporadic, highly variable manner. Therefore, in order to investigate the relatively unique circumstances surrounding supplementary program implementation, I used a more flexible research design,

based on the underlying principles of the above-mentioned implementation evaluation methods, and employing open-ended interviewing, observation, and document analysis. Qualitative interviews were at the heart of the inquiry, as their underlying objectives best suited the study's goals and philosophies.

The fundamental principle behind qualitative interviewing is to provide a framework within which respondents can express their own understandings in their own terms (Patton, 1980). Semi-structured, focused interviews have proven to be one of the most valuable research tools for investigating the perspectives of users of an innovation (Bussis et al, 1976; Fullan, 1983; Olson, 1980; Scheirer & Rezmovic, 1983; Werner, 1981). Recent research has shown that interviews are superior to observation when gathering information about program implementation (Leithwood & Montgomery, 1986).

In this study, I decided to use a semi-structured, open-ended interview for several reasons: (1) to allow for cross-site comparisons, (2) to minimize interviewer effects by asking the same questions of each person interviewed, (3) to allow the interview to be inspected and verified by program developers and users, thereby ensuring a more viable, relevant instrument, and (4) to focus the data collection, so that interview time is

carefully used, and data analysis is more efficient. The weakness of this approach is that a standardized guide limits the interviewer's flexibility in pursuing unanticipated issues that may arise in individual situations. However, I allowed for as much flexibility as possible in the interview guide itself, and during the interviews, to encourage more in-depth exploration. The following paragraphs describe the study's research methodology in more detail.

III. METHODOLOGY

In this section, the study's research procedures are outlined chronologically, and graphically displayed in Figure 2. The development of the interview guides is described in detail, as well as the data reduction and analysis processes, and the selection of research participants.

Research Framework

Initially, the environmental education program "Salmonids in the Classroom" was described in detail, in terms of its major goals and objectives, content, intended implementation, and general overall perspective. This description was developed with input and criticisms from several program developers and users, in order to

verify its relevance with respect to the program's overall purpose and actual use. Related program documents were also reviewed for relevant program information.

A flexible, open interview guide was then developed, based on the study's research questions, factors from the literature that have been shown to influence implementation, and information from the program description. Other relevant data with respect to program use were collected through informal classroom observations in six of the interviewed teachers' classrooms. Checklists were kept which focused on areas such as classroom records, display of program materials, and active involvement with the program.

IV. INTERVIEW DEVELOPMENT

The teacher interview guide (see Appendix 1) was developed around four general sections, corresponding to four 'global themes' that were distilled from the research literature, and from the information available about the program itself: A/ The Adoption Process, B/ Program Attributes, C/ School/ District/ External Factors, and D/ Teacher Characteristics. These research themes are graphically displayed in Figure 1. They constitute the main areas of investigation of the study,

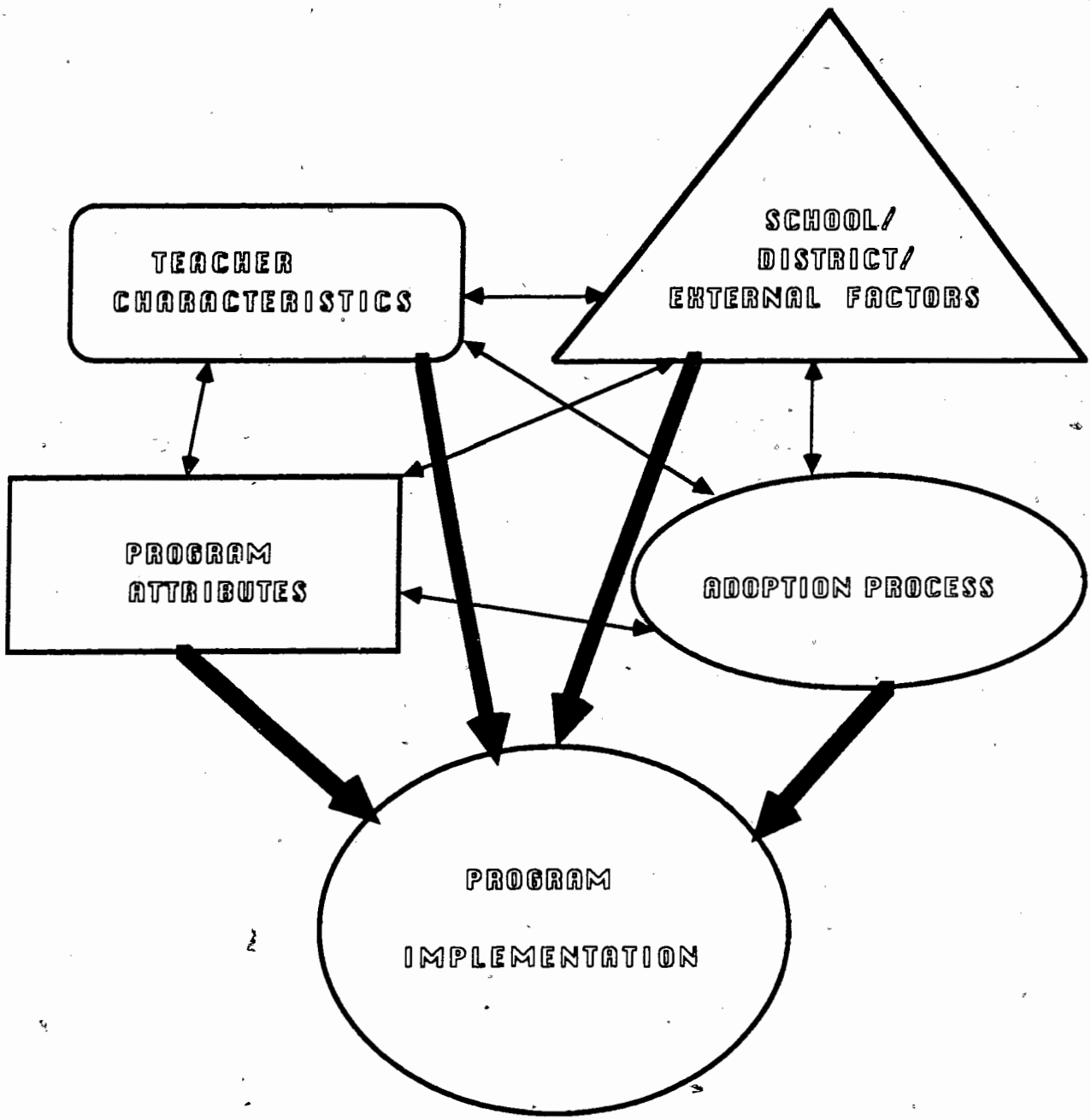


FIGURE 1 : THE FOUR RESEARCH THEMES OF THE STUDY

and provide the focus for data analysis and interpretation.

Teachers were also asked to describe any changes that they may have made to the salmonid program. I believe this adaptation perspective to be an important distinction, especially with respect to supplementary programs. However, very few implementation evaluation methodologies account for any changes that the user might make to the program (Fullan, 1983; Patton, 1978).

As a result of preliminary data collection and analysis, it became apparent that the district was quite involved with the program. The district's two assistant superintendents were mentioned repeatedly as major supporters of the salmonid program, and so were also interviewed, to obtain further information about district influences. Relevant questions for the district interview guide were drawn from information gathered from the teacher interviews, and from recent studies of district influences on implementation (see Appendix 2 for the District Interview Guide).

The teacher and district interview guides followed the format of a focused interview, as defined by Merton & Kendall (1946). They were developed using a semi-structured and unstructured style, with several semi-structured questions followed by open-ended probes,

leaving the interviewee as much freedom as possible to express her/his implementation experiences, successes, and problems.

The interview structure followed the "funnel design" advocated by several researchers, notably Bogdan & Biklen (1982), Bussis et al, (1976); Miles & Huberman, (1984a); and Patton, (1980). The interview was structured chronologically, beginning with broad-based questions that dealt with general content, background information, and activities that the teacher was familiar with and comfortable talking about. This set the scene for more in-depth questions that focused on specific program attributes, objectives, and teacher priorities and concerns. Care was taken to keep the questions clear and free from jargon, confusing terminology, and leading comments. Dichotomous 'yes-no' questions and "Why ?" questions were avoided, to promote fuller, descriptive discussions, and avoid assumptions of cause-effect relationships and rationality. Routine background demographic information was collected after the interview, on a personal data card. By omitting short-answer, dull, categorical questions from the interview, more active involvement in natural discussions is encouraged (Patton, 1980).

The format and content of the teacher interview was developed with assistance and input from several program developers and users. Initially, 61 questions were formulated, from factors identified in the implementation literature. These questions were then condensed, and appropriate probes and transition statements were added. A pilot interview was developed and field tested using four elementary teachers that were familiar with SiC, yet not involved with the study.

Fourteen teacher interviews were conducted during a two month period in the spring of 1986. They averaged 60 - 70 minutes in length. All of them took place either in the teacher's classroom or in a quiet room nearby. After preliminary data organization and coding had been completed, the district's two assistant superintendents were interviewed. This additional data served to corroborate the information collected through the teacher interviews, and explore any district level implementation influences.

V. THE RESEARCH SUBJECTS

The study's subjects consisted of fourteen elementary school teachers from one school district who were using "Salmonids in the Classroom". These teachers were located through the Education Coordinator of the Salmonid Enhancement Program, who maintained a listing of

educators using the salmonid program in B.C. The research sample was selectively or purposefully drawn from this group, to maximize the range of information collected (Guba & Lincoln, 1982). By specifically choosing teachers who were actively using the program, I increased the range and amount of information obtained about salmonid program users, the group under study. Initially, twenty teachers were identified in the North Vancouver school district, and contacted by phone. Several had discontinued using the program, and three others had left the district, leaving a sample size of fourteen teachers from nine different schools.

Deciding to interview teachers from one school district allowed for a cross-section of grades to be studied and different perspectives to be sampled, yet the administrative environment, community resources, and available information about the innovation remained constant. Also, by focusing on one school district and employing purposive samoling, it was possible to obtain more detailed, "thick description" about the program's use in context, thus increasing the transferability of the study's findings (Guba & Lincoln, 1982).

VI. DATA REDUCTION AND ANALYSIS

The fourteen teacher interviews were tape-recorded and subsequently transcribed in full soon after they

occurred, using a computer word processor. Three copies were made of each transcription, the original being stored on computer disc. The first stage of data reduction was to descriptively code the interviews, using codes derived from the four themes of the interview, and the accompanying questions (These codes are presented and defined in Appendix 3). Then the interview data was sorted into categories corresponding to the four themes of the interview framework. The photocopied, coded interviews were cut and pasted, and the coded sections were sorted into four file folders.

Four initial matrices were formed (see Appendix 4) using the interview questions and the descriptive codes, to condense the data further. In Chapter 5, the data is described and illustrated with relevant quotes taken directly from the interviews (Tables 1 - 6). By removing quotations from the body of the interviews, I ran the risk of taking the data out of context; however, it was done to gain better access to the data, provide some background to aid data interpretation by the reader, and give further credibility to the report. As Lofland (1971) stated: "...quoting and describing in an analytic context" is "the heart of qualitative analysis" (p.128). The data was then further analyzed with respect to the initial research questions and the current findings in the literature on change and implementation.

The district interviews were treated in much the same fashion: first coded descriptively, and then further interpreted. The implications of the district interview data on the teacher interview data are discussed in Chapter 6.

VI. CREDIBILITY OF THE RESEARCH FINDINGS

Generalizability and replicability, the traditional validity criteria specified in rationalistic inquiry, are not appropriate to naturalistic research; indeed, these concepts are undergoing revision in many fields of study. However, qualitative research has often come under fire for its lack of explicit, systematic methods for drawing conclusions and verifying their sturdiness. I agree with Guba & Lincoln (1982), and Miles & Huberman (1984a, 1984b) when they state that naturalistic researchers have an important obligation to attend to trustworthiness criteria, in order to combat this degree of uncertainty about qualitative analysis. In the following paragraphs, I have attempted to address this need by discussing the credibility and usefulness of the study's methods and findings.

I was strongly influenced by Miles & Huberman's (1984a) data analysis methods, and adopted their format of orderliness and clarity in the study's investigation and

analysis procedures. Throughout the study, I attended to explicit descriptions of my research methods and conclusions, in order to increase the study's validity. Also, by identifying the study's parameters, some measure of replication could be possible if further investigation was considered.

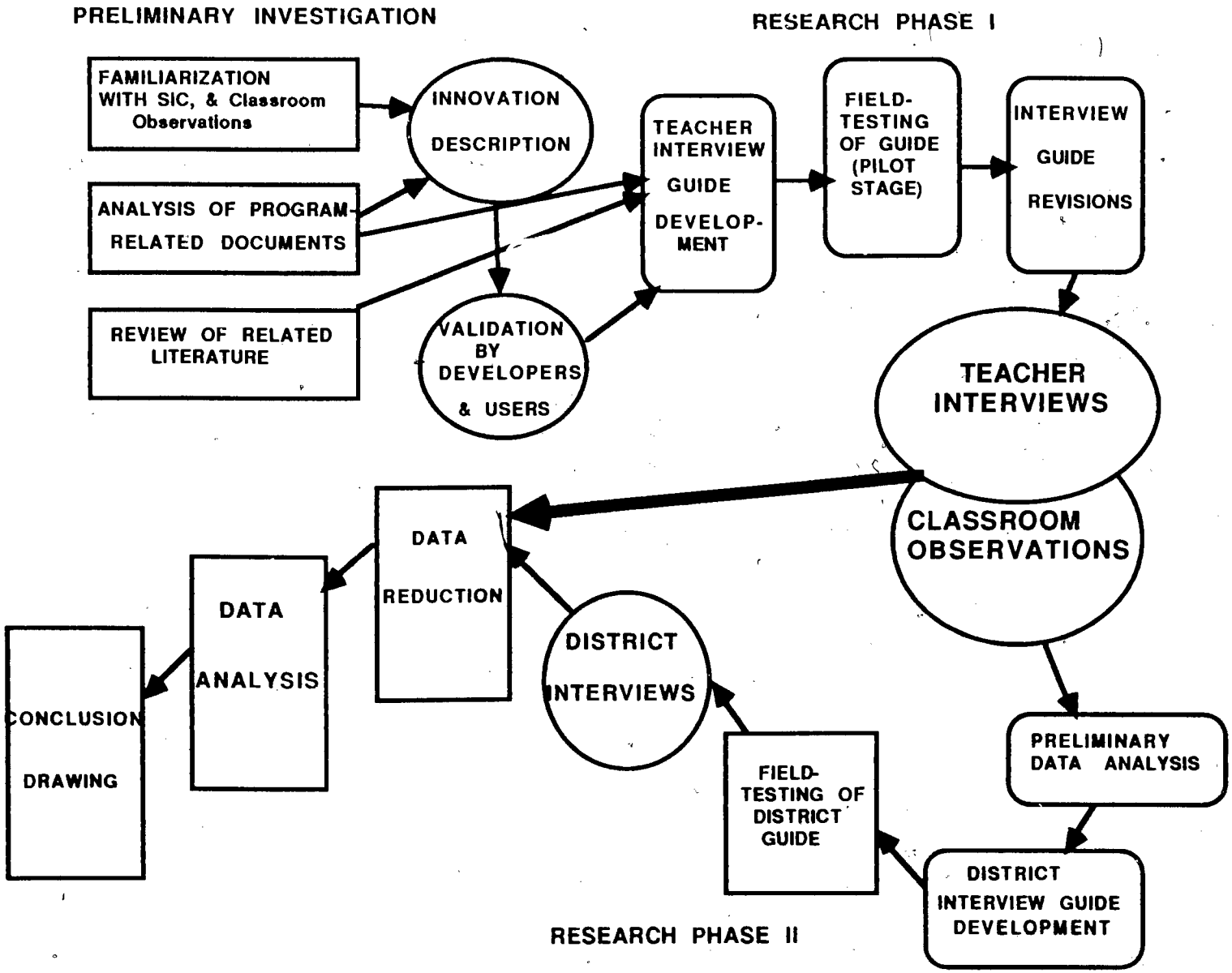
The credibility or validity of the data was assured by using several data collection methods: (1) interviews, (2) informal observation, and (3) document analysis. As well, multiple data sources participated in the study : (1) teachers, (2) the assistant superintendents, (3) students, and (4) Dept.of Fisheries and Oceans' personnel. Another researcher not involved with the study served as an external audit, randomly checking audio-taped data, interview transcriptions, and coding decisions to ensure reliability and validity of the data itself, and the analysis procedures.[5]

Primary source information, in the form of direct quotations and segments of related documents also adds credibility to the analysis and interpretation of events According to Lofland & Lofland (1984), this provides readers with direct access to the data, allowing them to draw their own references and conclusions.

The final research findings were compiled, and presented back to the actual data sources; the program

developers and several participants were asked to verify if in fact the study's interpretations represented their realities appropriately. This process complies with Guba & Lincoln's (1982) credibility and validity criteria, and meets the "referential adequacy" criterion described by Gray (1981), whereby..."the work is familiar to others who subsequently encounter it" (p. 346).

FIGURE 2 : THE STUDY'S RESEARCH FRAMEWORK



CHAPTER 4: A DESCRIPTION OF THE INNOVATION: "Salmonids in the Classroom" (SIC).

In this chapter, the environmental education program "Salmonids in the Classroom" (SiC) is described in detail, in terms of its development, goals, content and overall perspective. In addition, I have included a commentary section, containing my own perceptions of this curriculum. This personal view of "Salmonids in the Classroom" is included to provide some background information for the reader; it presents a critical review of the salmonid program, and outlines my own opinion and assessment of the program which have no doubt shaped my research somewhat. Also, many of my initial perceptions of the program were shared by the teachers I interviewed, as will be detailed in the following chapters.

The Dept. of Fisheries and Oceans' curriculum "Salmonids in the Classroom" was chosen for the study for several reasons. Through formal and informal evaluations (see DPA, 1983, and Snively, 1985) SiC has been lauded as one of the most successful marine/environmental programs in B.C. "Salmonids in the Classroom" fits the general genre of environmental education programs: it was developed through an outside agency, it is available to teachers through the British Columbia Teachers Federation Lesson Aids Services (which markets many educational aids

to B.C. schools), it is supplemental, locally relevant with respect to B.C.'s resources, concerned with environmental awareness, and has some hands-on activities. My own personal interest in the program, and my past experiences with marine biology and marine education also influenced my choice.

I. A DESCRIPTION OF "Salmonids in the Classroom":

" A Prospective Curriculum Aid to Instructing Students in B.C. about the Life and Being of Pacific Salmon and Anadromous Trout." Elementary Guide

"Salmonids in the Classroom" is a multi- disciplinary, supplemental program concerning the life cycles, characteristics, and associated human activities of the seven species of salmonids in British Columbia. The curriculum package consists of a large ring looseleaf binder of about 550 pages of printed materials, divided into 4 teaching units, reference material, an audio-visual catalogue, and a bibliography. In order to provide a thorough overview of the program, this description will review the history and development of the program, its rationale, format, and content.

SOME BACKGROUND

" Salmonids in the Classroom" is funded by the B.C. Salmonid Enhancement Program (SEP), a joint federal-provincial program with authority for carrying out salmonid enhancement activities across the province. SEP was established as a means to restore the depleted stocks of B.C. salmonids to the levels of abundance of 1900 - approximately double what they are today. The main causes of this depletion are overfishing and habitat destruction. SiC is part of the Public Involvement Program (PIP) component of SEP.

PIP's primary objective is to involve the public in the Salmonid Enhancement Program, by promoting public awareness and concern for the salmonid resource, providing information about SEP, and developing opportunities for the public to get involved in salmonid enhancement. PIP evolved a four-component approach: Education, Participation, Information, and Advisory. SiC constitutes the Education Component of PIP.

SiC's Development

Public inquiries conducted in 1976 by the federal Dept. of Fisheries and Oceans indicated a need for education about SEP. Therefore, a group of educators (mainly secondary school teachers and representatives from the

Ministry of Education) was established to develop an education package. A draft package of seven large ring binders was developed in 1978 for junior-secondary students, and field-tested in four school districts by 47 teachers. As a result of the field testing, teachers requested that a package be designed specifically for elementary grades, and a group of six teachers was formed to advise on its development. Both packages were submitted to the Ministry of Education for review, and were approved as supplementary materials.

In September 1979, "Salmonids in the Classroom" was introduced to the school system. During that year, SEP sponsored 33 workshops, attended by 680 teachers, as well as workshops at the University of British Columbia, University of Victoria, and Simon Fraser University, to familiarize teachers with the package.

In 1980, an Education Coordinator was hired. She edited the program to two volumes (one each for elementary and secondary schools), prepared an audio-visual guide, and developed a primary program which was introduced in Sept. 1985. A number of inservice workshops were conducted for teachers, but these have been limited in recent years by education budget cutbacks.

Community Advisors (CA's), the field staff of PIP, also carry out some educational duties. There are 9 CA's

stationed throughout the province, who serve as support staff for SEP participation projects. In addition to other public speaking and media duties, they give school talks and demonstrations, and assist with field trips and class projects.

OBJECTIVES

Although there are specific learning objectives for each lesson, there are no formally stated goals in the salmonid curriculum. In the introduction to SiC, it states that:

> ...this program has been assembled to provide a better understanding of (the salmonid resource) and the relationship of salmonids in our cultures and environment (SiC Introduction, p.1).

More formally outlined goals are found in the Dept. of Fisheries and Oceans' (DFO) literature on PIP, which states that the Education Component was directed at two of PIP's original objectives, namely:

1. To promote public awareness of, concern for, and commitment to the protection of stream systems as essential elements of a long term program of salmonid enhancement.
2. To provide the concerned public with factual information on the goals, strategies, methods,

implementation plans, costs, benefits, and administrative organization of the SEP.

(DPA Evaluation, 1983, p. 4-1).

