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A PATH ANALYSIS OF THE DIFFUSION OF THE MICHIGAN MODEL FOR COMPREHENSIVE SCHOOL HEALTH EDUCATION

By

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ABSTRACT

A PATH ANALYSIS OF THE DIFFUSION OF THE MICHIGAN MODEL FOR COMPREHENSIVE SCHOOL HEALTH EDUCATION

By

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The central problem addressed in this thesis concerns the need to develop and evaluate effective methods that encourage schools to use comprehensive health education programs. This research is an application of a Message Learning Theory of Persuasion in causal (path) analysis to evaluate the diffusion processes of the Michigan Model for Comprehensive School Health Education (MMCSHE). Analysis is based on a sample of 184 State of Michigan school district Superintendants.

The analysis identifies key message content and arguments, which are integral to an adoption decision, including knowledge of teacher training, of evidence of effectiveness and of multiple grade levels. It provides insight into the information needs and the underlying priorities of the school district in this regard.

The analysis is focused on the effectiveness of various alternative message sources in conveying the key arguments. Adoption of MMCSHE was determined indirectly through the workshops and the face to face contacts with administrators, resource persons and consultants. The type of school district,

public or private, was found to be a determining context.

Thus, this research provides an assessment of the impact of alternative dissemination strategies, which in course would enable management of MMCSHE to improve decisions regarding channel strategy, message content, and message sources etc..

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INTRODUCTION

The central problem addressed in this thesis concerns the reality that no matter how effective a health promotion program is, its potential value to society is not realized if it does not reach those who would benefit from it. For instance, many effective school health promotion programs have been developed but in reality few have been adopted and implemented. There is need to develop and evaluate effective methods that encourage schools to use comprehensive health education programs (Parcel, 1989, p. 1).

This paper is an application of the message learning theory of communication (McGuire, 1977) and the innovation decision process model of diffusion (Rogers, 1983) in a causal analysis to model the diffusion / dissemination process of the Michigan Model for Comprehensive School Health Education (MMCSHE).

STUDYING THE DIFFUSION OF HEALTH PROMOTION PROGRAMS

Briefly, the study of the diffusion of health promotion programs is in the very early stages of development. Though several review articles present possible theoretical bases and variables through which to study diffusion of health promotion programs (Parcel, 1986, Parcel et al, 1989, Basch, 1984), there has been very little research. Thus, the

theoretical and methodological structure that evolves from valid research is not available to the practitioner, the academic or the researcher (Parcel, 1986, p. 41 and Portnoy, 1989, p. 63).

Further, the overarching diffusion research base has serious flaws. These research designs have focused primarilly on the person level of analysis, which has neglected diffusion to organizations (Basch et al, 1986, p. 16). The research designs have also tended to be cross sectional surveys which has posed problems for studying the change process over time and for drawing causal inferences (Portnoy, 1986, p. 9). And results of diffusion research reflect the validity problems associated with a lack of statistical power, violations of statistical assumptions, and small samples (Portnoy, 1989, p. 67).

Thus, as Basch proposes,

> 'in order to improve the dissemination and implementation of health education programs in schools, research must: (1) develop concepts and methods by which to study variables of interest, (2) develop valid means to measure program dissemination and implementation, (3) identify and measure key factors that facilitate and hinder dissemination and implementation, (4) develop effective health education programs that are also feasible to disseminate and implement, and (5) compare the efficacy and efficiency of various mechanisms for disseminating effective school health education programs' (Basch, 1984, p. 67).

INTENTIONS OF ANALYSIS

The research and analysis in this paper contributes to the evolving body of knowledge of the diffusion of comprehensive health education curricula, of the persuasion

theory underlying its dissemination, and of the organizational decision making context of its adoption. Results of analysis have implications for the management of health promotion programs and MMCSHE.

The paper is an application of theory based analysis in a diffusion study. It poses a Message Learning Theory of Persuasion applied in causal / path analysis to model the diffusion processes of the Michigan Model for Comprehensive School Health Education (MMCSHE). This application provides a framework usefull in understanding the flow of the diffusion / dissemination processes and the interactions of relevant parameters.