FORMAT

"Salmonids in the Classroom" (Elementary) consists of a large ring binder of lessons, activity sheets, overheads, and reference materials. It is multi-disciplinary in approach and claims to be applicable within science, social studies, language arts, and art. The material is separated into four units, covering salmonid biology, habitat, fishing, and resource management.

These four units each contain 3 - 5 lessons, termed multiple session lessons. A lesson outline presents the theme of the lesson: what students will do, the important elements of the lesson, and the basic content to be covered. The outline also lists suggested subject areas and grade levels, pre-requisites, vocabulary, instructional objectives, and necessary preparation materials from the package.

Lesson goals are stated in relation to the Ministry of Education's Guide to CORE Curriculum, and identified by a letter, and a general goal statement. (for example: "Goal L - To develop the skills of inquiry, analysis, and problem-solving"). Learning outcomes are also provided in

relation to the CORE guide, but just the letter and number code are given (for example, B7, H6, K4), requiring the teacher to refer back to the Guide for details.

Following the outline, a lesson plan is presented, divided into several parts, depending on the length of the lesson. Student activity sheets and overhead transparencies referred to in the lesson are provided after the plan. Reference material and audio-visual guides are in separate sections. What follows is a brief outline of the four teaching units, and their accompanying reference sections.

UNIT AA, Biological Aspects of the Salmonid, consists of three lessons, dealing with classification, life cycles, and adaptations. Students are introduced to classification of animal species, the salmonid species of B.C. in general, and the coho in particular. The life cycles of these fish are examined, as are the physical and behavioral adaptations that allow salmonids to survive and reproduce in different environments.

UNIT BB, Salmonid Habitat, presents four lessons, relating to the four areas where the different salmonid species live during their lifetime; small streams, rivers, estuaries, and the ocean. Water quality and the necessary biological requirements for growth and survival

in each of these environments are discussed. The three major river systems in the province are examined, and some of the problems associated with human development of these areas are outlined.

UNIT CC, The Fishing Experience, is divided into five lessons. The economics of salmon, as influenced by the commercial, sport, and native fisheries, is discussed. The vessels and gear used by each fishery is examined, as well as the processing industry. The importance of salmon to the culture of the Indians of the Pacific Northwest is also discussed.

UNIT DD, Salmonids in Today's World, presents three lessons, which discuss human activities associated with the water resource, and their effects on salmon. The concepts of competition for resources, cooperative resource planning, and resource management are presented. The Salmonid Enhancement Program is described, including its various enhancement techniques and its benefits to Canadians.

There are six additional sections following the lesson outlines. The Reference Materials section provides a large amount of background information for teachers on topics related to the study of salmonids. It also contains a glossary of terms found in the text.

The Evaluation Suggestions section contains quizzes, tests, puzzles, and vocabulary activities to measure the instructional objectives of the lessons. They are presented as suggestions only, allowing each teacher to evaluate her/his own program objectives. All the evaluation tasks are structured pencil and paper activities.

An Audio Visual Catalogue and Guide is included, providing a synopsis of sixty-nine film/slide presentations. The materials are available through the Provincial Educational Media Centre, the National Film Board, or the Dept. of Fisheries & Oceans. Comments as to the content and applicability of the presentations are provided. Twenty presentations were selected as being most relevant to the program. A more detailed guide is provided for this material, and includes a synopsis, vocabulary outline, and discussion questions and assignments relating to each presentation.

The section on Optional Activities states in the opening rationale that the activities presented provide the teacher with the opportunity to: (i) involve his/her students in "doing" or "hands-on" type of activities, and (ii) integrate the study of salmonids into several subject areas.

The Community Advisors are listed as resource people to help with any of the proposed projects. The activities include small stream enhancement, stream incubation boxes, classroom hatcheries, ageing fish, studying other aquatic organisms, conservation games, and art ideas.

The section of Teacher Answer Sheets provides answers for the questions asked on the student activity sheets and the evaluation sheets.

The Bibliography consists of an unannotated list of books and publications relating to the study of salmon.

II. RESEARCHER'S COMMENTARY AND CRITIQUE

My own views and comments on the salmonid program are presented here, pertaining to the program's format, emphasis, and objectives.

Format

"Salmonids in the Clasroom" is a very factually oriented curriculum. There is a lot of knowledge-based information presented in the manual, and initially I found its size overwhelming. However, the manual materials are very well organized, with related student activity sheets and audio-visual aids clearly and logically presented in the lessons. Lesson plans are colour-coded for easier access.

There is also a large amount of background information provided for the teacher, and the glossary of terms is thorough and complete.

The introduction states that "Salmonids in the Classroom" is multi-disciplinary, and can be effectively used by teachers in several different programs, or by one teacher wishing to bring various disciplines into his/her subject area. The authors suggest that the curriculum is organized to encourage "the development of skills related to many disciplines including science, social studies, geography, political science, English language reading, art and music, philosophy, and economics" (SiC, Introduction, p.3). The program is described as having "logical formats for systematic teaching and progressive learning" (Introduction, p.2).

However, I found the lessons to be highly content-oriented, and very structured. The lesson plans are mainly teacher-directed, and consist of lecture/ discussion sessions, student activity sheets, overhead transparencies and/or film and slide presentations. Alternative learning styles, activity-oriented studies, and student-directed lessons are absent from the teaching units. This emphasis on knowledge and product-centered learning is more evident when one looks at the evaluation suggestions. They are highly objective, and concentrate

heavily on multiple choice, and true and false evaluation techniques.

The multi-disciplinary aspect of the curriculum is also not evident in the teaching units. Over half of the 15 lesson outlines presented are designed to be taught as science activities, the rest being oriented to social studies, with a few references to language arts.

The program partially fulfills its promise of multi-disciplinarity in the Optional Activities section. Although not extensively described, there are many process-oriented, hands-on activities listed, several involving outdoor studies such as stream rehabilitation, mapping, and aquatic studies. Several conservation games are presented, as well as art ideas, salmon recipes, and a creative writing activity. As for flexibility, the lesson strategies revolve around the behavior modification and information-processing models of learning. Each lesson contains clearly defined behavioral learning objectives. Where activities do not involve the direct acquisition of knowledge, they usually focus on a selected problem, and attempt to have students arrive at a solution. Again, most flexibility falls within the sphere of the extension activities, where a variety of both teacher and student-directed activities are presented.

Program Emphasis

The program content is quite extensive. The biological aspects and environmental needs of salmonids are well described and thoroughly presented. The material has a lot of local relevance, as it contains many references to B.C. rivers, resources, industries, and native cultures.

The program's main emphasis is on the wise use and enhancement of the salmonid resource. It stresses salmon as an important and valuable species for human use, economically, culturally, and politically. Salmon must be carefully and responsibly managed, through the Salmonid Enhancement Program, to maintain their continued availability to humans.

The relationships between salmon and humans, and salmon and the environment are dealt with quite extensively, yet the connections are not quite completed when it comes to discussions about human's relationships with, and neglect of, the environment, and how this affects salmon. There is only a cursory mention of the overfishing of salmonid stocks being at least partially responsible for the need for enhancement in the first place. Although there is information in the reference section that addresses these areas further, the curriculum takes on the appearance of not wanting to offend vested interests, such as commercial fishermen, sports fishermen, and industry.

Lack of an Ecological Perspective

Also, there is very little mention of the relationships of salmon to the wider ecosystems of which they are a part. There is almost no discussion of any other marine or freshwater organisms or natural systems. The aquatic environment as a whole, the populations of birds, animals, plants, and insects that it supports, predator-prey relationships, food chains, nutrient cycles and, most importantly, the interdependence of all of these essential elements are virtually ignored. This focus on salmonids alone implicitly elevates them in importance above all other species, whether commercially exploited by humans or not.

Hence the salmonid program is a very 'human - centered' curriculum, focusing on humans and our priorities in the environment (in this case salmon), as opposed to an 'environment - centered' curriculum, where natural and human environments are primary themes. This whole issue of values, although central to the entire salmonid enhancement emphasis of the program, is ignored in the curriculum.

The curriculum glossary defines the Salmonid Enhancement Program as "a positive manipulation of an ecological system". The enhancement program is assumed to be good in itself, and contains no mention of alternative

points of view. Concerns such as the genetic manipulation of salmonids, changes in population dynamics, the potential for the weakening of salmonid strains, and the effects on other aquatic species of enhancing salmonids are not addressed in the curriculum. Instead, the curriculum tends to be more of a promotional vehicle for a particular point of view, that of SEP. Obviously, a curriculum that has been sponsored and developed by the Salmonid Enhancement Program will stress salmonids, the salmon fishery, and enhancement as main priorities. The program does not claim to provide anything beyond information about the salmonid resource. However, I believe this narrow focus is detrimental, as it detracts from a thorough description of salmonids, and also forfeits an important opportunity to provide elementary students with a broad-based understanding of the aquatic environment.

In summary, I view "Salmonids in the Classroom" as a substantial, knowledge-oriented curriculum focusing primarily on salmonid enhancement. Many of my perceptions of the curriculum are also shared by Snively (1985), in her review of the program. The binder contains alot of information and teacher-directed lesson plans, yet its large size is detrimental. Lessons are primarily pencil and paper activities, with some "hands-on" activities

presented as optional material. The program is relatively narrow in focus, covering the biological, economic and cultural aspects of salmonids, and omitting the wider, ecological view of marine and freshwater ecosystems.

CHAPTER FIVE : PRESENTATION OF THE DATA

In this section, the study's findings are reviewed and described, using the four themes of the teacher and district interviews and their relative questions as a framework. The study's main research questions are addressed with respect to this framework as well. The summarized teacher interview data are presented in Appendix 4, in matrices that correspond to each of the four areas of investigation. Relevant quotes from the interviews have been included in the following data descriptions, and responses to specific questions have been summarized and are presented in Tables 1 - 5. The study's findings are described below, beginning with the first interview theme, the Adoption Process.

A/ THE ADOPTION PROCESS

Data from teacher interview questions 1-5 are summarized below, and the study's research questions (2) and (4) are addressed: (2) Review the program's adoption and implementation strategies, and identify possible advantages, difficulties, and omissions, and (4) Explore some of the decisions teachers make when implementing a supplementary environmental education program: what are their needs and concerns, and the criteria they demand of an innovation before implementing it?

District Promotion

"Salmonids in the Classroom" was first adopted and promoted at the district level. A factor which obviously affects adoption is access to information. District administrators receive most information about new programs; the two district assistant superintendents heard about the program, and were interested. At the same time, a host of other factors came into play which influenced the district's decision-making.

The initial stimulus came from the district's desire to establish a salmon studies program at the North Vancouver Outdoor School (NVOS), in Paradise Valley. At about the same time, in 1981, the newspaper The Vancouver Sun was establishing the "Save The Salmon Society", to promote salmon conservation and enhancement. One of the Assistant Superintendents was asked to be a director of this society, and in 1981, began the initiative to build a hatchery at the NVOS, sponsored by the Sun and the Salmon Society. The Department of Fisheries and Oceans (DFO) became involved with the NVOS hatchery, which was completed in 1982, and through the DFO Community Advisors, the district heard of the salmonid program's development.

Another important link at the time was the district's emphasis on improving its elementary science program. The

district was looking for active, relevant, hands-on science programs that did not require a heavy background in science to implement. As a result, the Assistant Superintendents focused almost soley on the classroom hatchery activity of the salmonid program, an activity that is limited to a five-page optional exercise in the original program materials. As the Assistant Superintendents (AS) stated:

> ...the salmon enhancement program was a natural...the in-school tank was something you could wrap a program around...we recognized that it could work for us; most importantly I think was the idea of hands-on science for elementary school. (AS 1)
>
> The initial impetus came from an idea to do something in a small way for elementary science...It's tough to teach elementary science for a lot of reasons, physical is one of them, you just can't turn a classroom into a science lab very easily. (AS 2)

There seemed to be no specific dispersal mechanism for the program, other than the occasional newsletter, workshops, and word of mouth. This perhaps accounts for the different means by which teachers first heard of SiC. Six teachers first heard of the program directly from the district, five heard of it through another teacher, two were told about it by their principals, and one had heard of its development directly, through the Dept. of Fisheries and Oceans.

A Small Scale Change Strategy

The district started small, and did not attempt to push the program, or 'hard-sell' it. Teacher participation was encouraged during the adoption process, and the program's implementation time frame was very flexible. There was no administrative pressure to adopt the program, and therefore no 'deadlines', or required minimum number of schools using the innovation. The district defined progress as a gradual increase in the number of people involved with the program, without expecting or attempting a sweeping, district-wide adoption. This perspective is well described by one Assistant Superintendent:

> ...I'm not a great supporter of gigantic programs..getting everyone in the district to do it..I'd rather that more individual schools see what's needed in their communities. (AS 2)

Several teachers who expressed an early interest in the program were recruited by the Assistant Superintendents. These teachers eventually became key promoters and developers, offering help and advice in initiating the program, designing the classroom hatchery, piloting the program in its first year, and hosting teacher workshops.

Workshops

The district organized "Salmonids in the Classroom" workshops at least once a year. They were put on by teachers who were familiar with the program's use, district resources, and related programs. All but one of the teachers interviewed attended the district workshops, and found them useful, due to their practical, hands-on nature. Most mentioned the importance of having experienced fellow teachers giving the workshops. One teacher summarized this prevailing viewpoint:

> The district workshops have been useful, I think mainly because they've been put on by teachers who've used the program, really know it, found it successful, and are sharing their ideas... (TCH 13)

Having local classroom teachers present the workshops increased the program's credibility. The workshops and resource teacher network also encouraged teacher communication about the program.

Initial Reactions to "Salmonids in the Classroom"

Most of the teachers (11) reacted positively to first using the program in their classrooms, due primarily to the help and support available, and the hands-on nature of the program. Table 1 summarizes the program's main attractions for the teachers. The classroom hatchery was the program's main selling point; all teachers mentioned

TABLE 1 : THE ADOPTION PROCESS : THE PROGRAM'S MAIN ATTRACTIONS FOR TEACHERS

Interview Question 5 : Was there anything specific about the program that first attracted you to using it?

TEACHERS	SUMMARY OF RESPONSES
TCH 1	"...the in-class hatchery, and the help; he'd (a resource teacher) come right to your school and help out."
TCH 2	"Having the hatchery right there in the class was a real plus...you didn't have to wait for ages for equipment, or to get your questions answered, which was really important."
TCH 3	"...the ease of having it set up for me, and having a resource teacher so close by..."
TCH 4	"The hatchery, that's the heart of the program...Having people to help out, I'm a neophyte on this".
TCH 5	"I liked the hands-on use...there were also alot of people you could phone if you were having problems"
TCH 6	"I really liked the idea of the hatchery, it seemed a worthwhile thing for the kids..."
TCH 7	"...having someone familiar with the program at the classroom level nearby, and willing to help out."
TCH 8	"...it was easy to get and set up, why not give it a try? I got alot of help from other teachers..."
TCH 9	"...the tank, the classroom hatchery. I'd seen it done in the school a fair bit before."

TABLE 1: CONTINUED

TEACHERS	SUMMARY OF RESPONSES
TCH 10	"...the tank in the class...help from the teachers that field-tested the program, they knew what they were doing, we had no clue!"
TCH 11	"...it was really easy for me to do because I'd seen someone else teach it...it was different, it was in the news, the 'Sun', so I knew what it was...I had alot of help."
TCH 12	"With teaching science...if somebody has everything right there, its a blessing... hands-on activities are how I mostly teach..."
TCH 13	"...my style of science teaching is to have hands-on activities...they're super (the resource teachers). They'll help you set up, if you run into any problems and they can do anything, they will."
TCH 14	"...the backup (help), the materials that were offered from the district...the hatchery itself, having it in my classroom."

it as being a major attraction. It provided teachers with an active science program, and a way to bring live animals into the classroom and explore basic life processes with their students. However, the hatchery was also their main concern: its specialized technical aspects and the added responsibility of raising live animals made many teachers nervous:

> At the beginning, we heard horror stories about what might happen, having a tank in your room... (TCH 13)
>
> At first I was hesitant about the program, well, mainly the use of tanks in my class, and the potential for things to go wrong. It sounded like an interesting program, though, and I was interested, but nervous. (TCH 7)
>
> ... initially, most people thought 'this is abit more than I can do', because no one had done hatcheries in classrooms before... (TCH 5)

User Support Network

Teachers' initial concerns about the hatchery were addressed to a large extent by the 'on-call' resource teacher network. According to the teachers I spoke with, the resource teachers could be called at almost any time, with questions, problems, or major catastrophies, and they would help out wherever they could. All teachers (except one) received most of the assistance they needed from the resource teachers, and were quick to praise their willingness to help. (The one exception, a key

resource contact himself, used the Dept. of Fisheries' Community Advisors as a primary resource). The following quote captures the teachers' sentiments towards the resource teacher network:

> ... for me, that is the most important thing, to have someone familiar with the program at the classroom level, nearby, and willing to help out. It makes a huge difference in deciding to try something new and different, like this salmon program. (TCH 7)

In summary, the adoption process from the teachers' perspective was generally a positive one. The interactive nature of the innovation met district and teacher criteria for a hands-on science program. Teachers took part in decisions concerning the program's use in the district. The novelty of the in-class hatchery was appealing and interesting to teachers, and the in-service workshops were useful, practical, and run by local classroom teachers. The teachers' main concerns about the classroom hatchery were adequately met by an 'on-call' support group of resource teachers that they could call on for assistance and advice.

B/ PROGRAM ATTRIBUTES

This section summarizes findings from interview questions 6 - 12, concerning the salmonid program's attributes and how they affected teachers' use of the program. Research questions (3), (5) and (6) are addressed:

(3) Determine teachers' clarity and understanding of the program's rationale, goals, and objectives.

(5) Assess the components of the program that teachers most often use, and those they omit, and investigate the reasons for these choices.

(6) Determine whether any changes were made by teachers to the program, and document these changes and the decisions behind them.

A Need for the Innovation

The district recognized the salmonid program's potential as a viable, active science curriculum, and originally promoted and designed it as such. The teachers in the study also saw the program's potential as a relevant, interactive science-oriented program, an important factor in its use. The following teachers summed up this sentiment:

> Yeah, I saw a need for the program, science needs more of that hands-on kind of thing, more so than any other subject... (TCH 5)

> ...I guess you could say I saw a need, the program is very hands-on, and corresponds well with the Outdoor School's stuff on hatcheries... (TCH 7)

All teachers used SiC primarily as a science program, although 8 teachers also added other activities, relating to art, creative writing, and poetry. Teachers stressed the interactive nature of the program, the major emphasis on the hatchery, and the chance to get away from "pencil and paper" science activites. Ten teachers stated that the hands-on nature of the program was the main reason they saw a need for it.

Clarity of Goals

The teachers' goal statements are summarized in Table 2. Nine of the fourteen teachers felt that the goals of the curriculum were unclear, or vaguely stated. All the teachers stated that they had their own goals in using the program, regardless of what was stated in the curriculum. Several had ignored the stated goals in favour of their own approach, as is expressed in the following quotations:

> ...the goals were relevant, but not really clear, I mean, I knew the points they were trying to get across, but they were so specific to each activity. I just changed them as I went along to fit the things I wanted to get across. (TCH 7)

> No, the goals weren't really clear, but I had my own, anyway, to increase awareness. (TCH 1)

> There were goals presented in the package. I guess we all have our own reasons and purposes for using programs anyway...the overall environmental concerns and objectives seemed overshadowed by the salmon concerns. (TCH 6)

The interview data gives us some interesting insights into the question of clarity and shared meaning. Many teachers felt that the printed goals of the binder were not clearly stated. Several had not even bothered to look for program objectives. However, all the teachers had clear ideas of why they were using the program. The hatchery, promoted by the district as the centre of the program, was a visible, specific teaching resource that enabled teachers and students to care for and observe developing salmon eggs. Its practical, tangible nature possessed a straightforward and relevant purpose for teachers. Therefore, even though the printed program goals seemed vague to some teachers, or unimportant, their own purposes for using SiC were clear, and very much a part of the program activities.

It is interesting to note that many of the teachers' stated goals deviated from the original program's emphasis (see Table 1). The salmonid program's goals focused on the salmonid resource, but most teachers expanded their program objectives to include wider environmental concerns. This alteration of program goals is the essence of "mutual adaptation", a process which

begins with the teacher's overall objectives for using the program, and is manifested in the actual activities he/she uses.

Packaged Materials: Flexibility and Sequencing

All of the teachers stated that the program was flexible and adaptable to their own use. The packaged materials were generally believed to be of good quality. Only two teachers felt that the program's suggested sequencing was of any use. Several teachers (five, including the above-mentioned two) felt that a general, overall lesson scope and sequence chart would be useful, to underline the major aspects of the curriculum, and to ensure that less overlap of material occurred between grades. As one teacher stated:

> ...there should always be a starting point...and at least something that stresses the important aspects of the program. With something as big as this, there's no way you'll use it all, and very little chance you'll have the time to go through it in any depth... it's my first year using the program; the last thing I want is something structured and stiff, I'd never use that, but just some overview, some scope. (TCH 8)

However, flexibility was generally seen as an important program attribute by all the teachers.

Sections of the Program Used and Omitted

The sections of the program binder that were used most often were the life cycle materials (from Lesson AA-2), especially the overheads, posters, and films. The section on the biological aspects of salmonids was also used by most teachers (from Lesson AA-3), primarily material on the physical and behavioral adaptations of the fish during spawning.