The analysis identifies the key message arguments, which led to an adoption decision. It provides insight into the information needs, the underlying priorities and the heuristic decision rules of the school district in this regard. The analysis is also focused on the effectiveness of various alternative message sources in conveying the key messages. Thus, the modeling identifies barriers and facilitators to effective dissemination, and provides an evaluation of the impact of alternative dissemination strategies.

By utilizing causal / path analysis, this research moves beyond descriptive analysis, allowing a researcher to address why (cause) questions, and to model the complex interactions (direct and indirect effects) between

theoretical constructs. In course, this research provides a framework that would enable a researcher to generate hypotheses, predict outcomes, test propositions and to build models regarding the diffusion of comprehensive health education curricula.

The analysis moves beyond the person focused limits of previous research, in that the school district organization is the unit of analysis. It is a scale (state wide) project, from a large sample (184 school districts), and has an adequate statistical power. And it is based on a sample of the Superintendants of schools (Chief School Officer), who are key decision makers in an adoption process and key persons to persuade in gaining access to a school district.

The results of analysis would enable management to improve decisions regarding channel strategy, message content, message sources and staffing etc.. Thus, it allows more effective allocation of the limited resources in time, money and staff and an improved diffusion system.

ORDER OF PRESENTATION

This paper is organized in logical sequence, introduction, intentions of analysis, literature review, procedures, analysis and interpretation, limitations and conclusions and an appendix. The next section presents an overview of the Michigan Model for Comprehensive Health Education and its diffusion / dissemination system. This is followed by a review of the theoretical background and

supporting literature in diffusion of innovations, dissemination systems planning, diffusion of health education promotion programs, and Message Learning Theory. The procedures section describes the relevant research process, the sample, the variables and data analysis methods. The analysis and interpretation section begins with a brief discussion of modeling the diffusion of health education curricula and an explanation of the path model, its rationale and hypotheses. Then the findings are presented, including the key message arguments, the key message sources and the key contextual determinants of the diffusion / dissemination of MMCSHE. This is followed by the limitations and the conclusions. The appendix includes an outline of the underlying assumptions to path analysis and tests of the data about the assumptions.

MICHIGAN MODEL FOR COMPREHENSIVE SCHOOL HEALTH EDUCATION

The Michigan Model for Comprehensive Health Education (MMCSHE) is intended to have an impact on health related attitudes, behaviors and life styles which in turn would have favorable influence on societal health. MMCSHE is an educational innovation in the sense that it is a new policy, process or organizational practice. It is a curriculum innovation, which would be new to the classroom, to the school and to the school district (Iverson et al, 1981, p. 60).

The MMCSHE is administered through a state interagency

steering committee which has representatives from: the Department of Education, Department of Mental Health, Department of Social Services, Department of State Police, and the Offices of Health and Medical Affairs and Substance Abuse Services.

There are 26 regional education centers (RECs) in the state. Each region hires the Michigan Model coordinator who becomes a liason between the classroom teacher, the local school district, the community resource agencies and the state lead agency (Department of Education). Each region has a steering committee which has representatives from similar agencies as those on the state steering committee. It may include other representatives. This regional steering committee assists the program in connection to local resources and in public relations.

The coordinators administer the inservice training program. MMCSHE is a new and a material intensive curriculum, and training is necessary for effective implementation. The materials include books, films, film strips, audio and video tapes, models of major body organ systems and there are many hands on activities.

Implementation began in 1984, with the elementary levels. To date, more than 90% of the Michigan public school districts have made a committment to adopt. There have been more than 25,000 teachers trained, there are more than 800,000 students currently enrolled, and it is the largest

school health program in the U.S.A..

COST STRUCTURE

The MMCSHE is subsidized by the federal government, the state government and local community organizations. Most federal funding is through the Drug Free Schools and Communities Act of 1986. State funding is provided through the State School Aid Act and the Departments of Public Health and the Department of Highway Safety. The funding for the Michigan Model is summarized in Table 1.