None of the teachers interviewed really used the binder materials very much. Most felt that the language arts and math activities weren't of any use to them, and all stated that they tried to avoid the "pencil and paper" activities (for example the student activity sheets) that make up most of the binder. As is summarized in the following quotes:

> I use immediate stuff, the visuals mostly. I don't really use the binder, more just the physical aspects of the tank, and the major concepts. (TCH 11)

> Most of the activities are pencil and paper work, I mean, thats the kind of thing kids are getting every day anyways...I find that too dry, like pulling teeth. (TCH 9)

Instead of working through the binder materials and presented activities, all teachers stressed the importance of observation and interaction. Children were able to follow the actual changes of the developing fish

in the classroom hatchery, in an on-going, and often spontaneous manner. The teachers were adamant about the importance of student interactions with the hatchery, as is described in the following quotes:

> ... the kids love the program... there's alot of dynamic involvement with it,...alot of ways kids could get involved. There was almost a motherhood element to it as well, they took care of these little eggs, and watched them grow, and change, got a real attachment to them... it gives the kids an incredible sense of ownership, and responsibility, both for the salmon, and also for the stream... (TCH 5)

> They (the kids) get very concerned about the fish, worry about them getting caught in the rocks, or if one is swimming funny. They get names for the ones that look different...the final day, when they take their little bag (of fish) to the stream, they handle them just like gold! They've got to go out in the real world, they worry about them, let them go in the water, and say, 'oh, they'll never make it!' (TCH 11)

Participation and interaction were major components of the salmonid program for teachers. Teachers were initially attracted to the hands-on, active aspects of "Salmonids in the Classroom", and used these components almost exclusively.

Student Benefits and Interest

Two major incentives for using the SiC program stated by all the teachers were its benefits and interest for students. All the teachers felt that SiC was valuable and enjoyable for their students, and that it adequately met

the majority of their students' needs. The importance of the program's value to students is summarized in the following quotes:

> Of course it's valuable, its one of the best we have. It's hands-on, it's something they can look at, you don't have to show them in films, and they don't have to read copious amounts of material to get the information. You've got the actual thing here to look at, and any time you do that, the learning is certainly increased. (TCH 12)

> There was a lot of quiet interaction (with the hatchery) rather than big fanfares! The kids would come in early in the morning, or at noon, and just sit in front of the tank, for 15 - 20 minutes, just watching the fish...it wasn't something I taught as much as something they came to on their own. (TCH 4)

These two factors were stated repeatedly by all the teachers interviewed, and were central to the program's successful use.

Problems with the Program

Teachers were asked to talk about any problems they had encountered with the program. Preparation time was the one problem all teachers mentioned, although several also stated that this problem was not limited to the salmonid program alone. The large size of the binder seemed to be the main culprit here. It was mentioned directly by six teachers, among them the two first-year users, as well as by four 'veteran' five and six-year users. Three teachers that did not mention the size of the binder as being a

problem had just decided to omit all or most of it anyway, and stick with the hatchery. They felt that the binder activities did not suit their teaching style, but also admitted that the size of the binder dissuaded them from fully reviewing the material. The following quotes describe the problem of preparation time for the teachers:

> Preparation time's my major problem, its just finding time to read through the materials. Its so bulky, I find it very heavy going. Its my first year at it, and maybe next year I'll have less trouble with it, but I've had it home with me many nights now... (TCH 4)

> Prep time is always a problem in anything you do, especially in elementary school!...anything that comes in a binder this size takes alot of wading through. (TCH 3)

This problem bears examination, as "Salmonids in the Classroom" is a supplementary, voluntary program, and therefore more likely to fall prey to elimination than prescribed courses. The district was aware of the problem posed by preparation time, and attempted to streamline the program by encouraging the resource teachers to prepare outlines on hatchery use, and related activities. These handouts were used and appreciated by all the teachers interviewed, and helped reduce the time they had to spend reading through the binder. (see Appendix 5)

Time constraints of the prescribed curriculum was seen as a problem by three teachers, but all teachers made

room for the program. Again, teacher priorities come into play: if a teacher feels a program is worthwhile, or better than what is currently being taught, he/she will probably use it.

Overlap, or repetition of activities and information in later grades, was seen as a problem by five of the fourteen teachers. Many of the other teachers commented that overlap could be a potential problem with the program, if there was no communication among users of SiC in the school. These perspectives are summarized below:

> My concerns are that now, its gotten to the point where there's a real potential for overlap...Salmon in grades 1,2,3,4,5...salmon again?! (TCH 2)

> If there's good communication between the teachers in a school as to what the kids have been taught, then there shouldn't be a problem (TCH 7).

Teachers suggested clearer sequencing of activities by grade level, better communication among all SiC users, and more inservice workshops to discuss program planning as ways of combatting potential program overlap.

Four teachers had trouble with some of the terminology of the SiC package. Other problems mentioned included the material's reading level being too difficult for some students (3 teachers), the difficulty of getting adult fish for dissection purposes (4 teachers), and much of

the packaged material being dry and boring to work with (2 teachers).

Adaptations Of "Salmonids in the Classroom"

One area the study set out to investigate was the adaptation of supplementary programs by teachers (Research Question 6). All the teachers I interviewed had added other activities and materials to the SIC program, and omitted most of the binder materials. The most common additions were stream studies and stream enhancement activities (11 teachers). These activities were taken from an extensive unit on stream studies developed by one of the resource teachers (Ian McWilliams, 1983) and distributed by the district. Half the teachers interviewed had also used a variety of art activities, and six had added ecology and marine studies units. Teachers looked at adaptation of the program as an integral part of its use. As one teacher summarized:

> I think everybody that does a program changes it, in trying some things, choosing parts of it, leaving some out...you always have to make changes..the nature of the subject allows you to have the freedom to do what you think is important. (TCH 13)

Mutual adaptation refers to the dynamic process in which program goals and methods are modified to suit the needs and interests of users, and users change to meet

the requirements of the program. It was an important part of the salmonid program's implementation in North Vancouver. All the teachers interviewed made many changes to the program, in addition to the district's initial selection of the hatchery as the focal point of the program. Individual teacher preferences and interests are evident from these changes. Some teachers focused soley on science, keeping hatchery records, and doing stream study activities. Others extended the program into art and language arts, adding poetry, creative writing, fish prints and salmon models. A few teachers focused specifically on the biology of salmon, and did egg and adult fish dissections, some took an ecological view of salmon and their environment, while still others concentrated on stream enhancement, anti-pollution, and conservation activities.

The teachers stayed away from the more conventional parts of the program, specifically the student activity sheets, deeming them "too dry", and "not really applicable". Their focus was the hatchery, and most of the activities teachers added were experiential, active, and student-directed. Program flexibility as well as teachers' relative independence in planning the objectives and activities of supplementary programs are important factors to consider in SiC's implementation.

In summary, the salmonid program's central attribute in North Vancouver was the classroom hatchery. This interactive, experiential aspect of "Salmonids in the Classroom" galvanized teacher and district interest in the program, was the key to the program's perceived value and interest for students, and clearly focused teacher's program objectives and activities.

The main problem expressed by teachers was preparation time, a difficulty that plagues all teachers, but that was especially evident in the case of the salmonid program, due to its large size. If the hatchery was the essential attribute, mutual adaptation was the major change process, again with the hatchery at its centre. Initially, the district envisioned a classroom hatchery component of the program. The resource teachers developed the hatchery, oriented SIC around it, and piloted it. Individual users further adapted the program, beginning with their own goals and objectives, and subsequently adding and omitting activities and planning units. The program was varied to fit their local needs, circumstances, and resources, and in the process teachers adapted their classrooms, their schedules, and themselves to the daily responsibilities and activities associated with raising salmon. In short, the program's attributes were 'personalized', to suit each teacher's needs and teaching style.

TABLE 2 : PROGRAM ATTRIBUTES: TEACHER'S GOALS FOR USING THE SALMONID PROGRAM

"Salmonids in the Classroom" objectives, as stated in the introduction (p.1): "..to provide a better fundamental understanding of the salmonid resource, and the relationship of salmonics in our culture and environment."

TEACHERS GOALS FOR USING "SALMONIDS IN THE CLASSROOM"

TCH 1 : "...to increase kids' awareness of salmon, salmon are a major resource in B.C., and the students should understand they are important, and have needs like you and I."...(goals weren't specified), "but I had my own, I took a more overall approach to it" (the program).

TCH 2 : "...it's an opportunity for kids to appreciate what's important in our world, the natural world, and the environment....it's a great opportunity to do hands-on stuff, that's why I use it."

TCH 3 : "Really, an appreciation of the environment, that's the focus I take, more of an overall approach."

TCH 4 : "...it gives the kids a chance to see a natural life process happening right in the classroom, this is a natural resource of B.C....I took the learning objectives that I wanted..."

TCH 5 : "It's a dynamic, hands-on program, kids have more awareness of the fact that we have to look after our environment...that's the focus I concentrated on."

TCH 6 : "The main goal for me is to get across to kids a total awareness of the environment...we need to be active in respecting and preserving all forms of life, not just salmon...this isn't really emphasized in the materials, we all have our own reasons and purposes for using programs..."

TABLE 2 CONTINUED: TEACHER'S GOALS

TCH 7 : "The program is abit too narrow, it should tie salmon in more with the rest of the world. I try and put in more ecology, more awareness and responsibility for all living things...The goals were so specific, I just changed them as I went along to fit what I wanted to get across..."

TCH 8 : "...to familiarize the kids with a natural resource, to promote respect for the streams, and for spawning salmon in the future."

TCH 9 : "...to generate an awareness of a major resource, in my program I try and get across the awareness that it's tied into a bigger thing, the environment."

TCH 10 : "...two purposes; one is to make the kids aware of the environment, the streams around them; the second one is, simply put, anti-pollution."

TCH 11 : "...it's a good, hands-on science program, it allows kids to work with real, live animals in the classroom...I have no idea where the goals are in that binder! Teachers have their own goals, I think everyone has a slant, or a priority with a unit..."

TCH 12 : "...to make kids more aware of the environment, using salmon, by having more knowledge of the biology of the salmon, and its environment. The hatchery is pretty self-evident."

TCH 13 : "...it opens up for kids what is happening in the streams, it enlightens them to the environment...and instills some responsibility.

TCH 14 : "...it's a good way to introduce conservation, to talk about pollution, and the problems it causes in streams. I don't know whether I've looked to see if there are any goals! You mean in that big folder? I really took my objectives from the children's reactions to the tank, they seemed so sensible..."

C/ SCHOOL/ DISTRICT/ EXTERNAL FACTORS

This section of the data is from interview questions 13-16, and outlines factors from the school, district, and external environments that influenced implementation. Research Question (8) is addressed from these three perspectives: Examine the cultural context of the implementation process to illuminate how external factors influence a program's use.

CHANGE PROCESSES AT THE SCHOOL LEVEL

The Role of the Principal

Principals are often seen as the major change agents at the school level. One interesting aspect of this study is the minor role that principals played in the adoption and implementation of the salmonid program. Essentially, the program was adopted at the district level, and introduced to teachers directly, first via an initial workshop at the Outdoor School, then through a pilot phase using interested teachers, further workshops, and the subsequent resource teacher network. Principals were not intentionally omitted; indeed, one of the initial resource teachers recruited by the district was a principal, who actively taught SiC in his school for several years, until several teachers picked it up. However, both the Assistant Superintendents stressed

teacher involvement and participation in the program's initial stages:

> No, we didn't really go through principals, the program was carried by teachers...we made the resource teachers our front line; we felt it was important to let them direct it. (AS 1)

> I like to keep my involvement as background, a catalyst, to do the legwork, but the real experts on how to teach it, and what to use in various subject areas are the teachers. (AS 2)

All but one teacher said their principals were supportive of SiC; most principals were aware of the program, pleased it was being taught, and provided any extra materials or resources that the teachers required. Four teachers had principals that were actively involved with the program; they helped assemble and dismantle the hatchery, participated in activities and field trips, and generally kept in touch with how the program was progressing. Teachers could rely on the district directly for program materials, hatchery equipment, training, and support, and so did not necessarily need a lot of active help from principals. Obviously, basic permission would be required from the principal to allow the teacher to use the program at all, and any further verbal or active principal support would in most instances be welcomed.

Overall, principals played a secondary role in the adoption and implementation of SiC, due to the district's initial focus on teachers, and the teacher-run support

system. Due to the supplementary, voluntary nature of the program, principals had no direct coercive influence over teachers in having them adopt the program. This aspect may partially account for the district's decision to go directly to teachers with the program. However, the district also seemed to realize the long-term importance of including teachers in implementation.

User Communication

The teachers' comments on communication with other program users are summarized in Table 3. All teachers said they communicated with other program users. They all had other teachers in their schools who were using the salmonid program, and were all in contact with the resource teachers. Teachers felt these peer interactions were useful, to solve problems, trade ideas, and generally discuss the program. This informal communication and socialization about the salmonid program was another influential factor in its dissemination and use.

TABLE 3 : SCHOOL/ DISTRICT/ EXTERNAL FACTORS: COMMUNICATION WITH OTHER PROGRAM USERS

Interview Question 13: Do you ever communicate with other program users? Do you find it useful? (If no, do you feel that it would be useful?)

TEACHERS	SUMMARY OF RESPONSES
TCH 1	"Yeah, its good to have someone else doing the program, to talk about it and get ideas."
TCH 2	"Salmon teachers get together; we do alot of teaming in this school...and get together to plan, do things as a big group"
TCH 3	"...it's very nice having him (a resource teacher) here, he's the resident expert, I don't have to worry about anything."
TCH 4	"Another teacher and I use it, he gives me good support, I get well looked after...I would have been much more hesitant if he'd not been here to help."
TCH 5	"...the teachers here often sit around and talk about it...people that have been involved usually stay interested in it, and know what's going on."
TCH 6	"I'm in touch with alot of other users, to help them out with problems, suggest ideas...its quite a little network..."
TCH 7	"Having other users so nearby is really important...its helpful to hear about other people's problems, and how they've done activities."
TCH 8	"There are two of us here using it, we help each other, share duties, it's abit more incentive, too, having two programs..."

TABLE 3 : CONTINUED

TEACHERS	SUMMARY OF RESPONSES
TCH 9	"We talk alot about the unit, its one of the only things we teach that is the same. So we talk quite abit about how it's going."
TCH 10	"Three other teachers use the program in this school...there is quite abit of communication... lots of involvement by teachers."
TCH'11	"Yes, we share the release (of salmon fry into the stream), and often work together..."
TCH 12	"...we communicate, the salmon teachers, mainly through workshops...I help out in other classes, too."
TCH 13	"A few of us here work together as one class...you need to get that little 'plus' from meeting people that do the same program, seeing the things they have come up with themselves, and seeing people from the outside (of the school system), of course."
TCH 14	"...the others (teachers) come to me for materials, and ideas...we always discuss it use each other as a sounding board."

CHANGE PROCESSES AT THE DISTRICT LEVEL

It was at the district level that all teachers noted a high degree of support and commitment to the innovation. Teachers' comments concerning district support are presented in Table 4. The district demonstrated its support for the salmonid program by establishing the resource teacher network, supplying hatchery and program materials to whoever was interested, and hosting salmon workshops. The district also kept the school board informed and involved in salmonid program happenings, which helped to maintain the board's support of the program. These factors were mentioned by all teachers as being positive. District support served to give the program a higher profile. The salmonid program was seen as a priority for the district, which encouraged teachers to invest time and energy into it, knowing the program would probably be around for a while.

A Favorable Environment for Environmental Education

One area that was often mentioned by teachers was the district's commitment to environmental and outdoor education, specifically through their support of the North Vancouver Outdoor School (NVOS). North Vancouver school district has been committed to environmental education for many years, and the NVOS is the most

obvious and successful example of this commitment. Its long term success and support is a good indication of a favorable and open environment for environmental education programs. The salmonid program 'fit' the district's past record of environmental program use, as well as their overall educational priorities.

EXTERNAL INFLUENCES ON THE CHANGE PROCESS

Parent and community factors in the district were found to play a significant role in the salmonid program's exposure and use.

Parent Participation

Only one teacher reported any active involvement with the program by parents, yet all the teachers felt that parents were aware and supportive of the salmon program, and often wanted to see the hatcheries during the school open house. A sort of 'second stage' parental involvement was mentioned by many teachers:

> ...the parents do become involved because the kids are so involved; they like to bring parents into the school, to show them their fish! Parents hear a lot about these fish at home. (TCH 10)

The External Community

According to the teachers, the community of North Vancouver was generally aware and supportive of the

salmon program. Salmonid enhancement is relatively familiar to people living in North Vancouver, due to the presence of two large federal hatcheries in the community, several local organizations' salmon enhancement projects, and the sport and commercial fisheries in the area. Community awareness about the program was also maintained in part through auxiliary connections: the district's association with The Vancouver Sun and its "Save the Salmon Society", the Coho Salmon Festival, and the North Vancouver Outdoor School's hatchery program.

Six teachers mentioned the NVOS's hatchery program as an important aspect of the program. Five teachers mentioned the involvement of The Vancouver Sun as a positive factor, as the paper gave the program wider exposure and a higher profile in the community. The NVOS and its salmon program have been featured in The Vancouver Sun, as well as in a National Film Board production. As well, school salmon displays, "Save the Salmon" poster contests, Coho Festival activities, newspaper articles about local school and community hatchery projects, and district- sponsored salmon art exhibits all contributed to the program's profile in the community. One teacher summarized these factors as follows:

> ...at the beginning, there was a lot of involvement from the Vancouver Sun; they started to sponsor the program, and put some money behind it...It had good community relations value, people could see it happening, and it wasn't dry and dusty; it was in the paper, it was taken out into the malls, kids went back to their parents and talked a lot about the hatcheries and the fish, so there was a second wave of information that went out to homes. (TCH 5)

Three teachers mentioned the importance of the Dept. of Fisheries & Oceans involvement and communication. In 1984, DFO recognised the district's contributions to the salmonid enhancement program by presenting them with an award, detailing their involvement and commitment to enhancement and education.

As well, the district has been involved with Japan, in relation to the Japanese "Come Back Salmon" enhancement program. Japanese dignitaries attended the NVOS hatchery's opening ceremonies, and in 1985, an exchange was organized between Maplewood School and a school in Sapporo, Japan, both schools having active salmon enhancement programs. Four teachers believed that these connections with the Japanese salmon program were also important in making the program more relevant, and maintaining its status. All these different factors contributed to the program's publicity, and high profile in the community. As one Assistant Superintendent put it:

> There's been a whole host of things that have happened surrounding this salmon program...It

> keeps the program relevant, and high-profile, it's talked about in the community. (AS 1)

Most teachers spoke of these external influences as being important to their use of SiC, and to the program's positive public image. A program that is popular with the community and has a wide exposure and status is more likely to be supported by teachers than a controversial or unpopular innovation.

TABLE 4 : SCHOOL/ DISTRICT/ EXTERNAL FACTORS
DISTRICT SUPPORT

Interview Question 16: Turning to the district, have they been involved at all in the support or funding of the program?

TEACHERS	SUMMARY OF RESPONSES
TCH 1	"...they've always backed it up really well...they've got the funds to do it, to make it go."
TCH 2	"The greatest thing is that we've always had strong support from the district... they've coordinated each zone, we have people to contact, to ask questions to, that's so important when you're tight for time and trying out a new program...more than anything that's what keeps the program going."
TCH 3	"...the Assistant Superintendants are sort of in charge of the program, they assigned contact people, each one has a group of schools, that's a great thing about doing salmon."
TCH 4	"...it was an easier program to do, especially with the support that was available...the district is very much behind this program..."
TCH 5	"The initial encouragement came from the district...and they identified salmon contact people for the schools..."
TCH 6	"The district seemed to give 'Salmonids' a high profile, and the needed impetus to go somewhere..."
TCH 7	"The district is pretty involved...you can't really avoid this program!...they've provided good backup support."
TCH 8	"They've (the district) been great on this one (the salmonid program), put alot of things in place to make it easier to do."

TABLE 4 : CONTINUED

TEACHERS	SUMMARY OF RESPONSES
TCH 9	"The district is big on this! We get memos to the 'fisherfolk' quite regularly."
TCH 10	"The district is extremely involved...the central administration has been really supportive, completely supportive, all the way along."
TCH 11	"The district's influential, alot of schools have undertaken it...salmon is in the air, it's a natural unit to choose in this district."
TCH 12	"The district here has been really important, the people at the top...decided that they wanted to take this on a couple of years ago...if you can get people like that involved, with money and access, that's all you've got to do."
TCH 13	"One thing that does make a difference, I think, is that it seems to me there was involvement at a very high level in the district...It's important to have people at the top. That's key.
TCH 14	"They're (the district) very helpful, they really made it easy for me, the resource teachers and all, and after the first year you gain confidence..."

D/ TEACHER CHARACTERISTICS

This final section summarizes data from interview questions 17 - 20: individual teacher's beliefs, perceptions, and values concerning the environment, and how they affected program implementation.
Research questions (1) and (7) are addressed:

(1) Determine some of the incentives and deterrents from the teacher's perspective for adopting and implementing the program.

(7) Explore the roles of teacher beliefs, values, and understanding in the implementation process.

Recognition and Rewards for Innovation: Teacher Perceptions

Overall, the teachers interviewed believed that they recieved little if any recognition for doing the salmonid program. No specific reward structure was present for users of the program. The district sent program memos and newsletters sporadically to users, as well as a thankyou note once a year. This contact was mentioned by most teachers as an indication of the district's awareness of their efforts, but as a whole, teachers felt there were no formal rewards for using the program. One teacher summed up the general consensus as follows:

> ...we get a little note from the district...I would say that other than a pat on the back and a "thanks, hey you're doing a great job", - the kids are interested , it all went well, that's about it... (TCH 10)

However, the salmonid program's internal or intrinsic rewards were mentioned by all the teachers; student enjoyment, benefits, and program success were the main factors specified. This aspect of teacher affiliation with students was important as a perceived reward for users, and as an indication of the program's value for students. These factors are summarized in the following quotes:

> ... no, there's no recognition, the kids like it, so I'll keep doing it. (TCH 7)

> The kids really like it and get into it; that's where most of the thanks comes from. It sounds a little idealistic, but when you see your class so involved, and motivated, you see it's all worthwhile. There's a reward there. (TCH 2)

Turning to the district's role, the two assistant superintendents said they did not provide any formal recognition for using the salmonid program due to lack of time, and the number of other on-going, supplementary programs in the district. They cited the program's internal rewards and the district's support as providing some recognition to teachers, as follows:

> No, we don't, (provide recognition) I expect we should do that, but we have so much going on...I think it's got its internal rewards, and they (the teachers) seem very satisfied and happy with it. (AS 1)

> We don't have a "salmon medal", or anything like that, but there are other ways that you can give some recognition...our support that we try to give says something to them (the teachers) as well. (AS 2)

The four resource teachers interviewed felt they received some recognition through their reputations as 'salmon experts', and from the time off they were granted to do associated program work. This recognition is important in examining the motivational influences of active program advocates, who were important elements in SiC's implementation. However, not all teachers can or want to be program promoters. In this study, the rewards that a general SiC user recieved were mainly intrinsic ones.