Each of the 26 regions are eligible to request at least $60,000 in grants for coordinator support and services, teacher inservice training and classroom materials. Additional funds are available to regions with more school districts and larger student populations.

MMCSHE requires a minimum 20% committment from the ISD. Some ISDs receive grants from community organizations and agencies to cover the minimum. This local matching can be in kind services. The cost of materials (books, video tapes, etc.) for the K-8 curriculum is approximately $8,000 (1991). Planning and sequencing allows Schools within districts to share materials.

MMCSHE was not an affordable alternative to most private schools until the federal Drug Free Schools legislation became law. This legislation contained provisions that would override the restrictions on public subsidies to private school districts.

Table 1

Funding of the Michigan Model *

source:		1985	1986	1987	1988	1989	1990	1991
Public Health	**	1000	1000	307	305	305	205	205
Mental Health		200	200					
Highway Safety		50	50	50	50	50	50	50
School Aid				1888	1888	1888	1888	1888
Local Match		200	200	378	378	378	378	378
Federal (Local dist)					3106	3476	5381	8487
Federal (State/MDE)					433	514	749	1257
Totals		1450	1450	2625	6160	6611	8651	12265

* Source: Michigan Model For Comprehensive School Health Education Implementation Plan FY 90.
** All figures are in thousands.

The diffusion strategy of MMCSHE took advantage of the state public education organization which includes the 26 regional education centers (REC) and the intermediate school districts (ISD). The regional coordinators are liason / manager to the region in dissemination through implementation processes, including the training of teachers. The dissemination of MMCSHE made use of media alternatives: brochures, newsletters, news releases, articles, letters from the state, sample materials, fact sheets, scope and sequence charts, etc., as well as the interpersonal channels: health fairs, conferences,

demonstration programs, word of mouth, work shops, and face to face meetings for administrators and resource people. There was much communication involved, requiring many meetings, several months of preparation and work with several key decision maker groups, including curriculum committees and Assistant Superintendants etc..

The diffusion of MMCSHE is distinguished from public health communication campaigns in general, which tend to focus on the individual (consumer) adoption processes, for instance, programs that attempt to reduce peridontal and dental problems or to detect early signs of breast cancer, or to lower salt (sodium) intake, or for the early diagnosis of arthritis etc.. The dissemination system of MMCSHE focused on the school district (educational organizations), and was promoting a comprehensive (k-8) health education curriculum. The desired behavioral change was adoption and implementation of a curriculum by the school district.

REVIEW OF LITERATURE

DIFFUSION OF INNOVATIONS

Diffusion refers to the process by which an innovation spreads to the members of a social system. It has four main elements; '(1) the innovation, which is (2) communciated through certain channels, (3) over time, (4) among the members of a social system' (Rogers, 1971, p. 18).

An innovation can be defined as a policy, organizational practice, product or service, process or

technology, which would be new to the potential users or to the adopting organization (Damanpour, 1991, p. 556).

Communication channels are frequently classified as either interpersonal or media and as either localite or cosmopolite. Media channels include: radio, television, film, video, newspapers, as well as other written forms. Interpersonal channels involve a face to face exchange between two or more individuals (Rogers, 1971, p. 253).

The social system includes the norms, social statuses, and hierarchies etc. which shape the behavior of members (individuals, group(s), family(ies), community(ies), organization(s)) of the system. The time dimension of the diffusion process can be represented as the Innovation Decision Process which is explained in next section.

The diffusion process is a communication process and can be conceptualized in terms of the S-M-C-R-E model: 'a source (S) sends a message (M) via certain channels (C) to the receiving individual (R)' with resulting effects (E) (Rogers, 1971, p. 11). The diffusion process also corresponds to the S-M-C-R-E model, where a social system is composed of receivers (R), knowledge of the innovation travels through communication channels (C), information about the innovation is in message (M), the message sender is the source (S), and changes in knowledge, attitude and/or behavior are the effects of the interaction (E) (Rogers, 1971, p. 19). Like communication research, diffusion

research attempts to trace change in knowledge or attitudes or behavior to the different configurations of the sources, messages, channels or receivers in the communication process.

A complete diffusion study would involve an investigation of, 'acceptance over time of some specific item by individuals or groups or other adopting units, linked to specific channels of communication to a social structure and to a given system of values or culture' (Larsen in Faris, 1964, p. 359). Throughout the diffusion process there are flows of information and there is change at many levels including: the community, the organization, the classroom, or/and an individual(s) etc..

THE PROCESS OF INNOVATION

The Innovation Decision Process (IDP) is 'a process through which an individual (or other decision making unit) passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to accept or reject, to implementation of the new idea to confirmation of this decision,' (Rogers, 1983, p. 163). This can be conceptualized as five stages: knowledge, persuasion, decision, implementation and confirmation. Information seeking and processing occurs at all stages, this processing generally focuses on reducing the uncertainties associated with the innovation (Rogers, 1983, p. 171 - 174).

The connection between diffusion processes and the

Innovation Decision Process is modeled in Figure 1. The IDP is determined by the interaction of communication processes, receiver characteristics, social system characteristics, characteristics of the innovation and time (Rogers, 1971, p. 102). The components are interrelated, for instance, where social system characteristics will shape the perceived value of an innovation, the user characteristics, the communication processes of diffusion and in course determine the Innovation Decision Process.

In this analysis the organizational innovation - decision process is the dependent variable. Like Rogers' model it is conceptualized as the flow of a decision: aware, considering, commited, implementing (Figure 2).

DIFFUSION OF INNOVATIONS AND HEALTH EDUCATION PROGRAMS

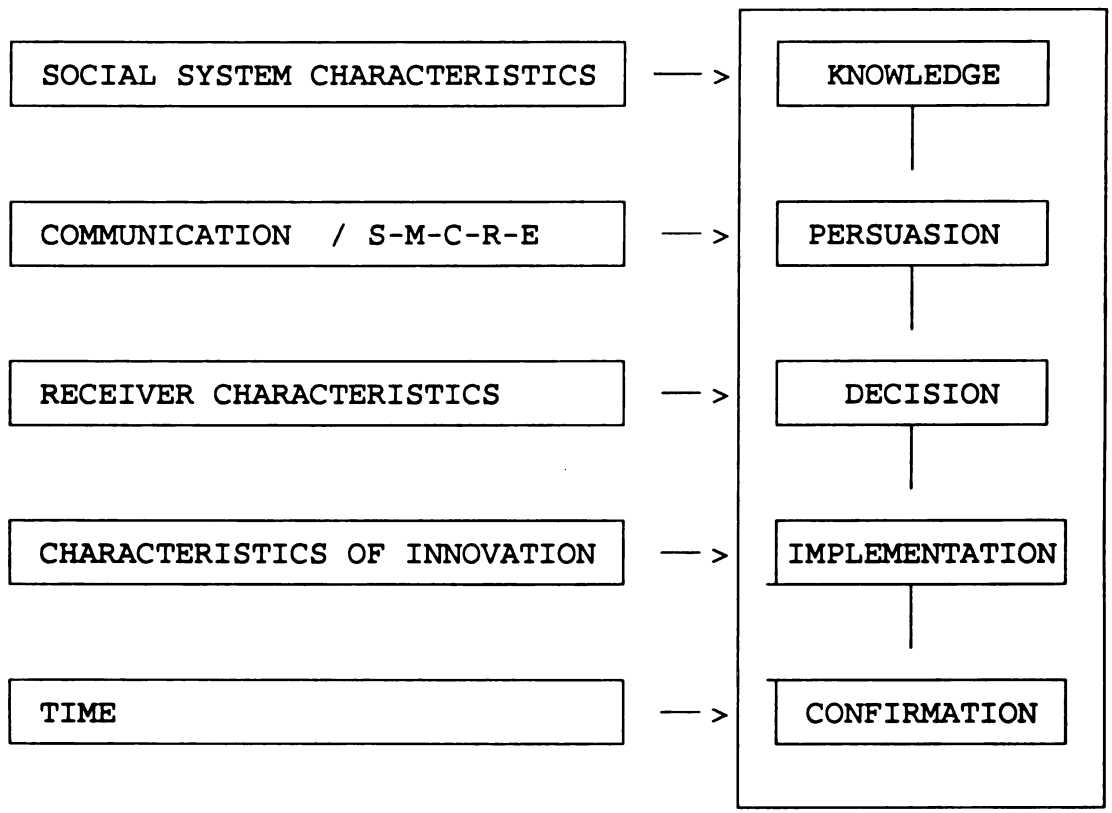
The study of diffusion of health promotion programs follows the general structure of the research work of the diffusion of innovations. This work has focused primarily on the characteristics of innovation users, the characteristics of the innovation, the organizational determinants of innovation, the work of change agents (diffusion networks) and the communication process.