Teachers' Personal Interests

All teachers expressed a personal interest in the outdoors and in conservation, and felt that generally their personal perspectives on the environment affected their use of the salmonid program. Two teachers summed up these sentiments as follows:

> Initially, I think my own feelings affected my adoption of the program. I guess I'm an environmentalist; now that I know the program, I endorse it, I feel it's a good one. (TCH 5)

> My own feelings (about the outdoors) would have to (affect use of SiC), because I'd be drawn to the program. I had the background knowledge, and you see the program's potential right away. (TCH 10)

The salmonid program held very strong personal interest for both Assistant Superintendents as well. Although neither had received any formal training in environmental education or science, both expressed a keen interest and commitment to SiC, that they expressed as follows:

> What you have here is an assistant superintendent with a fetish for salmon!...it's a natural topic to study...it's alive, it's real, that's what makes it so attractive. (AS 1)

> Salmon in themselves have a mystique about them...a real magic...I have a great love for the outdoors, I think it's (SiC) a way to bring a part of what is B.C. into the classroom, with important environmental and ecological spinoffs. (AS 2)

Teacher Skills and Experiences with Similar Programs

All but three teachers had used other environmental education programs, many of which were associated with the Outdoor School curriculum. It seems that, in general, teachers in this study followed their own interests, and implemented a program they felt had relevance and meaning for them, and their students. In this sense at least, it seems program developers were preaching to the converted; program users all had a strong interest in the environment. However, in looking further at the teachers' individual backgrounds, some interesting characteristics stand out.

Five teachers did not have any background in science, environmental education, or outdoor education. These 'non-science' users bear closer examination (see Table 5 for data summary). One teacher had been using SiC for five years, and was a key resource teacher, two had used it for three years, and two were first year users. None of them belonged to any environmental organizations. Two of the five had never used any other environmental programs, the other three had extended several of the Outdoor School programs for their own use. All five teachers actively used SiC as a science program, stressing biology and observation.

So why did these teachers use "Salmonids in the Classroom"? They all stated that the program's value and interest for their students influenced their use of the program. All five also cited program availability and support as key program attractions. The resource teachers and other program users in their schools were mentioned repeatedly as important support figures. Essentially, several teachers with no related background adopted and implemented a relatively technical, interactive, science-based program. It seems from this data that the teachers' personal interests, the program's easy availability, and an active, on-going peer support network acted to offset their initial concerns and lack

of related knowledge and experience, and encourage their use of the program.

The number of years a teacher had taught was not an influential teacher attribute in this study. Teachers using the salmonid program had taught from four to thirty-five years, with the average length of time being thirteen years.

Positive Influences on Program Use: The Teacher's Perspective

At the close of each interview, teachers were asked to talk about the main reasons they used the salmonid program. This data, from interview question 20, is summarized in Table 6. Also, throughout the interview, teachers discussed various incentives and deterrents for their adoption and implementation of the program. These factors are summarized and displayed using a bar-graph diagram, Fig. 3. I have chosen to examine these factors in concert, to develop a more complete, composite picture of the program's implementation as viewed by the teachers.

Five positive influences on SiC's implementation were mentioned by all teachers: the hands-on nature of the hatchery, the program's value and interest to their students, the active support of the district, their own personal interest in the program, and the importance of

peer interaction. Obviously, in dealing with such a complex process as change, one cannot examine these factors in isolation; they are interactive, and interdependent on the social and cultural contexts of the study. However, the 'across the board' frequency, and relative intensity of these influential factors make them significant; they seemed to be "Salmonids in the Classroom"'s major drawing cards - the hooks that grabbed teachers, and encouraged them to actively use the program.

Therefore, from the teacher's perspective, one gets a broader picture of the wide array of influences that promoted "Salmonids in the Classroom"'s use. The program held meaning and personal interest for the teachers who used it. They recieved support and backup help from the district, primarily through other classroom teachers. Teacher communication was encouraged and important in the program's success, and served to develop some sense of culture and group unity among SiC users. As it was a voluntary program, most of the motivation to use it came from the teachers themselves; they received no formal rewards or recognition for using SiC. The rewards mentioned most often by teachers were their students' interest and learning, and the program's overall success.

TABLE 5 : CHARACTERISTICS OF THE FIVE "NON-SCIENCE" SiC USERS

	YEARS USING SIC	OTHER EE PROGRAMS	CONCERNS WITH SIC	PROBLEMS WITH SIC	ATTRACTION TO SIC	MAIN INFLUENCE ON USE OF SIC
TCH1	5	—	Hatch	Pr. Time Trm	Hatch, Help Aval	Kid Val, Int, H-on, Help
TCH2	3	OSCH	Hatch	Pr. Time TiCo, Olap	Hatch, Help Aval	H-on, Aval, Help, Kid Val
TCH3	3	OSCH	Hatch	Pr. Time	Hatch, Help Aval	Kid Val, Help
TCH4	1	OSCH	Hatch	Pr. Time	Hatch, Help Aval	Aval, Help, Int, Kid Val
TCH8	1	—	Hatch, Amt. Mat.	Pr. Time Trm	Hatch, Help Aval	Kid Val, Int, Help

TABLE 6 : TEACHER CHARACTERISTICS : TEACHERS' MAIN REASONS FOR USING SiC

Interview Question 20: Are there one or two areas that stand out in your mind as being the most important in influencing your use of SiC?

TEACHERS	SUMMARY OF RESPONSES
TCH 1	" It gives the kids alot of responsibility, it benefits the students, gives them an awareness, a sense of importance. It's a great program for the kids."
TCH 2	" ...it's a good opportunity for the kids to have a hands-on experience. It's a good bridge to other topics, and it's an easy program to do, too."
TCH 3	" It's a really worthwhile, interactive program for the kids, if I didn't do it now they'd be really disappointed. The ease of having it set up for me is another thing, and having the resources so easy to get."
TCH 4	"...I was interested in it, and thought it would be good to try, to have in my class, for the kids. It was an easier one to do, especially with the support available"
TCH 5	" The kids' enjoyment and benefits is the main reason why I use the program...The responsibility factor is also important. Contact people here in the district really make the program work."
TCH 6	" The district is definitely a driving force behind the program, also the number of creeks in North Van., and the Outdoor School. The benefits to the kids is the most important reason I use it..."
TCH 7	" The kids response and interest, definitely, is a main reason, the awareness and information the program gives to kids, ... it's a good vehicle to teach environmental awareness.."

TABLE 6 : CONTINUED

TEACHERS	SUMMARY OF RESPONSES
TCH 8	"...it gives the kids a better awareness, and sensitivity,...it captures their interest. It's a good program to have here also because of the Outdoor School, the kids get exposed to the hatchery there.
TCH 9	"...I'm interested in it, I think it generates enthusiasm and interest in the kids."
TCH 10	"...student interest and value, definitely, ease of using the program, and the help that's available...the obvious importance of making kids aware of our environment."
TCH 11	"Having success is a big factor, and the ease of running this program, all the legwork is done. The kids love it, it's a good program for them, the Outdoor School does it; its a natural unit to choose."
TCH 12	"My interest in science would be one, the district has made the materials so readily available, that certainly helped to implement it, its one of the best programs we have..."
TCH 13	"...it's a terrific program to enlighten them (students) to what they're doing to the environment, and to the streams especially. The Outdoor School is another reason... support from the upper level administration, and the association with people from outside teaching."
TCH 14	" The hatchery, having the eggs hatching and developing in the class, that's the centre of the program. It gives the kids a sense of responsibility, and ownership...that increases learning."

CHAPTER 6 : ANALYSIS, DISCUSSION AND INTERPRETATION

This chapter is divided into six parts. The data discussion is in four sections, corresponding to the four investigative themes of the study. The chapter also includes a short summary of my own observations of the workings of "Salmonids in the Classroom" in North Vancouver, and a concluding section, summarizing the study's salient findings. The following discussion provides an analysis of the study's findings in relation to the influential elements identified in the change and implementation literature. This analysis is also presented in tabular form (Table 7) to concisely summarize and display the study's prominent findings.

A/ THE ADOPTION PROCESS

Adoption and Introduction: Many Links in a Complex Chain

A whole series of interconnected events characterized the salmonid program's adoption in North Vancouver, and is examined here in light of influential factors identified in previous studies.

Administrative Support for the Change

The district's two assistant superintendents were the primary initiators of the salmonid program. Advocacy for a change by central administrators has been shown to

influence adoption in previous studies (Berman & McLaughlin, 1978; Crandall et al, 1983; and others; see Table 7). These studies concur with my research. Both assistant superintendents were interested and supportive of the change, a key factor in its adoption. Furthermore, they followed through with active support for "Salmonids in the Classroom", involving teachers in its initial adoption decisions, engaging in fund-raising, tracking down hard-to-find materials for developing the classroom hatcheries, and promoting teacher autonomy. This support demonstrates district level commitment, and signals teachers as to how seriously they should take a program.

Big or Small Changes? Ambitiousness versus Practicality

In adopting the salmonid program, the district chose to 'go small', a factor which disagrees with much of the literature's findings. Many studies point to the greater effects of challenging, large-scale changes (Berman & McLaughlin, 1978; Fullan, 1982; Huberman & Miles, 1984). "Attempt more, get more" (Huberman & Miles, 1984, p.280). However, "more" can mean more negative effects. As Fullan (1982) states:

> ...it is wrong to let hopes blind us to the actual obstacles to change. If these obstacles are ignored, the experience with implementation can be harmful to the adults and the children directly involved - more harmful than if nothing had been done. (p.103).

In the salmonid program's case, 'small is beautiful' was the key strategy. The district focused on several keen and experienced teachers, letting their success with the program generate interest and further use. This initial small-scale change directed at committed individuals promoted program success, which in turn led to gradual, district-wide adoption.

Flexible Orientation to the Change Process

Another factor that influenced the program's adoption was the district's orientation to change. Berman & McLaughlin (1978) identified two main orientations that characterize a district's decision-making process with respect to innovations. An opportunistic approach to change decisions is a response to available funds, with little or no interest in the actual innovation. On the other hand, a problem-solving approach responds to district needs, resources, and interests. The district under study possessed a problem-solving approach to change; motivation to adopt the program came from a strong personal interest in it, a recognition that it met a need for an experiential, hands-on elementary science program, and that it was applicable and relevant to the district.

This orientation was also evident in the district's change strategies, a topic that is the centre of much debate in the literature. Should a program's implementation strategy be carefully designed and tightly adhered to, with its locus of control in the central administration office? Or should user flexibility and autonomy prevail? Williams (1982) states that detailed, inflexible strategies may stifle creativity and extended use, or rule out innovations that do not suit local settings. However, Huberman & Miles (1984) contend that an implementation strategy that consists only of basic ideas, with no concrete guidelines or administrative pressure, may never get implemented. They found that strong mutual commitment, and efforts to develop and maintain good communication, cooperation, and conflict resolution between the differing worlds of teachers and administrators were key factors in implementation.

"Salmonids in the Classroom"'s implementation strategy was a sort of hybrid of the above two positions. The district introduced the program slowly, with no rigorous time line, or coercive pressure. The adoption process was very flexible, with lots of room for adaptation and creativity - hence the development of the in-class hatchery, an aspect of SiC that well-suited North Vancouver. However, although the program's implementation

strategy had no formalized guidelines or administrative pressure behind it, strong commitment to SiC, administrative support, and communication among program users figured highly.

Again it seems the exception is greater than the rule concerning implementation. Flexible strategy guidelines combined with advocacy and communication were a positive combination in encouraging the salmonid program's use in North Vancouver.

Teacher Participation in Program Decisions

Berman & McLaughlin (1978), Gross et al. (1971), Sarason (1982) and others state that program developers must include teachers in an innovation's development. These studies state that teacher participation in materials development increases their ownership of a program, and promotes the clarity and commitment necessary to effective implementation. This factor was not present in my study; the teachers I interviewed were not involved in the salmonid program's development. Yet in spite of this, teachers were very committed to the program, and were actively using it. The origins of teacher motivation and commitment to innovations is an important area that requires further study in order to understand the basis of the adoption process.

However, three teachers did participate in the program's adoption process, another factor which has been shown to be influential to program use (Rosenblum & Louis, 1981; and others). By including teachers in decisions relating to program adoption, local resources and classroom realities (such as availability of sinks in classrooms, and local expertise with aquariums) were addressed and incorporated into the program's use. This inclusion of teachers in adoption decisions helped to tailor the salmonid program to teacher needs, and provided a forum for participation.

Initial teacher involvement in program adoption had other benefits as well. The DESSI Study (Crandall et al, 1983) found that if another teacher, or some other trusted person vouches for an innovation, teachers are willing to give it a try. This factor holds true in the present study. The initial users of the salmonid program gave it credibility and exposure. Other teachers saw the program in action during its first pilot year, and were intrigued and encouraged by its success. As the Assistant Superintendents put it:

> ...it became safe, a safe program to do, and an easy program to do. The resource teachers de-mystified the program, proved it could work in the classroom; this small core of people have just become our ace in the hole. (AS 1)

> ...this program sells itself. The resource teachers, the ones that are practising and

> using the program, they are identified by teachers as the prime players; that's great promotion right there... (AS 2)

Therefore, although teachers were not involved in program development, user commitment and motivation towards the salmonid program was evident. As well, some teacher input was present during the adoption of the salmonid prorgam, adding to its applicability, and credibiltiy in the district.

Staff Development

Most of the major change studies (Berman & McLaughlin, 1978; Crandall et al, 1983; Gross et al, 1971, to name a few) identify concrete, teacher-specific training, and ready availability of materials as being crucial to an innovation's adoption and use. The workshops put on by the district met both these criteria quite well. These elements also correspond to Doyle & Ponder's (1977-78) "practicality" ethic that teachers use to assess innovations: a program is considered more practical if its goals and activities have been specifically addressed and operationalized in in-service training. Program workshops were run by local classroom teachers, another factor found in the change literature to influence adoption.

Sustained User Assistance and Support

The resource teacher network provided an on-going trouble shooter service and information source for users of the salmonid program, a central element in the program's adoption and use. This element of sustained program support agrees with most major studies on implementation (Berman & McLaughlin, 1978; Fullan, 1982; Gross et al, 1971; Sarason, 1971, 1982; and Werner, 1981). As Fullan states, "... it is when people actually try and implement new approaches that they need the help and support" (1982, p.67). The resource teacher network was a major factor in addressing teacher's initial concerns about the innovation, and providing batkup support during adoption.

In summary, by examining the adoption process from the teacher and district perspectives, one gets a more detailed picture of the many interacting factors at work. The district seems to have played its adoption cards well. In addition to its initial problem-solving approach to SiC's adoption, the district became an active and resource-rich advocate of the program. Teacher participation, teacher-directed training, peer assistance and communication, sustained support, classroom assistance, and local materials development were

important parts of the adoption process. Perhaps the key factor in the adoption of "Salmonids in the Classroom" was district support, manifested in district advocacy, easy availability of materials and resources and, most meaningfully for teachers, the resource teacher network that provided initial instruction, classroom assistance, communication, and on-going program support.

B/ PROGRAM ATTRIBUTES

Program attributes played a specific role in the salmonid program's implementation, focused around the interactive, classroom hatchery.

Need for the Innovation

Teachers and the district's Assistant Superintendants all saw a need for the salmonid program, due to its hands-on, interactive nature. Perceived need for a new program is a consideration that most change researchers agree is critical to its adoption and continued use. "Congruence" is an aspect related to perceived need; teachers assess a program in terms of how well it fits their teaching style (Doyle & Ponder, 1977-78). If teachers can see the need and basis for adopting a new program, and understand the rationale for change, they are much more likely to use an innovation (Werner, 1981).

Clarity of Program Goals

Clarity of program goals has been consistently cited as an influence on implementation since the initial studies done in the early 1970's. Major studies on change (notably Berman & McLaughlin, 1978; Gross et al, 1971; and Crandall et al, 1983) found that clarity - the extent to which teachers grasped a program's philosophy

and operational objectives - had a major effect on a program's use.

However, this study's findings show a discrepancy with respect to clarity as an influential implementation factor. Teachers were either unclear about the salmonid program's goals, ignored them completely, or never looked for any, yet they all had their own reasons for using SiC, which were very clear and operationalized. The literature does not address this aspect of individual user's goals; most past studies examined teacher applications of specified program objectives. Very few researchers step beyond this relatively narrow view of program goals and investigate individual reasons for using a program.

It seems from this study that user adaptation applied not only to the program's activities and attributes, but to its overall goals as well. Program users changed the salmonid program's objectives to suit their own preferences, thereby by-passing the 'necessity' to understand and use them. Olson (1980) and Werner (1981) come closest to this individual interpretation of clarity in their discussions of "shared meaning" between an innovation and teachers as a necessary prerequisite for its use. "An innovation is in the eye of the beholder" (Olson, p.3). This area of individual user objectives for

a program merits further investigation, especially concerning voluntary, supplementary curricula.

The Value of the Innovation for Students

Student enjoyment and benefits were major influences in teachers' use of "Salmonids in the Clasroom". This emphasis on student behavior concurs with most current studies on implementation. Two studies specifically address teacher behavior in relation to student learning and enjoyment. Harootunian (1980) found that teachers define success in terms of their students' behavior, and that a teacher is rewarded primarily by her students' reaction to a program, and their progress and learning. Leithwood & MacDonald (1981) studied teachers' curriculum choices, and found that teacher's affiliation with students is their central basis for decision-making. Studies done on supplementary environmental education programs arrive at similar conclusions. A teacher's sense of efficacy and success is strongly tied to his students' reactions and performance with a new program. Student interest, enthusiasm, and learning were major criteria that teachers used to assess the salmonid program.

Program Materials and Mutual Adaptation

The flexibility of an innovation is another characteristic that is emphasized in most of the major

studies on change and implementation. Teachers in this study felt that the salmonid program was flexible and adaptable enough to meet their teaching needs; it could be changed easily to suit their individual preferences. The Rand Study (Berman & McLaughlin, 1978) was the first large scale investigation to identify "mutual adaptation" as the process that characterized successful implementation. The authors define mutual adaptation as follows:

> Each classroom, each school, and each school system, being somewhat different from others, implements the same innovations in different ways at different times or places...A key to understanding implementation, then, is adaptation at the users' level. (p.15)

This implementation perspective was important in the salmonid program's use in North Vancouver, yet it raises an on-going debate in the implementation literature, that of fidelity versus variation. Should innovations be 'done right', following their developers' intents to the letter? Or should they be adaptable and flexible, and able to fit local contexts and cultures? We see arguments for both sides in the major studies on change.

Berman & McLaughlin (1978) stress the importance of mutual adaptation in implementation. Huberman & Miles (1984) state that adaptive innovations become too "watered down", and suggest that fidelity should be enforced, but accompanied by effective, long-term

assistance. Williams (1976) believes that a balance must be struck between an overly flexible, unstructured implementation strategy, and a conformist, "teacher-proof" focus, but provides us with no guidelines to follow. Fullan & Pomfret (1977) and Berman (1981) both suggest that user-oriented adaption may be better for complex innovations that demand strong user commitment to comprehend and revise.

"Salmonids in the Classroom", being a voluntary program, demanded just such commitment from its users. Mutual adaptation was the key process in SiC's adoption and implementation. Changes to the program began at the district level, with the in-class hatchery, and were further encouraged at the individual teacher level. Adaptation generated shared meaning between teachers and SiC, helped users to develop some sense of ownership and participation, and allowed teacher needs, beliefs, skills, and resources to become incorporated into the program.

Presently in North Vancouver, every elementary school has at least one classroom hatchery; several schools have as many as seven. "Salmonids in the Classroom" is a high-profile, active program in the district, integrated into many classrooms and schedules as well as the hatchery program at the Outdoor School. In short, for a

supplementary, voluntary program, SiC has been very successful in the district.

However, if we were to take the fidelity perspective for a moment, things might not look so rosy. The original program materials in the SiC binder were used very rarely and sporatically by the teachers in the study. The focus of the North Vancouver program was the hatchery, and related activity-oriented materials, much of which were developed locally. Even the program's basic goals and objectives were not adhered to strictly: some teachers admitted to not having seen any program goals. Do we then deem the program to be unsuccessful? I think not.

Perhaps we need to rethink our definition of success in implementing innovations, especially supplementary ones. If the salmonid program was a validated, well-tested innovation that was to be a prescribed part of every science program, then perhaps fidelity should be given a greater emphasis. However, in the case of North Vancouver, the in-class hatchery, which came to the foreground through mutual adaptation, was a primary factor in the salmonid program's success. From this study, it seems that for supplementary innovations, school autonomy, creativity, and mutual adaptation should be encouraged from the start, as it is critical to develop the innovation through practical use.

Problems With "Salmonids in the Classroom"

Since this study interviewed program users, obviously any difficulties that they may have had were not severe enough to prevent them from using SiC. However, by examining user problems, some of the limitations of the implementation process can be determined, as well as possible recommendations for program improvement.

The teachers' major initial concern was with the classroom hatchery, a problem that was adequately met by the resource teacher network. Preparation time was the only problem that was mentioned unanimously. Teachers have concerns about student learning, but also with how an innovation affects their role in classroom planning and organization. For most teachers, the program materials were too plentiful, and the binder's size deterred their use of it. Program complexity, or "cost" to teachers, in terms of the time, energy and skills required to use an innovation should be prime considerations for program developers, especially developers of supplementary programs.