Much of the emphasis of diffusion research has been to study catagories of innovation users, such as innovators, early adopters, early majority, late majority, laggards, and to identify the characteristics of these groups that would predict diffusion over time (Basch, 1986, p. 2). This

Figure 1

DIFFUSION AND THE INNOVATION DECISION PROCESSES

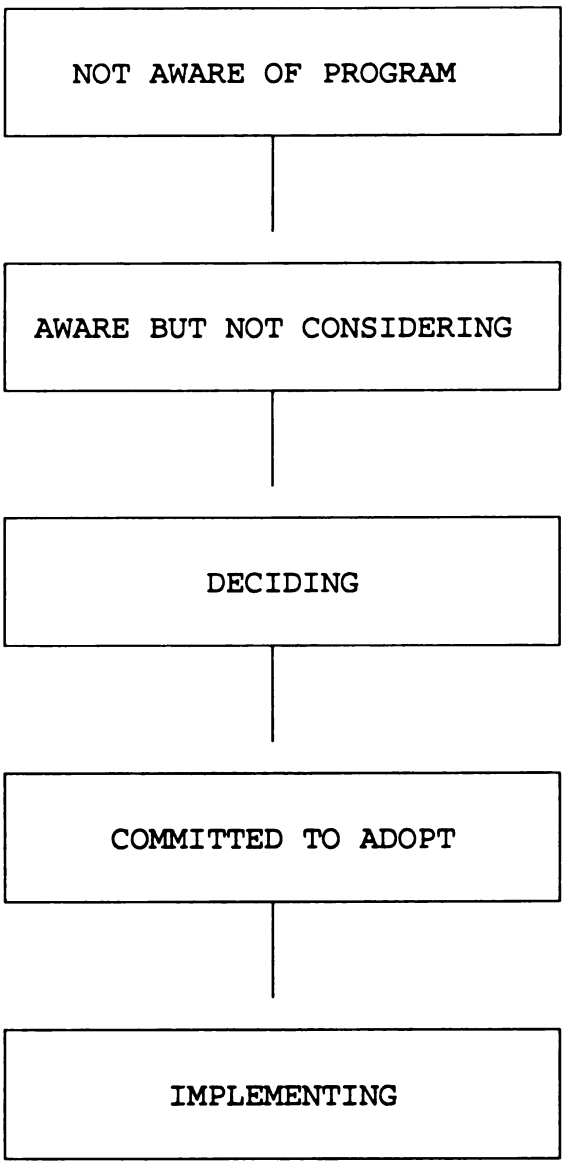
UNIVERSE = SOCIAL SYSTEM



* adapted from Rogers (1971, p. 102)

Figure 2

INNOVATION DECISION PROCESS



approach to the study of diffusion was taken by Anderson et al (1986) from their case study evaluation of the Childrens Health Futures Project (CHFP), a comprehensive health education program for elementary students.