In summary, the implementation of "Salmonids in the Classroom" revolved around the classroom hatchery. The hatchery met most of the identified criteria that teachers use to assess an innovation: need, its value for students, quality, and flexibility. One exception

concerned clarity of program goals: program users ignored for the most part the program's stated goals in favour of their own interpretations. This study supports the research that stresses the importance of mutual adaptation as an integral part of program implementation.

C/ SCHOOL/ DISTRICT/ EXTERNAL FACTORS

This section discusses the external, cultural context of the implementation of "Salmonids in the Classroom", beginning with factors at the school level.

CHANGE PROCESSES AT THE SCHOOL LEVEL

The Role of the Principal

Most of the major change studies speak of the school as an important unit of change, and the principal as a major player in the process. However, in this study, principals played a minor role in implementation, providing only verbal support for the salmonid program in most instances. The district went directly to teachers with the program, bypassing the principals, who are usually the main recipients of district innovations. Some principals did get actively involved with the program, yet this was not essential to program implementation. In one instance, a teacher who received no support at all from the principal still adopted and implemented the salmonid program. These findings raise interesting questions about the roles of the district and the principal in supplementary program implementation. It would be useful in further understanding these roles to investigate how the principals in North Vancouver viewed the implementation of "Salmonids in the Classroom", and

how other school districts adopted and implemented the program.

Teacher Involvement

In this study, the two assistant superintendants recognised the need to involve teachers in program adoption and implementation, as consultants and developers, and actual change agents. This district perspective is illustrated by the following quote:

> ...our involvement of some incredible teachers in the program gave it credibility...having teachers involved from the beginning, having ideas that come out of the field; there's far more chance of a program, one, being useful, and two, being implemented...that's the way a program really works well, if you can start the ball rolling, and then get the teachers to do the bouncing, to carry it through. (AS 2)

Sarason (1982) speaks of the dangers of the "lethalness" of superiority in implementing a change. All too often, planners take total ownership of an innovation, holding their version up as 'the one and only', and allowing little room for users to develop their own sense of the innovation.

All the teachers spoke of the benefits of having other users nearby, to discuss problems and ideas with. The major research on change directly confirms that the quality of working relationships among teachers is strongly related to implementation. Many researchers have

described the isolation of teachers' professional life (Lieberman & Miller, 1984; Lortie, 1975; and Sarason, 1971, to name a few). Several studies, including the DESSI Study (Crandall et al, 1983), have shown that contact among people attempting the same change is a primary factor in its success.

Socialization allows users to talk about a new program, assess it, and learn how to use it. Perhaps Werner (1981) speaks most directly to its importance, in his discussion of the role of conversation in any change process. He sees implementation as a social process, where clarity of an innovation must emerge through its actual use, and through formal and informal discussions among users.

CHANGE PROCESSES AT THE DISTRICT LEVEL

All teachers noted a high degree of support and commitment to the salmonid program by the district. District administrators play an important role in the planning of change. As Fullan states:

> The district administrator is the single most important individual for setting the expectations and tone of the pattern of change within the local district. (1982, p.159)

Teachers were very aware of the high expectations and positive tone set by the district concerning "Salmonids in the Classroom", a factor that influenced thier use of the program. The two Assistant Superintendants were the

primary promoters of the innovation, its initial advocates. District assistant superintendents are directly responsible for program development and improvement, and so their planning skills are important considerations.

Fullan (1982) outlines the district's role in implementation. The administrators must (1) assess the appropriateness of the innovation, (2) support the role of principals as central to implementation, (3) ensure availability of materials, inservice, one-to-one technical help, and opportunity for peer interaction, (4) allow for some adaptation, (5) communicate with the community and school board, (6) monitor implementation problems through a feed-back system, and (7) have a realistic time perspective.

Most of these criteria were met by the district. Although no formal assessment was made of the program, it seemed to meet several district needs at the time of adoption with respect to its local relevance, its connections with the NVOS, and the district's emphasis on active elementary science. As discussed previously, principals were not specifically involved in the implementation process. The district targeted the teachers directly, for involvement, participation, and support. Materials, in-service workshops, technical help,

and teacher seminars were all part of the district implementation strategy. Developing constituencies for the change was important too; teacher advocates of the program were identified and recruited early in the program's adoption. This emphasis on developing a program constituency parallels the political systems view of change, and affected all levels of SiC's implementation process.

Another important factor was the district's history of positive involvement in environmental education. The importance of this factor concurs with the literature's findings. Fullan (1982), Gross (1971), and Sarason (1971, 1982) believe that many studies of change lack a historical perspective, which hampers their research findings. The more administrators and teachers have had negative experiences with previous attempts at using new programs, the more cynical and hesitant they will be regarding the next attempt, no matter how impressive the program seems.

EXTERNAL INFLUENCES ON THE CHANGE PROCESS

Schools do not exist in a closed system. The surrounding community and its social and cultural norms can have far-reaching effects on school policy and politics. Sarason (1971) was one of the first researchers

to speak of the transactional relationship schools have with their community. He believes that one must understand the legal, cultural and political features of this relationship to properly investigate any attempts at changing the educational system. Communication with the local community about a new program is seen as an important implementation strategy, paralleling the political perspective of change.

The district made a conscious effort to inform the local community about "Salmonids in the Classroom", which paid off in establishing a positive public image for the program. This type of district involvement is not often seen with respect to a supplementary educational program, and is an important one for program developers to be aware of. It would be interesting to examine other situations where the salmonid program is not as well-supported by the district administration, and explore the resulting effects on program implementation and community awareness. Further research in the area of district support and involvement with environmental programs is needed to better understand and make use of this potentially powerful implementation catalyst.

In summary, implementation of "Salmonids in the Classroom" essentially occurred at the individual teacher level, supported by influential factors from the school,

district, and community environments. Change is a process of personal development in a context of socialization. Teacher communication, participation, and support were major elements in the program's use, and compensated for the lack of involvement by principals.

The district played a major role in the salmonid program's implementation, laying the foundations for program success. Resources and materials were provided, a forum for teacher input and participation was established, and program adaptation was encouraged. The Assistant Superintendents were the program's initial change agents, and they cultivated the resource teacher network to continue this role.

A program's social and cultural environment always affects its use, whether overtly or inconspicuously. In this study, the external factors I was able to identify were of a wide and sometimes exotic variety, ranging from a newspaper's active support, to the Japanese government. It is rare that a supplementary educational program, or any educational program for that matter, is so central to the public's eye. These associations added a contemporary, topical element to the salmonid program, that further increased its relevancy and appeal. They also underline the significant influence of the district on the program's popularity at the community, school, and classroom level.

D/ TEACHER CHARACTERISTICS

One of the main assumptions of this study is the centrality of teachers to the change process. This section discusses teachers' internal characteristics, personal attitudes and interests, in relation to program use.

Recognition and Rewards

Why do teachers innovate? Common sense would indicate that we humans react to positive incentives: rewards and recognition for our efforts. This has been borne out in the change research as well. Leithwood & MacDonald (1981) found that one aspect teachers looked for in deciding to use a program was esteem, or recognition by others: teachers, administrators, parents, and students. Stephens (1974), Pincus (1974), and Leithwood, Clipsham et al, (1976) believe that a reward system as perceived by teachers is a crucial variable associated with change. However, in practise there are very few incentives for teachers to attempt new programs, especially supplementary ones.

The lack of a specific reward system did not seem to affect the salmonid program's adoption or implementation from the perspective of the teachers in this study. One can only speculate as to the possible increased program

dissemination and use such a system might have encouraged. However, in terms of program continuation, this lack of external recognition may have negative consequences in North Vancouver. This aspect of the change process is discussed further in the study's final chapter.

Personal Interests

The strong influence of personal interest on the salmonid program's adoption and use is not surprising, considering "Salmonids in the Classroom"'s specific focus, and voluntary nature. Most recent change researchers stress the critical role of belief in implementation. The operating assumptions and values of an innovation must have meaning for teachers; they must agree with its basic spirit and intent in order to use it. As Anne Bussis and associates discovered in their study of teacher behavior:

> ...internal mental processes (such as understandings, beliefs, and values) are major underlying determinants of behavior...their (materials, special programs, and equipment) value in the long run is determined by the teacher's interpretation and use of them. (1976)

Much of the literature contends that a major barrier to implementation is teachers' lack of the skills and knowledge needed to use an innovation. Several environmental education studies also emphasize this

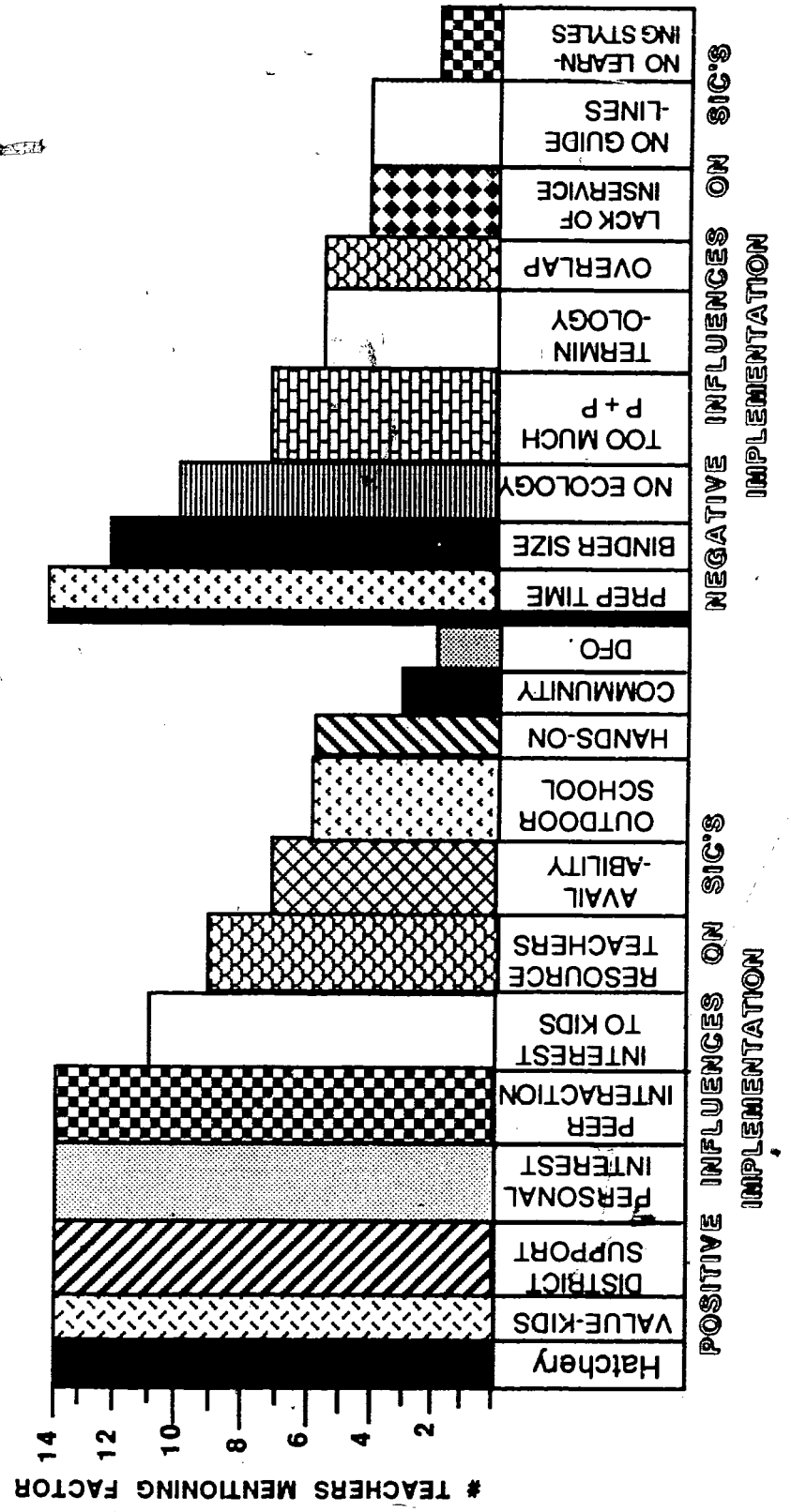
factor; teachers with an environmental education or science background were more likely to use related programs. (Hall & James, 1981; Jaus, 1978; and Johnson, 1980). Basically, if a program doesn't relate to a teacher's existing knowledge, skills, and competence in an area, it is impractical in terms of time, energy and potential repercussions to adopt it.

This practical perspective on implementation would seem to be particularly influential in the case of a supplementary program like "Salmonids in the Classroom": why attempt a technically risky innovation that you have little or no experience with when it is not prescribed in the first place? The five program users who had no science background are an interesting case in point, and emphasize the significant influence of both personal interest and motivation, and sustained program assistance in innovation implementation.

Positive Influences on Program Use: The Teachers' Perspective

The five positive implementation influences mentioned by all the teachers provide an important perspective on the salmonid program's use in North Vancouver (see Figure 3 for a summary of these factors). These influential factors are discussed here with reference to the

FIGURE 3 : POSITIVE AND NEGATIVE INFLUENCES ON SIC'S IMPLEMENTATION



literature, and to the entire process of change in the district.

Personal Interests, Program Value, and Program Rewards

The program's value to students was specifically mentioned by all teachers. Assessing a program's value and worth is a personal, subjective decision based on an individual's own values and beliefs. I believe personal interest in the salmonid program was a major determining factor in its implementation. It featured strongly in the assistant superintendents' decision to adopt SIC, and also in the district's advocacy of the program. Teachers' personal interest in SIC initially attracted them to the program, and provided additional motivation to tackle the extra workload and any initial problems or difficulties.

Teachers' individual style and teaching methods also come into play. The classroom hatchery, a hands-on, interactive component, was the program's main selling point. Teachers saw a need for an experiential science program, and generally believed in active, concrete learning experiences for their students. "Salmonids in the Classroom" spoke to teachers' own interests, beliefs and preferred teaching styles, all of which affected their perceived value of the program.

All teachers mentioned their students' curiosity and enthusiasm for the classroom hatchery, and this reaction was verified during the classroom observations: the hatchery was a source of pride, excitement, and stimulation for the large majority of students I observed. Lortie (1975) found that the greatest rewards mentioned by teachers were "psychic rewards", where teachers see positive student behavior, enthusiasm, and an increase in learning. Spurred on by the success of the program, and buoyed up by peer support, these "psychic rewards" were received by teachers early on in the program.

The Role of the District

The district support structure is another underlying aspect of "Salmonids in the Classroom"'s implementation. It was mentioned specifically by the majority of teachers, and was implicit in many of the other factors that were mentioned: the program's easy availability, the ready supply of resources and materials, the teacher-run workshops, and the resource teacher network. The district encouraged teachers' active interest in the salmonid program by including them in its adoption and distribution. As well, the district support structure promoted early success with the program, which provided

personal rewards to teachers, as well as increased student interest and enthusiasm.

Peer Interaction

Teacher communication is a central factor that underlies much of this implementation picture. Through the resource teacher network, the workshops, the notes from the district to the users ("the fisherfolk"), and the formal and informal discussions and activities with other program users, a 'mini-salmon society', or 'club' evolved. Perhaps 'club' implies too much structure; users were not formally organized into a cohesive group, yet they all shared common interests, program goals, and enjoyed and encouraged user gatherings - more of a shared culture evolved. The crux of implementation is individuals developing new understanding in relation to an innovation within a complex social system. This sense of belonging, of working towards a shared goal, trading ideas, and discussing problems is important in promoting shared meaning of an innovation.

It is also a step in combating teacher isolation. Lortie (1975) found that teachers do not develop a common technical culture, because of their physical isolation when actually at work, and because of the usual practise of not sharing and discussing each other's work. Teachers are not "colleagues who see themselves as sharing a

viable, generalized body of knowledge and practice" (p.79). According to Lortie, this lack of a "technical culture", and of sharing and reflection among teachers creates ambiguity and uncertainty. I believe that the teacher communication that occurred during the adoption and implementation of SiC helped to build a form of shared sense of belonging, which furthered program use.

E/ Incidental Observations on the Continuation of "Salmonids in the Classroom" in North Vancouver School District

During the course of this research, I spent a large portion of eight months in the North Vancouver school district, talking to teachers, students, administrators, and parents, observing classrooms, attending salmon art exhibits, and school open houses, and helping with hatcheries, salmon egg takes, rearing troughs, and incubation boxes. Through this association with the district and the salmonid program, I was able to gain some insights into the workings of SiC in North Vancouver. What follows is a short summary of my observations, presented here in the hopes that North Vancouver specifically, and other districts and schools in general might find them useful.

"Salmonids in the Classroom" is a successful environmental program in North Vancouver, promoted through the efforts of two enthusiastic assistant superintendents, and a sizeable group of committed teachers. I enjoyed experiencing the program's overall vitality, success, and popular appeal. However, I was also aware of several problems with SiC in the district: specifically, a waning of interest in the program, a lack

of a sense of future for the program after elementary school, and a weakening of the program's communication network.

Many teachers I spoke to felt that the program was stagnating somewhat; it was becoming more difficult year after year for them to get excited about the arrival of salmon eggs that initiates the program. Many of them stated they would most likely keep using SiC, as their students enjoyed it so much, but that for them personally, the program was becoming dry and repetitive.

"Salmonids in the Classroom" seems to be at a sort of 'mid-life' crisis in North Vancouver. It has been around for six years, and the initial excitement and sense of participation and development has faded somewhat. As Fullan (1985) states, the spread and continuation of a new program is an important phase in the change process. First users often have a 'pioneer status' (p.412) that is self-motivating, and that is not as available to later users.

This problem merits some discussion here, as I believe teacher's personal interest and self-motivation are crucial factors in the use of most supplementary, environmental education programs. Teachers are not only the key to program implementation, they are also central to its continued use.

The rewards that the salmonid program users received came primarily from within; teachers believed in the worth of SiC, and felt good about seeing their students enjoy and learn while using the program. However, these internal rewards may not be enough in the long run. Most studies of human motivation point to the need for tangible, external rewards and recognition for efforts and success (see Peters and Waterman's 1982 review of the management of successful businesses, as well as the recent effective schools literature, Purkey and Smith, 1983, 1985).

Humans need meaning, motivation, and celebration in their lives. The salmonid program held personal meaning for teachers, and its success with students was a strong motivational force, yet celebration in the district was pretty well non-existent. To foster further diffusion and continued use of environmental programs, I believe change agents must pay more attention to this basic aspect of individual motivation, especially in the educational system where financial rewards and promotional benefits aren't available. In North Vancouver, recognition of teacher's efforts in implementing SiC could take the form of a salmon barbeque once a year, salmonid T-shirts, field trips for users to view hatcheries or other programs, or a salmonid retreat at the North Vancouver Outdoor School, with invited speakers from the federal

Department of Fisheries and Oceans, or university research labs. Incorporating some celebration into SiC would provide needed recognition and rewards to users, and also serve to re-energize and revitalize the program.

Another area of concern that was evident in the district was a prevailing sense that there was no future for the salmonid program after elementary school. The DPA Evaluation of SiC (1983) found that the secondary salmonid program is rarely used, due to an already full, compulsory curriculum. The evaluation recommends an on-going program, to maintain and enhance students' 'salmon experiences': "For most students it is unrealistic to expect that their newly acquired knowledge and protective attitude will be maintained throughout their lives unless reinforced by other experiences, information, and education" (DPA, 1983).

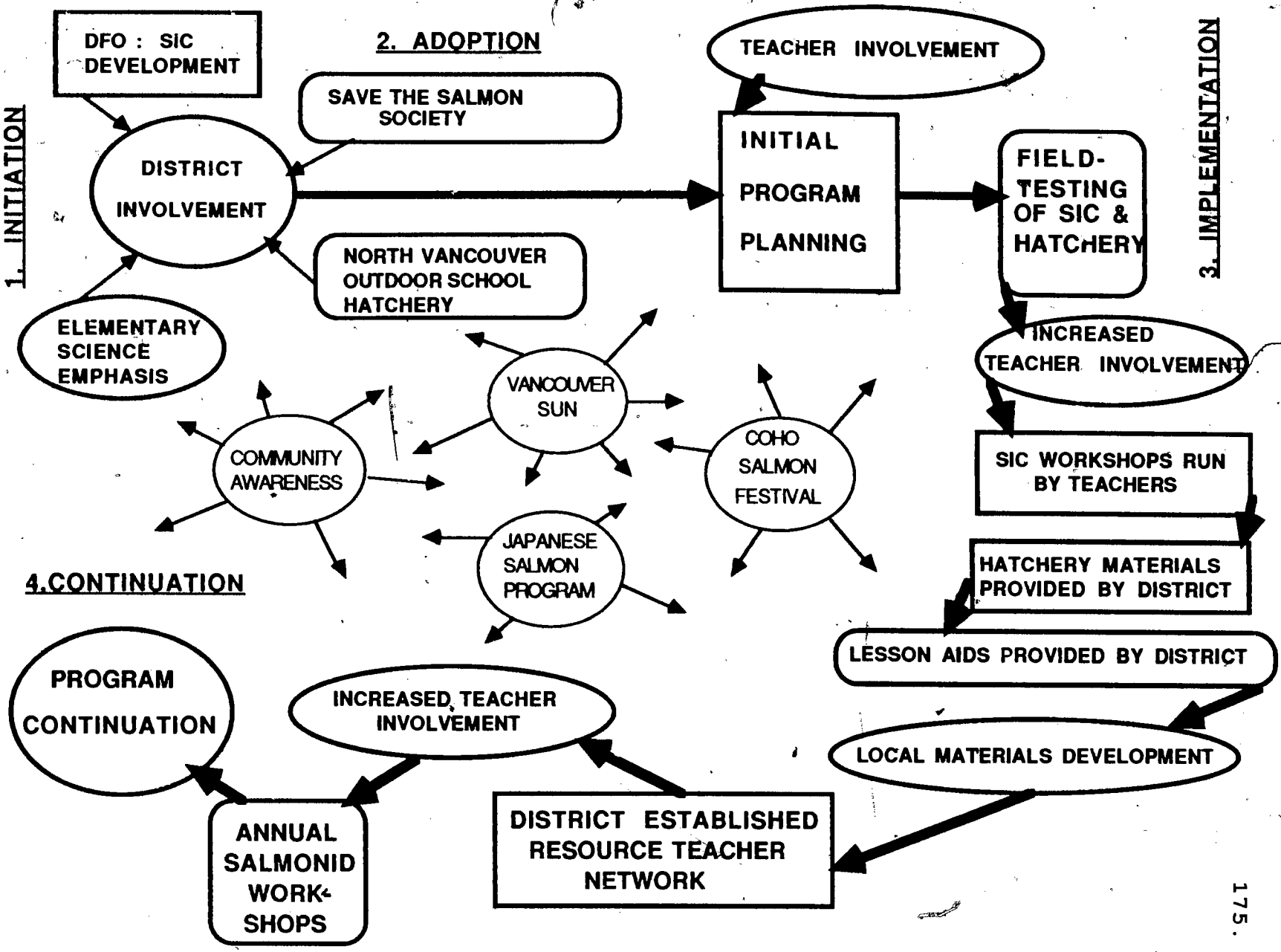
Many teaches in the study saw the salmonid program as 'going nowhere' after their students left elementary school. Frustrations were expressed at getting students excited and involved in what is ultimately a long term project (salmon mature in three to five years, from egg to returning adult), and then providing no followup or continuation later in their school lives. Again, this is a problem of continuation that needs to be examined by the district, and by the program developers.

A final element that was conspicuous by its absence was the lack of an information feedback system concerning the salmonid program, at both the district and program developer levels. The two problems mentioned above were openly discussed between teachers, with the resource teachers, and with me during the study, yet the assistant superintendents both stated they knew of no problems with the salmonid program in North Vancouver. Although the resource teacher network is an important link between users, it seems to have some shortcomings as a communication link between users and the district. Intensive communication and interaction between all levels of a system is a key factor in any change process. In order to identify problems, monitor an innovation, and reward successes, implementors and program developers must have an established system of keeping in touch with the change itself, and following its progress. There may be a time when an informal communication network must be 'formalized' to survive.

Obviously, these three problem areas take time, organization, and money to address, factors that are especially scarce in this time of severe educational cutbacks, especially with respect to supplementary programs. The point remains however, that environmental program developers and implementors need to pay increased

attention to program users, to try and foresee the entire process of change, and to attempt to encourage and sustain influential change elements in all possible ways.

FIGURE 4 : SIC'S IMPLEMENTATION PROCESS IN NORTH VANCOUVER



F/ CONCLUDING REMARKS

This study of program implementation was able to portray the change process in North Vancouver school district in detail, describing a set of interconnecting, influential elements that ranged from individual teacher attributes to the larger, external environments in which the process occurred. These influential elements are summarized in Figure 4, a flow chart diagram of the implementation of "Salmonids in the Classroom" in North Vancouver. A summary of influential elements identified in the change and implementation literature is presented in Table 7, comparing their relevance to the implementation process in North Vancouver.

The change process in North Vancouver as portrayed by this study resembles a web, in which each strand seems as important and necessary as the rest in order for the entire process to function successfully. However, there are several major, connecting threads or supports that travel through all four areas of investigation, and that were mentioned specifically by all teachers as significant factors in their use of SiC. These factors are: (1) district support, (2) the value of the program to students, (3) user's personal interest and (4) peer interaction. In the following paragraphs, I have traced these factors through the four research areas examined in

the study: (i) the adoption process, (ii) program attributes, (iii) external factors, and (iv) teacher characteristics. These influences and interactions are summarized in Table 8.

I would argue that these factors of "Salmonids in the Classroom"'s implementation process were central to the program's success in North Vancouver - mainstays within an interactive web of influential, contributing factors.

I. District Support

The important and influential role that the district played in SiC's implementation was not anticipated at the start of the study, yet became evident during the first few teacher interviews. Much of the change literature points to the user of an innovation as being of major importance. This study's findings concur with this perspective, yet also highlight the potential impact and important influence of central administrators on implementation. The user-in-context was at the heart of the salmonid program's change process, yet the district influenced a major portion of this context, at all levels of the change.

The district's perspective on change and its endorsement of "Salmonids in the Classroom" was evident and influential during the adoption process. Teachers

mentioned five influential factors that can be attributed to district support: (1) ease of access to program materials, (2) early involvement of users in program planning, (3) teacher-directed in-service, (4) peer communication, and (5) the resource teacher network, probably the most outstanding and successful element of district support.

The salmonid program's attribute of flexibility, combined with the district's advocacy for mutual adaptation, encouraged the district focus on the classroom hatchery, as well as local material development, both main elements in SiC's success in N. Vancouver. Community awareness of the salmonid program was encouraged through district-initiated media coverage, local salmon activities and art displays, and the district's association with the local "Save the Salmon Society."

Teachers' initial assessment of the program was influenced by the show of support it received from the district. The district's support of SiC and its participatory view of the implementation process also provided a stable base for the program, from which teachers could interact, learn, and adapt the program to their individual needs.

It is evident that district support for an environmental program can play a large role in its successful

use. The district's role in environmental program implementation merits further study as an important avenue for successful planned change.

II. The Value of the Program to Students

Recognition for attempting a change is an important aspect of any change endeavor. This is evident from the teachers' specification of the program's value for their students as an influential implementation factor. Teachers' primary indicators of the success and utility of a new program are their student's reactions to it; teachers used the salmonid program because their students loved it and benefited from their experiences with it. This aspect of implementation raises further questions about how environmental program developers can best meet teachers' program assessment criteria.

Through the involvement of teachers in the adoption process, the teacher-directed workshops, and the resource teacher network, the program was given credibility early on during its debut in North Vancouver. Teachers were able to observe the program being used in local classrooms during its adoption, and saw the student enthusiasm generated by the experience of raising young salmon. This early success with the salmonid program,

measured primarily through positive student reaction, prompted further adoption.

The hatchery, the main program attribute in the North Vancouver salmonid program, was hands-on and interactive; teachers felt these characteristics benefited their students, and also generated immediate student interest and curiosity, positive selling points for the innovation.

External elements, such as the positive reactions of parents and the local community to the salmonid program, re-emphasized its value to teachers.

Positive student response and enthusiasm towards the program, and a perceived increase in student learning were major, tangible rewards received by the teachers in the study.

III. Personal Interest in the Program

Teachers' personal attitudes and values figured highly as influential factors in this study, and were interwoven through many of its salient findings. Once again, users' perspectives and characteristics were shown to be fundamental to a program's successful implementation.

Initially, the salmonid program sparked the personal interest of the districts' assistant superintendents and several teachers, who initiated the adoption process.

The group of teachers that piloted "Salmonids in the Classroom" were instrumental in adapting it to better suit North Vancouver's local resources, again working primarily from their own interest in the program.

The hands-on hatchery was a unique and interesting program component for the teachers to use. It caught the imagination of many teachers, and fit in well with available resources, such as accessible streams and creeks, and the North Vancouver Outdoor School.

Individual personal interest in the program encouraged a number of events at the school, district, and community levels, including user socialization, the resource teacher network, materials development, as well as community awareness and involvement. The hatchery held meaning for many people; its basic purpose could be easily understood by most of the factions that made up the local environment.

Personal interest was also the primary teacher characteristic that served to motivate, encourage, and reward the users of the salmonid program. Personal interest in SiC drew teachers to it initially and was a prime motivator in sustaining them through the extra work involved in adopting a supplementary innovation. It also carried them through the often problematic first attempts at using the program, and later difficulties they encountered.

These findings raise additional questions about environmental program users and non-users. What factors contribute to a program users' motivation and drive? How essential are environmental values and beliefs to the use of environmental programs? How and why are beliefs and concerns about the environment instilled and developed? Is it possible to instill an interest and a commitment to use environmental programs in teachers?

The centrality of the user to innovation implementation has been well-established. It is time to look further, to the users themselves, their incentives and motivations to change, and the context in which they are changing.

IV. Peer Interaction

Communication about the salmonid program was fundamental to its use. By openly sharing implementation problems and solutions, teachers learned from each other and supported each other. The development of good working relationships between program users enhanced implementation, and promoted socialization ansd the sharing of ideas, re-emphasizing that change is a personal/interpersonal process.

Peer interaction and socialization served to build a network, or informal 'club' of "Salmonids in the Classroom" users. Peer communication was encouraged

during the program's adoption, through initial teacher participation in decision-making, teacher-run workshops, and the ensuing resource teacher network.

Peer interaction aided the mutual adaptation process of program materials. Teachers were encouraged to interact and call on each other for assistance; this built an informal network of SiC users that produced a variety of popular, locally developed activities.

Socialization about the salmonid program also provided some links between schools, the district, and the community. The resource teacher network was in touch with most users and with the district, other teachers worked together on program activities and encouraged parental involvement, and the district liasoned with local community groups, the media, and schools in Japan, to develop even more links and interconnections.

Peer interaction promoted a shared salmon culture' of sorts among users. User discussions contributed to the continuous shaping of the new program, the development of a shared understanding of the innovation, and the revitalization of personal interests and beliefs - all important factors in the program's implementation. I would even argue that the presence of two keen and interacting peers at the district level served to reinforce interest and support for the program more successfully than one district advocate might have.

A primary aspect of implementation is the teacher's acquisition of new skills, behavior, and attitudes. This is best achieved through peer interaction, provided in the form of (a) teacher participation in decision-making, (b) concrete, on-going staff development, (c) relevant, practical assistance on an 'on-call' basis, and (d) formal and in-formal program meetings. These factors played a large role in teachers' adoption and use of "Salmonids in the Classroom", and should be strongly considered by environmental educators and program developers.

The resource teacher network was at the heart of the salmonid program's successful implementation in North Vancouver, and provided the primary connections for peer interaction. Its success as a program support system also merits attention by program developers, implementors, and researchers interested in the implementation process.

TABLE 7 : A COMPARISON OF INFLUENTIAL IMPLEMENTATION FACTORS FROM THE LITERATURE AND FROM THE PRESENT STUDY.

INFLUENTIAL FACTORS ON IMPLEMENTATION	REFERENCES	APPLICABILITY TO THE PRESENT STUDY'S FINDINGS
A/ ADOPTION PROCESS ELEMENTS		
DISTRICT SUPPORT FOR THE CHANGE	Berman (1981), Berman & McLaughlin (1978), Crandall et al. (1983), Daft & Becker (1978), Fullan (1982), Fullan & Pomfret (1977), Gross et al. (1971), Huberman & Miles (1984), McCaw (1979-80), Rosenblum & Louis (1981), Sarason (1982), Smith & Keith (1971).	YES. District support was found to be a major factor pertaining to SiC's implementation.
USER PARTICIPATION IN ADOPTION DECISION-MAKING	Berman (1981), Berman & McLaughlin (1978), Crandall et al (1983), Fullan (1982), Gross et al. (1971), Huberman & Miles (1984), Rosenblum & Louis (1981), Sarason (1982), Williams (1976,1982).	YES. Teacher input was encouraged by the district at an early stage of SiC's adoption.
USER PARTICIPATION IN PROGRAM DEVELOPMENT	Berman & McLaughlin (1978), Gross et al. (1971), Fullan (1972, 1982), Fullan & Pomfret (1977), Pincus (1974), Sarason (1982).	No. Teachers in this study did not participate in the program's initial development.

TABLE 7 : ... CONTINUED

INFLUENTIAL FACTORS ON IMPLEMENTATION	REFERENCES	APPLICABILITY TO THE PRESENT STUDY'S FINDINGS
PRACTICAL, RELEVANT STAFF DEVELOPMENT	Berman & McLaughlin (1978), Crandall et al, (1983), Fullan (1972,1982), Gross et al, (1971), Hall & Loucks (1978), Leithwood, (1978), McCaw (1979-80), Rosenblum & Louis,(1981),Sarason (1982),Smith & Keith (1971).	YES. Practical in-service workshops were provided, and were run by teachers.
SUSTAINED USER ASSISTANCE AND SUPPORT	Berman & McLaughlin (1978), Crandall et al, (1983), Doyle & Ponder (1977-78), Fullan (1972,1982), Gross et al (1971), Hall & Loucks (1978), Huberman & Miles (1984), (1978), McCaw (1979-80), Rosenblum & Louis (1981), Sarason (1982),Smith & Keith (1971) Werner (1981), Williams (1976).	YES. The resource teacher network aided new and on-going users with SiC.
FLEXIBLE TIME FRAME FOR CHANGE TO OCCUR	Berman & McLaughlin (1978), Fullan (1982), Sarason (1982), Smith & Keith (1971), Williams (1976).	YES. The district had a flexible implementation time frame for the program.
POWER AND CONFLICT AS FACTORS OF THE CHANGE PROCESS.	Baldridge (1972), Berman (1981), House (1974, 1979), Williams (1976), Zaltman et al (1977)	NO. The district possessed a problem-solving approach to change.

TABLE 7 : ...CONTINUED

INFLUENTIAL FACTORS ON IMPLEMENTATION	REFERENCES	APPLICABILITY TO THE PRESENT STUDY'S FINDINGS
GREATER SUCCESS OF LARGE SCALE CHANGES	Berman & McLaughlin (1978), Clark & Guba (1965), Crandall et al.(1983), Fullan (1972, 1982), Huberman & Miles (1984), Rosenblum & Louis (1981).	NO. Planning and implementation of SiC occurred slowly, on a small scale.
RATIONAL, SYSTEMIC PRE-DETERMINED CHANGE STRATEGIES WITH A LOCUS OF AUTHORITY	Baldridge (1972), Clark & Guba (1965), Daft & Becker (1978),House (1974, 1979), Rosenblum & Louis (1981), Runkel et al (1979) Zaltman et al (1977).	NO. The district's change strategy was flexible and participatory.
B/ PROGRAM ATTRIBUTES		
PERCIEVED NEED FOR THE INNOVATION	Berman & McLaughlin (1978), Doyle & Ponder, (1977-78), Fullan (1972,1982), Fullan & Pomfret (1977), Gross et al (1971), Lortie (1975), Olson (1980), Rosenblum & Louis , (1981), Sarason (1982), Wang (1984), Werner (1981).	YES. There was a percieved need for the innovation at both the district and user levels.

TABLE 7 : ... CONTINUED

INFLUENTIAL FACTORS ON IMPLEMENTATION	REFERENCES	APPLICABILITY TO THE PRESENT STUDY'S FINDINGS
CLEAR, OPERATIONAL PROGRAM GOALS	Berman & McLaughlin (1978), Crandall et al, (1983), Doyle & Ponder (1977-78), Fullan, (1982), Fullan & Pomfret (1977), Gross et al, (1971), Huberman & Miles (1984), Olson (1980), Smith & Keith (1971), Werner (1981) Williams (1976).	NO. Most teachers felt the program's goals were unclear. Teachers ignored them in favor of their own.
QUALITY AND PRACTICALITY OF THE INNOVATION	Crandall et al (1983), Doyle & Ponder (1977-78), Fullan (1982), Fullan & Pomfret (1977), Rosenblum & Louis (1981).	Yes and NO. Quality was seen as good overall, yet the large volume was deemed impractical.
MUTUAL ADAPTATION	Berman & McLaughlin (1978), Doyle & Ponder (1977-78), Fullan,(1982), Fullan & Pomfret (1977), Harootunian (1980), House (1979), Leithwood & MacDonald (1981),Olson (1980), Sarason (1982), Wang (1984),Werner (1981).	YES. Mutual adaptation was a key process in SiC's Implementation.
PERSONAL "COST" OF THE INNOVATION TO IMPLEMENT	Berman & McLaughlin (1978), Doyle & Ponder, (1977-78), Fullan (1971,1982), Gross et al, (1971), Sarason (1982).	YES. Program preparation time & hatchery concerns were 2 "cost" elements mentioned by teachers.

TABLE 7 : ... CONTINUED

INFLUENTIAL FACTORS ON IMPLEMENTATION	REFERENCES	APPLICABILITY TO THE PRESENT STUDY'S FINDINGS
THE VALUE OF THE INNOVATION FOR STUDENTS	Berman & McLaughlin (1978), Crandall et al, (1983), Doyle & Ponder (1977-78), Fullan, (1972,1982), Gross et al (1971), Harootunian, (1980), Huberman & Miles (1884), Johnson, (1980), Leithwood & MacDonald (1981), Little, (1984), Mirka (1973), Wang (1984), Werner (1981).	YES. Teachers felt the program was valuable and interesting for their students.
C/ SCHOOL / DISTRICT/EXTERNAL FACTORS		
ACTIVE SUPPORT OF THE PRINCIPAL NECESSARY	Berman & McLaughlin (1978), Crandall et al, (1983), Fullan (1982), Leithwood et al (1978) Leithwood & Russell,(1973), McCaw (1979 -80), Sarason (1982), Wang (1984).	NO. Principals did not figure highly in SiC's implementation process.
PEER COMMUNICATION AND SOCIALIZATION ABOUT THE CHANGE	Berman & McLaughlin (1978), Crandall et al, (1983), Fullan (1972,1982), Fullan & Pomfret, (1977), Huberman & Miles (1984), Leithwood & MacDonald (1981), Little (1984), Rosenblum & Louis (1981), Sarason (1982), Wang (1984) Williams (1976), Zaltman et al (1977).	YES. Teacher communication was an integral part of SiC's implementation.

TABLE 7 : ... CONTINUED

INFLUENTIAL FACTORS ON IMPLEMENTATION	REFERENCES	APPLICABILITY TO THE PRESENT STUDY'S FINDINGS
INFORMATION FLOW & FEEDBACK SYSTEM TO MONITOR PROGRAM	Clark & Guba (1965), Fullan (1972,1982), Rosenblum & Louis (1981), Sarason (1982), Williams (1976), Zaltman et al (1977).	YES. The resource teacher network provided some information feedback.
DISTRICT'S HISTORY OF INNOVATIVE ATTEMPTS	Berman & McLaughlin (1978), Fullan (1982), Gross et al (1971), Sarason (1982).	YES. The district has a long history of commitment to environmental education.
AVAILABILITY OF PROGRAM MATERIALS / RESOURCES	Berman & McLaughlin (1978), Doyle & Ponder, (1977-78), Fullan (1982), Gross et al (1971) Lieberman & Miller (1984), Sarason (1982).	YES. Teachers felt the availability of program materials was a positive incentive to use SiC.
EXTERNAL CULTURAL INFLUENCES	Baldridge (1972), Berman & McLaughlin (1978) Crandall et al,(1983) Doyle & Ponder,(1977-78), Fullan (1982), House (1979), Lieberman & Miller (1984), Lortie (1975), Rosenblum & Louis (1981), Sarason (1982), Smith & Keith, (1971), Williams (1976), Wolcott (1977).	YES. A variety of external elements had an impact on SiC's profile in the district, and its subsequent use.

TABLE 7 : ... CONTINUED

INFLUENTIAL FACTORS ON IMPLEMENTATION	REFERENCES	APPLICABILITY TO THE PRESENT STUDY'S FINDINGS
D/ TEACHER CHARACTERISTICS		
RECOGNITION AND REWARDS FOR INNOVATION	Berman & McLaughlin (1978), Bussis et al (1976), Doyle & Ponder (1977-78), House (1974), Huberman & Miles (1984), Leithwood & MacDonald (1981), Leithwood & Clipsham (1976) Lieberman & Miller(1984), Lortie (1975), Peters & Waterman (1982) Pincus (1974), Sarason (1982), Stephens (1974) Williams (1976).	No. There were no formal rewards or recognition for SiC users; however teachers felt the program had intrinsic rewards.
USER COMMITMENT TO THE CHANGE	Berman & McLaughlin (1978), Crandall et al (1983), Doyle & Ponder (1977-78), Fullan (1972,1982), Gross et al (1971), Huberman & Miles (1984), Olson (1980), Werner (1981).	YES. Teachers in the study were very committed to the program.

TABLE 7 : ....CONTINUED

INFLUENTIAL FACTORS ON IMPLEMENTATION	REFERENCES	APPLICABILITY TO THE PRESENT STUDY'S FINDINGS
CENTRALITY OF USER BELIEFS AND ORIENTATIONS	Bussis et al (1976), Doyle & Ponder (1977-78) Elbaz (1981), Fullan (1972), Harootunian (1980), Huberman & Miles (1984), Kritek (1976), Lehman (1972), Leithwood & MacDonald (1981), Lieberman & Miller (1984) Little (1984), McCaw (1979-80), Mirka (1973) Olson (1980), Peters & Waterman (1982), Sarason (1982), Schmidt & Buchman (1983), Tomatsky et al(1980), Werner (1981), Yin (1982).	YES. Teachers' personal interests and beliefs were major factors in their use of SiC.
TEACHERS' SKILLS AND KNOWLEDGE CONCERNING THE INNOVATION	Berman & McLaughlin (1978), Bussis et al (1976), Doyle & Ponder (1977-78) Elbaz (1981), Fullan (1972,1982),Gross et al (1971), Harootunian (1980), Huberman & Miles (1984), Leithwood &MacDonald (1981), Lieberman & Miller (1984),Lortie (1975) McCaw (1979-80), Mirka (1973), Olson (1980), Sarason (1982),Schmidt & Buchman (1983), Werner (1981).	YES.* Most teachers had some background in science and/or environmental education. *See Table 5 for data on 'non-science' users
TEACHERS'# YEARS TEACHING AS HAVING A NEGATIVE EFFECT	Berman & McLaughlin, (1978)	NO. The # of years users had taught varied from 4 to 35 years.

CHAPTER 7 : RETROSPECTIVE REFLECTIONS AND RECOMMENDATIONS

A/ THE IMPORTANCE OF THE STUDY

This study investigated the implementation of a specific environmental education program in one urban school district. The study's purpose and methodologies do not attempt to address broad generalizations or claims: however, the study is important for several reasons. To date, it is one of the only published research projects that examines the implementation of a supplementary environmental education program. Many environmental programs have been and are being developed for use in schools, yet little attention has been paid to their actual use. This research emphasizes once again the intricacies of the change process, and the many variables that affect an environmental program's entry into the educational arena. This descriptive portrayal of a positive example of implementation can be compared to and contrasted with other implementation experiences to raise questions and new ideas for the reader, and stimulate critical reflections on implementation and planned change.