Much of the diffusion literature has focused on the characteristics of the innovation. For instance, the diffusion of an innovation is more likely when there is a relative advantage (compared to existing programs it has significant advantages), compatibility (the fit into the existing system is visible), complexity (it can be easily understood and used), divisibility (it can be implemented on a small scale), reversibility (easy to discontinue), and communicability (it can be disseminated) (Kolbe and Iverson, 1982, p. 60-63). This approach was also taken by Anderson et al (1986), who described the desirability of CHFP as resting on the sequential and comprehensive curriculum, its compatibility with teacher and administrator needs, its meeting the mandated state requirements, the reduced teacher preparation time, the experiential based classroom activities, and that it allowed teachers to fit the lesson to their classroom (Anderson et al., 1986, p. 29-30).

Much of the diffusion literature has focused on the organizational determinants of innovation. Researchers have attempted to identify the determinants of organizational innovativeness, including specialization, functional differentiation, professionalism, centralization, managerial

attitude toward change, etc.. These connections are mediated by the type of organization (manufacturing or service / not for profit or for profit), the stage of adoption (initiation, implementation), the type of innovation (administrative or technical, product or process, radical or incremental) and the scope of innovation (high or low intensity) (Damanpour, 1991, p. 556 - 557). Determinants of the innovativeness of an educational organization, include the stability of the program leadership, the influence of an innovation advocate, the district endorsement, administrative support, the initial training, and support through implementation etc. (Huberman and Miles, 1984, p. 190).

The relevant organizational change literature has focused on the work of change agents and opinion leaders (Monahan and Scheirer, 1988). Change agents can work to facilitate diffusion in very many ways (Kanter, 1983, Rogers, 1971). This work led to a network approach, that the innovation process involves the work of many persons and constituencies. This diffusion network approach has been taken by McLeroy et al, (1981), in an evaluation of the first annual North Carolina Healthful Living Institute (HLI). HLI is an annual, week long school health promotion conference which is organized for School district teams. Its activities were designed to facilitate the interactions among school personnel so that each school district would be

capable of planning and implementing comprehensive school health. The participants were exposed to awareness sessions, workshop sessions on selected health promotion activities, team building exercises and developed an action plan for their school district. However, results indicated no significant relationship between team composition, team interaction, and quality of interaction. They were unable to connect conference activities to desired outcomes (McLeroy et al, 1989, p. 29).

Much of diffusion research has focused on the communication process (S-M-C-R-E). There is a general understanding, that some kinds of channels are more effective than others for some kinds of sources, with some kinds of messages and for some kinds of receivers (Rogers, 1971, p. 251). Research findings suggest, that mass media channels are more useful in building awareness of innovations, and interpersonal channels are more useful in forming and changing attitudes, and that cosmopolite channels tend to be more effective in the knowledge function and localite channels tend to be more effective in the persuasion function of the innovation decision process (Rogers, 1971, p. 255). More effective communication occurs when source and receiver are similar in beliefs, values, education, social status and so on (Petty and Caccioppo, 1981).

A communications approach has been taken by Parcel et

al (1989), in an evaluation of the 'smart choices' school based tobacco prevention program. They describe applications of Banduras' learning theory / strategies to the design of diffusion interventions (Parcel et al, 1989, p. 6). The dissemination phase made use of three channels of communication newsletters, a video tape, and workshops. The workshops were used to train school district opinion leaders, who would present a video to their colleagues. The videotape made use of students and teachers of the pilot classrooms to model teacher concerns about program changes, barriers to implementation, expected benefits and incentives for adoption. Newsletters were used throughout diffusion, making use of the testimony from opinion leaders and school personnel (including Superintendants). Message content emphasized the more relevant incentives in benefits to the lives of students and in meeting the mandated instructional elements (Parcel et al, 1989, p. 6).

DISSEMINATION SYSTEMS DESIGN

The health promotion literature presents several campaign situation analysis. The process of communications campaign design can include an analysis of situational opportunities and constraints, an evaluation of potential targets, a definition of the sociocultural context, a description of the psychological matrix, a decision about campaign theme(s), the design of the persuasive communication, and an evaluation of the campaigns progress

(McGuire, 1981, p. 8 - 13). Diffusion systems are also framed in terms of marketing theories (Lancaster, McIlwain, and Lancaster, 1983, p. 41).