The naturalistic research methodologies I adapted for use in the study may serve to aid future researchers in investigating implementation. As Miles and Huberman

(1984a) stated, there is a serious need for specific, detailed, published analysis methods in the field of qualitative research. I tried to present my methodologies as explicitly as possible, in order to increase the study's validity and to describe systematic methods that could possibly be useful to other researchers.

This study does not attempt to provide a replicable, generalizable 'model', or step-by-step guide to implementation; indeed, it re-emphasizes the interdependency of the implementation process on the context, conditions and variables of local situations. However, although many features of SiC's implementation process were situation-specific, several significant factors formed the backbone of the program's use on North Vancouver. District support, peer interaction and learning, the aspect of the program's value, and personal interests stand out from my research, and from the recent change literature as salient components of implementation.

The study's findings also include elements that do not correspond to factors identified in current studies on change: (1) in North Vancouver, program users were generally unclear or unaware of the original salmonid program's goals, (2) the district's assistant superintendants, and not the school principals assumed

central roles in program adoption, support and implementation, and (3) users were not involved in the program's original development stages. These discrepancies are significant, as they oblige researchers to continually question and debate the current premises of change during every analysis. We have much to learn about all aspects of planned change and implementation.

TABLE 8 : A SUMMARY OF THE MAJOR INFLUENCES ON SIC'S IMPLEMENTATION, AND THEIR INTERACTIONS WITH THE STUDY'S FOUR RESEARCH THEMES.

	DISTRICT SUPPORT	VALUE OF THE PROGRAM TO STUDENTS	PERSONAL INTEREST IN THE PROGRAM	PEER INTERACTION
THE ADOPTION PROCESS	PROGRAM AVAILABILITY, TEACHER INVOLVEMENT	SUCCESSFUL PILOT PROGRAMS GAVE SIC EARLY CREDIBILITY	PERSONAL INTEREST GENERATED AT THE DISTRICT & TEACHER LEVEL INITIATED ADOPTION	ENCOURAGED THRU PARTICIPATION IN ADOPTION DECISION-MAKING, FIELD-TESTING
PROGRAM ATTRIB-UTES	MUTUAL ADAPT-ATION PARALLELED FLEXIBILITY OF PROGRAM	HATCHERY GENER-ATED STUDENT INTEREST, INVOLV-MENT, & CURIOSITY.	HATCHERY UNIQUE, INTERESTING, RELEVANT TO LOCAL RESOURCES	AIDED MUTUAL ADAPTATION, HELPED WITH TEACHER CONCERNS.
SCHOOL/ DISTRICT/ EXTERNAL FACTORS	TEACHER INVOLVE-MENT, COMMUNITY AWARENESS, MEDIA COVERAGE	POSITIVE REACTIONS TO PROGRAM FROM COMMUNITY RE-EMPHASIZED ITS VALUE	SIC HELD MEANING AND INTEREST FOR COMMUNITY AT LARGE	ENCOURAGED SOCIALIZATION, & LINKS BETWEEN SCHOOLS, DISTRICT COMMUNITY.
TEACHER CHARACT-ERISTICS	DISTRICT SUPPORT INFLUENCED TEACHER'S INITIAL REACTIONS TO SIC	STUDENTS' POSITIVE RESPONSE GAVE REWARDS & RECOG-NITION TO TEACHERS	PERSONAL INTEREST PROVIDED PRIMARY MOTIVATIONAL FORCE BEHIND SIC'S USE.	PROMOTED MUTUAL SALMON CULTURE AMONG USERS, & SHARED UNDER-STANDING OF SIC

REDISCOVERIES AND RECOMMENDATIONS

Instead of specific recommendations or formulas for how to best implement an innovation such as "Salmonids in the Classroom", I came away from this study with an array of learnings, garnered from my research, and from the literature on change. Interestingly, the influential strategies that were evident from this study correspond to many of the factors inherent in normative- reeducative change, as defined by Chin and Benne (1976). The authors describe these factors as: a focus on the individual in context, participation in change decisions, the influence of normative beliefs and attitudes, and the use of education, participation and communication to effect change. Thus, although they are not entirely unique discoveries to add to the many theories on how change occurs, I believe the following rediscoveries provide a better overview of implementation and offer more helpful insights than any step-by-step recipe for success.

I. It is essential to understand change as a process and not an event, and to examine it at all possible levels of a system. Environmental program developers and implementors must recognize the many complexities of, and subtle influences on, the change process, learn from past changes, and build on accomplishments in order to

increase the success of innovations. The ultimate goal of change strategies is to improve an organization's capacity to identify, evaluate, and implement appropriate innovations, thereby maintaining the organization's ability to survive.

II. It is essential to understand that context is central to the meaning and character of program implementation. There are unique social and cultural differences in each school, school district, and community, that interact with the structure and form of any innovation. The mutual adaptation process is an important and almost inevitable part of supplementary environmental program implementation, that serves to incorporate local contexts with users' own understandings of the innovation.

III. The teacher must be recognized as occupying the key position in the change process. Teachers are especially important with respect to implementing supplementary educational programs because they are the sole decision-makers as to whether or not to use these materials. In the midst of all the constant change on this planet, it seems many environmentalists have lost perspective on what change means, and what or who needs to change. Environmental program developers have followed the lead of many other educational innovators in solving problems: whenever another one occurs, the cure is to add something

more to the classroom. Few program developers seem to realize that change is only accomplished when the individuals who are to use the programs change. We have much to learn about teachers' perceptions, beliefs, needs, and concerns with respect to educational programs and their use, if environmental programs are ever to be successful purveyors of change.

IV. The importance of recognizing education and assistance in promoting the entire change process. Practical, good quality in-service and assistance aid program users in developing skills and knowledge, an individual understanding of program goals, and a shared awareness of what a new program will mean to their everyday teaching lives. If possible, developers and implementors of an innovation should provide practical, participatory, pre-implementation training taught by classroom teachers, as much assistance as possible during the early stages of program use, an on-going user support system, and rewards or recognition for success. As Huberman and Crandall (1983, p.76) state: "Innovations entailing significant practice change live and die by the amount of assistance they receive."

V. There is a need to promote communication, socialization, and cooperation between all those involved with an innovation. Change is a process where individuals alter

their ways of thinking and doing, primarily through discussion and socialization. Werner (1981) believes that facilitating conversation among participating groups is a major task in implementation. Communication about the change process is also necessary to monitor progress, successes, and problems. Finally, keeping the change process open and democratic ensures more long-term success than employing 'top-down', coercive change strategies.

VI. It is important to clarify and develop the role of district administrators in the change process. The role of the district has not been widely studied with respect to program implementation (Fullan, 1985). However, it is evident from this study at least that district support and advocacy for an environmental education program can play a large role in its successful use, at all levels of the change process. Huberman and Crandall (1983) make a strong case for keeping central office administrators involved in the change process.They even suggest providing a special mini-course on the administrative features of an innovation, and what it means for administrative support during implementation. The district's role in environmental program implementation merits further study, in order to increase the use of

these programs in schools, and adequately explore the process of change.

VII. It is essential to plan for the continuation and spread of an innovation. Successful implementation is not the end of the story. Good, implemented innovations should not disappear through neglect, or by accident. In the absence of specific measures to build in continuity and revitalization, environmental programs are too often the primary victims of budgetary cutbacks, stagnation, and attrition. If environmental education is to build a strong future, and produce long-term results, the often overlooked area of program continuation demands further attention.

VIII. It is necessary to appreciate that there are many different variations on the themes of change and implementation; there is no 'one way' to effect change. One can envision change occurring in a system in many ways: a wave of change forcibly sweeping over a system, a seed planted and well-tended, growing and dispersing other seeds of change to the larger environment, a slow, meticulous, spreading change, finding its way into the many cracks and fissures of a system like water passing through sand. I see change as a chemical reaction, that will occur in different environments under differing conditions. Some specific initiating catalysts and

conditions are critical for a chemical reaction to occur. However, just as different physical and chemical conditions and properties affect a chemical reaction, so do unique, local settings and conditions affect how change occurs. In every local situation, the environmental influences, external forces, and individual needs are different, and require different catalysts for the process of change to occur.

APPENDIXES

APPENDIX 1 : TEACHER INTERVIEW GUIDE

INTRODUCTION

I'm very interested in implementation, especially from the teacher's perspective, and am trying to investigate the teacher's role in the implementation process.
I really appreciate your time, and your willingness to help.
So many new programs and ideas get introduced into schools, yet we really don't know much about what happens to them after the first introductory workshop.

I'd like to go through your experience with SiC, and get an idea of some of the realities and problems that you've come across. Please feel free to expand on the questions I ask you, and digress a little with your answers. I want your opinions and experiences, without trying to fit them into any particular framework.

I've mentioned the matter of anonimity before, but I do want to assure you again about it. (show no names appear on paper)
I would like to hear your reactions to this interview, so anytime afterwards, please don't hesitate to tell me about any comments, additions, or changes you might want to make. Do you have any questions?

SECTION A THE ADOPTION PROCESS

The first general area I'd like to ask you about is implementation plans; - how the program was advertized, the workshop, and your initial reactions to SiC.

Lets go back to when you first heard about the program.

1. Do you remember when that was?

probes : -how did you first learn about it?

-formally? -Thru meetings? peers? bulletins?

-what was emphasized? - components? - benefits?

2. Did you abit attend a SiC workshop?

What were your general overall feelings about the workshop and the practical training you recieved?

probes: - specific demonstrations and "hands-on" activities presented ?

- was the training adequate to prepare you to use the program on your own?
- could workshop be improved at all? In what ways?

Lets be abit more specific about your initial reactions to the program itself. Think back to when you first had a look at SiC.

3. How did you honestly react to the notion of using it in your classroom? Initially, did you have any major concerns?

probes: - clearly connected vs. confusing?

- clear how to start vs. confusing, overwhelming?

- complex, many parts vs. simple & straightforward?

- flexibility? - teaching style?

4. Was there anything specific about the program that first attracted you to it?

probes: - activities? - objectives? - program materials?

Now, I'd like to focus on the time when you first began to use the program in any way in your classroom.

5. Talk abit about your first experiences with using SiC.

probes: - sections you used

-how well did each of these activities work out ?

-any serious problems with any of the activities?

-any help or advice that you needed during your first attempts at using SiC which you didn't get?

- Who should have provided it, in your opinion?

SECTION B PROGRAM ATTRIBUTES

Let's talk abit more about your continued use of the program.

6. Describe for me a typical SiC day or activity - what would I see if I visited your class ?

probes: -where do you include it in your curriculum?

- integrated it at all into your schedule?

- using the program now? How long have you used it for?

- activities that you never use? Any reasons for this?

7. Did you feel there was a need for a program like this? Why?/ Why not?

probes: - gaps in the prescribed curriculum?

-what parts seemed ready to use, things you thought would work out? - what parts seemed not worked out, not ready for use?

8. Overall, how do you find the program generally, with respect to your needs as a Gr.__ teacher?

probes: - guidelines for sequencing and lesson planning adequate? - need more? -less?

- materials of good quality? - complicated ?

-any difficulties making sense of the materials?

-understanding concepts?

9. Generally, have you had any difficulties or problems

in using SiC?

probes : time constraints of the prescribed curriculum?
- scheduling difficulties? - weakness of the program?
- are you concerned at all with overlap, ie repetition of materials or activities in later grades? (earlier?)
- how about preparation time? - was this a problem for you?

10. Did you make anx changes in the standard format of the program at all? Talk abit about the changes you made. probes : - what kinds of changes with things you thought might not work, - things you didn't like, - things you couldn't do in this school? - things dropped? - added? - created? - things revised? (are you considering making any changes?)

PHILOSOPHY & OBJECTIVES

We've been discussing the program itself, and its use in the classroom.
Lets turn for a moment now to the program's main objectives.

11. Briefly, in your own words, what do you feel the main purpose of SiC to be? - essentially, how do you see the program?

probes: - do you feel that the goals and objectives are clearly laid out? - unclear?

- reflected in the program activities?
- do they seem relevant and important to you?

Lets talk for a moment now about your students' reactions to SiC.

12. How do your students enjoy the program? - is it interesting to them?

probes : - valuable for them? - in what ways ?
- can all your students benefit from the program?
- does it meet their various problems, needs?
- any feedback from your students?
- seen any positive consequences for them?

We've been talking about the program's characteristics and your use of SiC. I'd like to ask you some questions now about your school and district, and look at how they might affect the program.

SECTION C SCHOOL/DISTRICT/EXTERNAL FACTORS

13. Lets concentrate on your principal for a moment. Is he/she supportive of your use of SiC? In what ways?

probes : - provide any active leadership & help?
- did your principal attend the workshop?
- how does she/he feel about other EE programs, or extra activities such as field trips, outdoor work, etc.? -opposed at all?
- is his/her support important to your use of SiC?

14. How about the other teachers in your school? Do any of them use SiC?

probes : - ever do activities together, exchange tips, ideas, problems?

Do you ever communicate with other program users?

- do you find it useful? (if no, do you feel that it would be useful?)

I'd like to talk abit more now about some other external factors, such as school resources, community involvement, and funding.

15. Are you aware of any involvement from parents or other community members with the Salmonid program ?

probes : - any parents help out with class activities

- eg. field trips, hatching eggs, etc.?

- any negative reactions from the parents at all?

16. Turning to the district, have they been involved at all in the support or funding of the program?

probes : - in what ways? -was lack of funding a problem?

SECTION D: TEACHER CHARACTERISTICS

Finally, now, I'd like to talk about your personal, specific views and opinions of SiC.

Student enjoyment and benefits can be a main factor in using supplementary programs. I'd like to talk for a moment about other incentives, such as personal recognition, or rewards for your involvement with SiC.

17. Have you ever recieved any recognition for using SiC, or for work you've done through the program, from let's say, the principal, parents, or other teachers?

18. Have you ever used any other EE programs? Tell me abit about your experiences with them.

probes : - did you find them helpful or useful?

-do you think that your experiences with them influenced your use of SiC?

19. I would like you to talk abit about your own beliefs about EE, and your personal feelings about the outdoors. Do you feel that they have affected your adoption and /or use of SiC? - in what ways?

20. Thinking back now over all the different factors, resources, and people that we have been talking about, such as the workshop, program's objectives, support, personal relevance, student interest, etc. - are there

one or two areas that stand out in your mind as being the most important in influencing your use of SiC?

21. Do you have any concerns or questions about the program that you would like to talk about?
Is there anything you would like to ask me?

Thank you again so much for your time and information today.

PERSONAL DATA SHEET

(completed by the teacher at the end of the interview)

1. How many years have you taught?

2. What grade are you teaching at present?

3. How many children are in your class?

4. How long have you taught at your present school?

5. Did you recieve any undergraduate training in environmental education? If yes, please provide some details.

Outdoor education?

Science education?

6. Have you had any other training or experience in environmental or outdoor education?

7. Do you belong to any environmental organization; for example, S.P E.C., the Sierra Club, Federation of Naturalists?

8. Do you, or have you ever used any other environmental education programs or materials? If so, please list them below.

APPENDIX 2 : INTERVIEW GUIDE: DISTRICT

INTRODUCTION

I'm very interested in implementation, especially from the teacher's perspective, and am trying to investigate the teacher's role in the implementation process. Virtually all of the teachers I talked to mentioned the importance of district support. I'd like to explore these district-level influences on implementation.

I really appreciate your time, and your willingness to help. So many new programs and ideas get introduced into schools, yet we really don't know much about what happens to them after the first introductory workshop.

I'd like to get your perspective of SiC, and talk about its adoption and implementation in the district. Please feel free to expand on the questions I ask you, and digress a little with your answers. I want your opinions and experiences, without trying to fit them into any particular framework.

I would like to hear your reactions to this interview, so anytime afterwards, please don't hesitate to tell me about any comments, additions, or changes you might want to make.

Do you have any questions??

SECTION A: ADOPTION PROCESS

The first general area I'd like to ask you about is how the district came to adopt the salmonid program.

Lets go back to when you first heard about the program.

1. Can you talk abit about the initiation of the program? Do you remember when that was?

probes : -how did you first learn about it?

2. Can you talk abit about the decision-making processes in terms of supplementary programs such as SiC?

probes: - were there any other programs (of any type) considered?

- some influencing factors for adoption?

3. Initially, did you have any major concerns about the program?

probes: - flexibility? - teaching style?

- complicated set-up?

4. Was there anything specific about the program that first attracted you to it?

probes: - did you feel there was a need for a program like this?

- gaps in the prescribed curriculum?

SECTION B: PROGRAM ATTRIBUTES

I'd like to know abit about the district's development of the program, and how applicable it is for your district's needs.

5. Can you talk abit about the sections or activities of the program that you focused on initially?

probes: - classroom hatchery a main emphasis. Talk abit about this activity.

- where do you see it included in the curriculum?

6. Did you make any changes in the standard format of the program at all? Talk abit about the changes you made.

probes : - specific ommisions ? - reasons?

- things you promoted? (eg., Stream Study booklet, art extension booklet)

7. Overall, do you believe the program meets the needs of the teachers in your district?

probes: - applicable to your district?

- materials of good quality? - complicated?

- relevant?

PHILOSOPHY & OBJECTIVES

We've been discussing the program itself, and its use in the classroom. Let's turn for a moment now to the program's main objectives.

8. Briefly, in your own words, what do you feel the main purpose of SiC to be? - essentially, how do you see the program?

probes: - do you feel that the goals and objectives are clearly laid out? - unclear?

- do they seem relevant and important to you?

IMPLEMENTATION STRATEGIES

I'd like to discuss the implementation process now - how the program was advertized, and supported.

9. What were some of the ways that you introduced the program to teachers?

probes: - inservice workshops?

- meetings? -bulletins?

- teacher involvement in planning?

10. Tell me abit more about the inservice workshops. Who put them on?

probes: - any consultants from fisheries?

- materials for in-class hatchery provided?

11. To what extent did you involve school principals?
probes? - meetings? - encouraged to attend workshops?
- information provided? - is their support important?

12. There has also been some involvement with outside organizations, such as The Vancouver Sun, and the Coho Salmon Festival. Can you elaborate on these connections?
probes: - media involvement important? - encouraged?
- higher profile of program beneficial?

13. The logistics of a program such as SiC are fairly considerable, with eggs to deliver, materials to supply, and potential technical as well as lesson-related problems to solve. Can you tell me abit about how you overcame some of these difficulties?
probes: - when was resource teacher network established? - how?
- any communication system between users?
- newsletters? - meetings?
- feedback to district from contact teachers?
- was money a problem? - any fund-raising?

14. Generally, what do you see as some of the problems and setbacks with implementing a supplementary program such as SiC ?
probes : - logistics? - funding? - teacher prep time?

SECTION C: SCHOOL/ DISTRICT/ EXTERNAL FACTORS

Lets talk for a moment now about the teachers' reactions to SiC.

15. What kind of feedback do you get from teachers using the program? probes : - easy to use? - valuable for the students?

16. Does the district provide any type of recognition or rewards for using SiC? - in what way?

I'd like to ask you now about some external factors, such as Dept of Fisheries, the school board, and community involvement.

17. What role did Fisheries play in establishing the program in N. Van.?

probes: - community advisors helpful?
- still maintain contact with them?
- does fisheries provide any incentives?

18. Are you aware of any involvement from parents or other community members with the Salmonid program ?

probes : - any parents help out with class activities
- any negative reactions from the parents at all?
- communication with the community ?

19. Turning to the school board, is your board aware of the program?

probes: - supportive? eg. money to purchase it, aquire aquariums, eggs, go on field trips?

- communicate events to the board?

SECTION D PERSONAL CHARACTERISTICS

Finally, now, I'd like to talk about your personal, specific views of the salmonid program.

20. Have you or the district in general ever endorsed any other EE programs? Tell me abit about your experiences with them.

probes : - Outdoor School is a major facility, is it influential?

- other programs successful?

21. Concerning you personally, have you recieved any training in EE or Outdoor Ed.?

- belong to any environmental organizations, such as the Sierra Club, S.P.E.C., etc.?

- hobbies pertaining to the outdoors?

22. I would like you to think for a moment now about your own beliefs about EE, and your personal feelings about the outdoors. Do you feel that they have affected your adoption of SiC? - in what ways?

23. Thinking back now over all the different factors, resources, and people that we have been talking about, such as the program's objectives, its personal relevance, value to students, etc.- are there one or two areas that stand out in your mind as being the most important in influencing your support of SiC?

24. Do you have any concerns or questions about the program that you would like to talk about?
Is there anything you would like to ask me?

Thank you again so much for your time and information today.

APPENDIX 3

DESCRIPTIVE CODES USED IN THE ANALYSIS OF TEACHER AND DISTRICT INTERVIEWS: DEFINITIONS

The descriptive codes are presented in relation to the teacher interview questions, within the framework of the four research themes of the study.

A/ THE ADOPTION PROCESS

1. DSTINFO = district information
   DST WSHOP = district workshop

   WSHOP = workshop
   OSCH = Outdoor School
   PRNPAL = principal

2. WSHOP UFUL = workshop was useful
   WSHOP NUFUL = workshop not useful
   ? = why?
   PRACT = it was practical
   H-ON = it was hands-on
   TCHRUN = it was run by teachers
   MAT = materials were provided
   LES IDEAS = lesson ideas

3. R-USE(+) = first reaction to program use was positive.

   R-USE(-) = first reaction to program use was negative.

4. R-CRNS = first concerns?
   HATC = hatchery
   AMT MAT = amount of material
   L EXP = lack of experience

5. ATR? = what first attracted you to program?
   HATC = hatchery
   AVAL = availability
   HELP = help and support available
   HI PROF = high profile of program
   KID VAL = value to kids

6. HELP- WHO? = who was available to provide support at first?
   CA'S = community advisors (DFO)
   RTCH = resource teachers
   DST SUP = district support

B/ PROGRAM ATTRIBUTES

1. (+) USE = sections of the program you used
   (-) USE = sections you didn't use

BIO = biology
LCy = life cycle
OBS = observation of hatchery
ANAT = anatomy
ART = art activities
PUZZ = puzzles, word searches
LA = language arts

PICS = pictures, transparencies
FILMS = films
P+P = pencil & paper activities
MATH = mathematics activities

SAS = student activity sheets
FISHMETH = fishing methods section
DEFN = definitions
HIST = history

BIND = binder
PROD = production section

2. WHR? = where do you use the program (what subject areas?)
Sc = science
LA = language arts
ART (AR) = art

3. NEED? = did you see a need for the program?
Y = yes
N = no
ENV = environmental aspects
CONSV = conservation aspects
H-ON = hands-on activites
OSCH = outdoor school connections

4. K-NEEDS? = does the program meet all your kid's needs?

5. FLEX-? = is the program flexible?
SEQ UFUL? = is the sequencing provided useful?
QUAL? = are the program materials of good quality?

6. PBLM- TiCo = have you had problems with time constraints?
PBLM-PrepT = problems with preparation time?
PBLM-OLAP = problems with overlap?
PBLM-Term = problems with terminology?
PBLM-OTHER = other problems?
AMT MAT = amount of material
DIFF MAT = students had difficulty with the material
FISH DISS = hard to get fish for dissection
content boring = found materials to be boring

7. GOAL CL = the program's goals are clear.
GOAL NCL = the program's goals are not clear

8. KIDS (+) = the kids enjoyed and benefited from the program
(-) = the kids do not enjoy the program
AL KIDS? = can all your kids benefit from the program?
VAL KIDS? = is the program of value to kids?

9. ADAPTATIONS
   CHNG = what changes did you make to the program?
   ADD? = what did you add? OMIT? = what did you omit?

C/ SCHOOL /DISTRICT /EXTERNAL FACTORS

1. PRNPAL SUP = the principal was supportive
   PRNPAL INV = the principal was involved
         NSUP = not supportive
         NINV = not involved

2. TCH USE = other teachers in the school used the program
   COMMCATION = we communicated about the program
   UFUL = this communication was useful

3. PRNTS INV = parents were involved with the program
   PRNTS SUP = parents were supportive
        NINV = not involved
        NSUP = not supportive

4. OTH INF = other influences on program use
   SUN = The Vancouver Sun
   JAPAN = Japan exchange program
   OSCH = Outdoor School
   DFO = Dept. of Fisheries and Oceans

5. DST SUP = the district was supportive
   MAT = materials were provided
   $ = funding was provided
   RTCH = resource teachers were provided
   WSHOP = workshops were provided

D/ TEACHER CHARACTERISTICS

1. RCOG = recognition for doing the program
   DST = from the district
   KIDS = from the kids (students)
   XPRT = expert; recognition from being seen as a program expert, giving workshops, acting as resource teachers.
   SUCCESS = from the success of the program

2. EE USE? = other EE programs used before?
   ENCORE = "ENCORE", a B.C. env. ed.program
   PLT = "Project Learning Tree"
   Aquatic Bio. = water and aquatic studies
   VEEP = "Vancouver Environmental Education

Project"
SPEC = "Society for the Promotion of Environmental Concerns" - materials they have produced
OSCH = North Vancouver Outdoor School Programs
EE, Sc EXP? = previous EE, Science Ed. experience?
INFL? = were these programs influential in use of SiC?

3. PRS INT = personal interest
OUTDRS = outdoors
CONSV = conservation
EE = environmental education
ENVIR = environmental concerns
MARINE ENV.= marine environment

4. MINFL? = main influences for using program?
KID VAL = value to kids
KID INT = student interest
AVAL = availability of the program
SUP = available support and help

APPENDIX 4 : A / THE ADOPTION PROCESS

TEACHERS	FIRST HEARD HOW ?	REACTIONS TO WSHOP?	FIRST REACTIONS	FIRST CONCERNS?	ATTRACTION ?	HELP FROM WHO?
tch1	DST	UFUL PRACT	(+) HELP	HATCH	HATCH, AVAL,HELP	RTCH CA'S
tch2	DST	UFUL PRACT	(+) CONF,HELP	HATCH	HATCH, AVAL,HELP	RTCH, CA'S
tch3	TCH	UFUL PRACT	(+) HELP	HATCH	HATCH, AVAL,HELP	RTCH, CA'S
tch4	TCH	UFUL PRACT	(+) H-ON	HATCH	HATCH, AVAL,HELP	RTCH
tch5	DST	UFUL PRACT	(+) H-ON	HATCH, AMT MAT	HATCH, AVAL,HELP	RTCH
tch6	DST	UFUL PRACT	(+) SKILLS	HATCH, AMT MAT	HATCH, KID VALU	CA'S
tch7	PRNPAL	UFUL PRACT	(-) LACK EXP.	HATCH	HATCH, HELP	RTCH
tch8	TCH	UFUL PRACT	(+) HELP	HATCH, AMT MAT	HATCH HELP,AVAL	RTCH
tch9	TCH	UFUL PRACT	(+) H-ON	HATCH	HATCH AVAL	RTCH
tch10	DST	UFUL PRACT	(-) LACK EXP.	HATCH, AMT MAT	HATCH HELP	RTCH
tch11	PRNPAL	DID NOT ATTEND	(+) HELP	HATCH	HATCH, HELP,AVAL	PRNPAL, RTCH
tch12	DFO	UFUL PRACT	(+) SKILLS	HATCH	HATCH, AVAL	RTCH
tch13	TCH	UFUL PRACT	(+) H-ON	HATCH	HATCH	RTCH
tch14	DST	UFUL PRACT	(-) LACK EXP.	HATCH	HATCH, AVAL	RTCH

APPENDIX 4 : B/ : PROGRAM ATTRIBUTES : (1)

TEACHERS	SECTIONS USED	SECTIONS NOT USED	WHR USED	NEED FOR SIC?	FLEX ?	SEQ UFUL	QUAL ?
TCH1	BIO,. LCY, OBS	LA, p+p, puzzles	Sc	Yes, H-on	Y	N	OK
TCH2	BIO, OBS	p+p	Sc	Yes, H-on, OSch	Y	N	Y
TCH3	OBS, BIO, LCY, ANAT	p+p, math	Sc, Art	Yes, H-on	Y	N	OK
TCH4	BIO, OBS	math, LA, p+p	Sc	Yes, H-on	Y	N	Y
TCH5	OBS, BIO, LCY, FILMS	p+p, sas	Sc	Yes, H-on	Y	N	Y
TCH6	BIO, LCY, OBS	binder, p+p, sas	Sc, LA,Ar	Yes, H-on, Env	Y	N	OK
TCH7	BIO, LCY, OBS	sas, p+p	Sc, LA	Yes, H-on, OSch	Y	N	Y
TCH8	OBS, BIO, LCY	sas, p+p, dfn., lists	Sc	Yes, H-on	Y	N	OK
TCH9	OBS, BIO, LCY	p+p, sas	Sc	Yes, H-on	Y	Y	OK
TCH10	BIO, LCY, OBS, ANAT, SPECIES	p+p, math, LA	Sc	Yes, Env	Y	Y	OK
TCH11	BIO, LCY, FILMS, SPECIES, OBS	binder, p+p	Sc	Yes, Env	Y	N	Y
TCH12	BIO, LCY ANAT, OBS	binder, p+p	Sc	Yes, Env, H-on	Y	N	N
TCH13	LCY, OBS, FILMS	binder, p+p	Sc	Yes, H-on	Y	N	Y
TCH14	OBS, FILMS, LCY	binder, p+p	Sc, LA	Yes, Env	Y	N	OK

APPENDIX 4 : B/ ; PROGRAM ATTRIBUTES :(2)

TEACHERS	PROBLEMS				OTHER	GOALS CLEAR?NC?	VALU FOR STUDENTS	ADAPTATIONS MADE
	Time Const	Prep Time	Over lap	Trm ology				
TCH1	N	Y	N	Y		NCL	(+)	st. study, inc. trough. ecology
TCH2	Y	Y	Y	N	No fish for diss	CL	(+)	st. study, ecology
TCH3	N	Y	N	N		NCL	(+)	art, cr.writing, st. study, diary
TCH4	N	Y	N	N	Diff.mat boring	NCL	(+)	diary, st. study, computers
TCH5	N	Y	Y	Y	No fish diff.mat	NCL	(+)	ecology, st.study res. mgmt
TCH6	Y	Y	N	N	amount. of mat	NCL	(+)	st. study, ecology poetry, art, cr.wr
TCH7	N	Y	Y	N	amount. of mat	NCL	(+)	poetry, ecology, st. study, cr.wr.
TCH8	N	Y	N	Y	amt. mat	CL	(+)	diary
TCH9	N	Y	N	Y	no fish diff mat	NCL	(+)	ecology, st.study diss., biology
TCH10	N	Y	Y	N		CL	(+)	st.study, ecology art, cr.writing
TCH11	N	Y	N	N	amount. of mat.	NCL	(+)	st.study, art
TCH12	N	Y	N	N	no fish diss.	CL	(+)	diary, art, diss.
TCH13	N	Y	Y	N	content boring	CL	(+)	diss., history, st.study, art
TCH14	Y	Y	N	N	amount of mat.	NCL	(+)	cr.writing, art, st.study

APPENDIX 4 : C / SCHOOL / DISTRICT / EXTERNAL FACTORS

TEACHERS	PRINCIPAL SUPPORTIVE? INVOLVED?	COMMUNICATION W/OTHER USERS *	PARENTS INV? SUPPORTIVE?	OTHER INFLUENCES	DISTRICT SUPPORTIVE?**
TCH1	SUP NINV	COMMCATION UFUL	NINV SUP	SUN JAPAN, DFO	DST SUP RTCH, MAT, $
TCH2	SUP INV	COMMCATION UFUL	NINV SUP		DST SUP RTCH, MAT,RCOG
TCH3	SUP INV	COMMCATION UFUL	NINV SUP	JAPAN	DST SUP RTCH
TCH4	SUP NINV	COMMCATION UFUL	NINV SUP	OSCH	DST SUP RTCH, WSHOP
TCH5	SUP INV	COMMCATION UFUL	NINV SUP	SUN, OSCH JAPAN	DST SUP RTCH, WSHOP
TCH6	SUP NINV	COMMCATION UFUL	NINV SUP	SUN	DST SUP, WSHOP, RTCH, MAT, $
TCH7	SUP NINV	COMMCATION UFUL	NINV SUP		DST SUP, WSHOP RTCH, MAT
TCH8	SUP NINV	COMMCATION UFUL	NINV SUP	OSCH	DST SUP RTCH
TCH9	SUP NINV	COMMCATION UFUL	NINV SUP		DST SUP RTCH, MAT
TCH10	SUP NINV	COMMCATION UFUL	INV SUP	JAPAN OSCH	DST SUP RTCH, MAT
TCH11	SUP INV	COMMCATION UFUL	NINV SUP	OSCH	DST SUP RTCH, MAT
TCH12	SUP NINV	COMMCATION UFUL	NINV SUP	OSCH	DST SUP RTCH, MAT, $
TCH13	NSUP NINV	COMMCATION UFUL	NINV SUP	DFO, SUN	DST SUP RTCH, $
TCH14	SUP NINV	COMMCATION UFUL	NINV SUP	DFO, SUN	DST SUP RTCH, MAT

*SEE TABLE 3

** SEE TABLE 4

APPENDIX 4 : D / TEACHER CHARACTERISTICS

teachers	Recognition: Using SIC	EE, Sc.Ed. Experience?	Other EE Programs?	PERSONAL INTERESTS	YRS/ SIC	yrs/ tchg	GR.	kids/ class
TCH1(M)	KIDS, XPERT	NO	NO	OUTDRS, CNSV, FISHING	5 R*	7	7	34
TCH2(M)	KIDS	NO	OSCH	OUTDRS, E E	3	8	5-6	34
TCH3(F)	KIDS	NO	OSCH	OUTDRS CONSERVATION	3	17	3-4	30
TCH4(F)	KIDS, SUCCESS	NO	OSCH	OUTDRS CONSERVATION	1	17	2-3	29
TCH5(M)	KIDS	Sc Ed	Marine Education	ENVIRONMENT, CONSERVATION	5	7	7	30
TCH6(M)	KIDS, XPERT	Sc Ed	Encore, PLT AquaticBio.	OUTDRS, CONSV AQUARIUMS	6 R*	9	6-7	30
TCH7(M)	KIDS	Sc Ed	VEEP, SPEC Encore	OUTDRS, CONSERVATION	5	16	6-7	30
TCH8(M)	KIDS, SUCCESS	NO	NO	OUTDRS, FISHING	1	14	5	31
TCH9(M)	KIDS	EE Minor	Marine Education	OUTDRS, MARINE ENV.	3	4	6	23
TCH10(M)	KIDS, XPERT	BSc Biology	OSCH	OUTDRS, MARINE ENV.	6 R*	17	3	21
TCH11(F)	KIDS, SUCCESS	Sc Ed	VEEP	OUTDRS, Sc. ED	5	12	7	36
TCH12(M)	KIDS, XPERT	BSc. Biology	Marine Ed. Ecology	OUTDRS, CONSV ENVIR.	6 R*	20	6	31
TCH13(M)	KIDS	Sc Ed	NO	OUTDRS, CONSERVATION	3	14	6	31
TCH14(F)	KIDS	Sc Ed	PLT, OSCH	OUTDRS, CONSERVATION	5	35	1	26

M =MALE, F=FEMALE

R* DENOTES PROGRAM RESOURCE TEACHER

NORTH VANCOUVER SCHOOL DISTRICT

School District No. 44 (North Vancouver)

SETTING UP A CLASSROOM FISH HATCHERY

The Aquarium:

- As large as possible (33 U.S. gal.).
- Locate in dark, quiet area of room, near a tap and sink on a strong table.
- Clean glass sides and bottom with dry steel wool (steel wool without soap) then rinse out with water.
- Put in undergravel filter and air bubble riser tubes (locate tubes at front of tank).
- Wash gravel in a clean plastic flower pot and put a 3 inch layer in the aquarium on top of the undergravel filter.
- Secure an accurate celsius thermometer to the front of the glass inside the aquarium (can be stuck into the gravel).

The Cooling System: (Water temperature must be kept below 17° C)

- Mount large plastic tubing on plastic grid squares with plastic straps (make sure the tubing does not kink at the bends), cut off excess plastic strap ends with cutting pliers. Leave enough plastic tubing on either end of your cooling coil to reach from the water faucet to the tank and from the tank to your sink drain (this length depends on the location of your tank).
- Remove the filter screen assembly from the end of your classroom water faucet and screw on the tapered plastic tubing attachment.
- Put cooling coil into the aquarium and lean it against the back glass wall.
- Push the cooling coil plastic tubing (intake end) onto the tapered water faucet attachment firmly.
- Place the cooling coil plastic tubing (outlet end) in the sink drain and turn the tap on to test the cooling system. If water is not running through the tubing and into the sink then one of the bends in the cooling coil must be kinked.
- To fill the tank turn on the tap so that the water runs through the cooling coil (direct the outlet end of the tubing into the aquarium until the aquarium is filled to the desired height - about 2 inches from the top).

721 Chesterfield Avenue, North Vancouver, B.C. V7M 2M5 Telephone (604) 987-8141

The Cooling System (continued)

- Now take the outlet end of the plastic tubing out of the aquarium and put it in the sink to drain the cooling coil water runoff (secure this tubing to the water faucet with a plastic strap so that it does not fall out of the sink).
- Turn the tap on and let the water continue to flow through the cooling coil for the duration of your project (the temperature of the water in the aquarium can be raised or lowered by adjusting the water flow with the tap). Try to maintain the water at about 12^{o} C - it must never rise above 17^{o} C or the fish will die.

Finishing Touches:

- Tape black paper to the back and two sides of the aquarium to prevent the growth of algae.
- Cut a piece of black card to fit over the top of the aquarium. Laminate this piece of card to make it waterproof. Secure it to the top of the aquarium with a long strip of tape along the back side to form a hinge.
- After tank has been filled with water locate the air pump in a spot that is higher than the water level in the tank.
  . The air pump is located higher than the water level in the aquarium as a safety measure. If it was mounted lower than the water level and a power failure occurred the pump and its connecting airlines could act as a syphon and drain the water from the aquarium all over the floor.
- When the pump is located connect the air tubing from the pump to the bubble riser tubes then plug in the pump.
- Let the aquarium operate for 3 days to get rid of the chlorine in the water and adjust the temperature to the desired range before fish eggs are added.
- Check the pH (measure of acidity and alkalinity of the water) with litmus paper strips. It should be maintained around the neutral range 7.0. If the water starts to become acid (ex. values of 6.8 and lower) dissolve half of a teaspoon full of baking soda in water and pour into the aquarium. Do this every day (only once a day) until it reaches the neutral range again.
- You are now ready to add the fish eggs. When they are added they drop down into the gravel so make sure some are sprinkled near the front glass so that they are easily observed.

When the Eggs Hatch: (about 3 weeks to 5 weeks after put into tank)

- The length of time it takes the eggs to hatch is tied to the water temperature in the aquarium - the colder the water the longer the hatching time, the warmer the water the sooner the eggs hatch. The colder the water the better for the developing eggs, the fish have a longer period of time in the egg stage and hatch as healthier fish.
- When the eggs do hatch the fish stay in the gravel until they consume their egg sack (about 1 to 2 weeks). Do not feed the fish until their egg sacks are consumed.

Setting Up a Classroom Fish Hatchery

When the Eggs Hatch (continued)

- When the egg sacks are consumed the fish will come out of the gravel - this is the time to start feeding in very small amounts three times a day (morning, noon, after school). Feed tropical fish food (freeze dried brine shrimp or shrimp flakes). Grind between fingers and sprinkle on top of water in very small amounts.
- The food which is not eaten will settle to the bottom of the aquarium, rot and cause bacteria growth. Keep the aquarium as cold as possible once you start feeding the fish until they are released in the stream. This will slow down the bacteria growth.
- When the fish have hatched and been feeding vigorously for 2 to 3 weeks they can be released into a stream. The aquarium will support about 250 fry. The longer the fish are kept at this stage the greater the danger of death caused by bacteria.
- When the eggs start to hatch a white foam will appear on the water surface. This foam is protein which is released into the water from the egg case. This foam must be skimmed off several times a day. I use a large fish net filled with cotton batten to do this. The cotton batten can be rinsed out and used again. This protein build-up also causes the pH to lower (become acid) so it will have to be watched carefully and have the baking soda added daily during this period.

Letting the Fish Go In the Stream:

- Prepare several plastic ice-cream buckets lined with plastic bags and fill half full with water from the aquarium.
- Use a large fish net to catch the fish, put about 20 or less into each prepared bucket. Seal the plastic bags with a twist tie and leave an air space at the top of the water. Keep the prepared buckets as cool as possible while waiting to transport them to the stream (ex. place outside in the shade).
- When you arrive at the stream take the bag of fish and water out of the bucket and set in the stream water for about 5 to 10 minutes so the water in the bag becomes the same temperature as the stream.
- Open the bag and let some stream water enter. Let the fish swim out of the bag into the stream.

Good Luck!

p.s. If you have questions while your salmonid project is underway, please phone:

Ian McWilliams
Blueridge School 929-1295

For classroom materials, posters and information write to:

Information Branch,
Fisheries and Oceans Canada (Pacific),
1090 West Pender Street,
Vancouver, B.C.
V6E 2P1

SALMON ENHANCEMENT FILMS AND VIDEO TAPES

FILMS

(1)	574 MP 013	New Channels for Sockeye	20 min. INT.
(2)	639 MP 003	Salmon's Struggle for Survival	26 min. INT.
(3)	639 MP 010	To Catch a Trout	10 min. INT.
(4)	639 MP 011	Capilano Salmon Hatchery	8 min. INT.
(5)	639 MP 009	B-License	10 min. INT.
(6)	597 MP 003	Tomorrow's Salmon	25 min. PR.-INT.
(7)	597 MP 004	Life of Sockeye Salmon	25 min. INT.
(8)	597 MP 006	The Tragedy of the Red Salmon	24 min. PR.-INT.
(9)	597 MP 008	Birth of a Salmon	5 min. INT.
(10)	597 MP 009	Atlantic Salmon	27 min. INT.
(11)	597 MP 007	The Fish in a Changing Environment	11 min. INT.

VIDEO TAPES

(1)	VLS-76	Estuary	30 min. INT.
(2)	VLS-167	Kokanee of Meadow Creek	13 min. INT.
(3)	VLS-75	Salmon Rivers	30 min. INT.
(4)	VLS-67c	Secret Life of a Trout River	10 min. INT.
(5)	VLS-149	Steelhead	30 min. INT.
(6)	VLS-150	Strait of Georgia	30 min. INT.

FOOTNOTES

1. Oppenheimer, Robert. (1955). Prospects in the Arts and Sciences. Perspectives USA, 2, 10-11.

2. This definition has been adapted from definitions found in two sources : (a) Miller, G. T. (1979). Living in the Environment. Belmont, CA: Wadsworth., and (b) Environment Council of Alberta. Environmental Education : Government Services for Teachers & Leaders. Edmonton, Alberta.

3. Normative-re-educative change, as defined by Chin and Benne (1976, p. 23) : "..normative re-educative strategies...build upon assumptions ...that change will only occur as the persons involved are brought to change their normative orientations to old patterns and develop commitments to new ones."

4. Environmental education definition: adapted from Volk, Hungerford, & Tomera, (1984).

5. Carol Smithson, Faculty of Education, Graduate Studies, Simon Fraser University, Burnaby, B.C. V5A 1S6 Carol acted as an external audit, randomly checking the data as well as the study's coding and analysis procedures to ensure reliability and validity.

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