Diffusion systems have purposes in disseminating information and in influencing the spread of an innovation. The aims of the diffusion system may depend on: the stage of innovation (adoption, implementation, maintenance), the unit of the ecological context (individuals, small groups, organizations, communities, larger macro systems), the catagory of innovation user, or on the characteristics of the innovation (Basch, 1986, p. 7). Communication strategies are developed to identify, contact and persuade potential users (Basch, 1984, p. 58).

MESSAGE LEARNING APPROACH

In this paper, Message Learning Theory (MLT) provides a theoretical structure for the study of diffusion systems (Figure 3). It serves to identify parameters, and suggests how persuasion theory may be useful in understanding the diffusion processes of health promotion programs and comprehensive health education (Parcel, 1986, p. 41).

According to Message Learning Theory (MLT), fundamental processes in attitude change are attention, comprehension, yielding and retention. These processes are affected by source, message, recipient and channel factors. The interaction of S-M-C-R and the mediating variables effect change in belief, attitude and behavior.

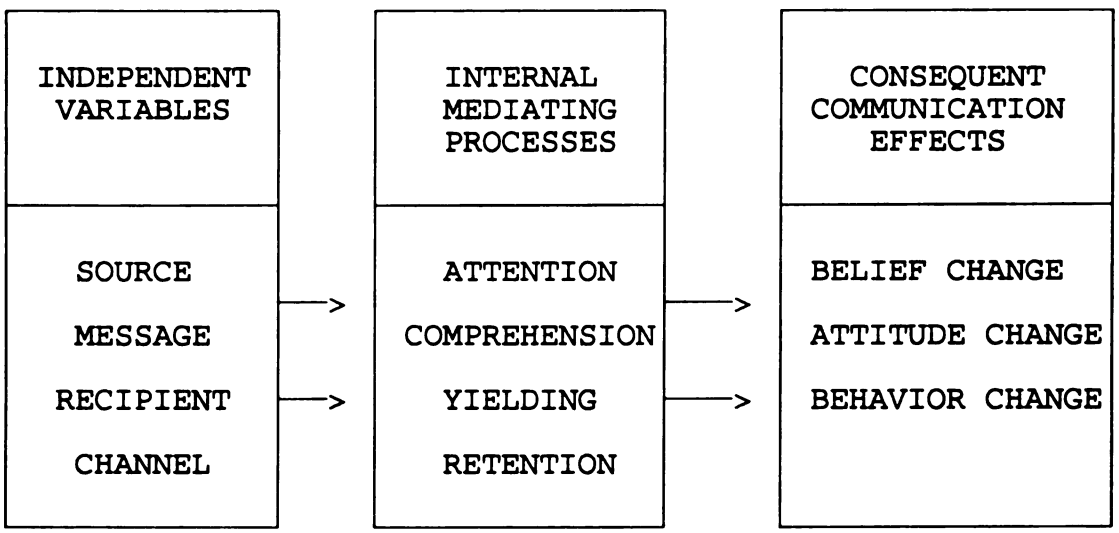
A source refers to the characteristics of the person(s) or groups who are communicating. A message refers to the content and form of the communication. A channel refers to the medium through which the message is conveyed. And the recipient refers to the characteristics of the audience (McGuire, 1978, p. xxvii). Mediating processes refer to a series of steps that the target persons pass through in deciding about a persuasive communication. Logically, first the target group or persons must be exposed to the message (attention), and the message must be received and comprehended (comprehension), accepted and approved (yielding), and remembered (retained). A change in belief, attitude or/and behavior is a product of the interaction of these forces (McGuire, 1978, p. xxviii).

Thus, 'persuasive contexts (sources and messages) question a recipients intitial attitude, recommend the adoption of a new attitude and provide incentives for attending, understanding, yielding to and retaining the new rather than the intitial attitude ' (Petty & Cacioppo, 1981, p. 60).

Clearly, a dissemination system reflects the processes and characteristics modeled by MLT. In making decisions about the dissemination of health promotion programs, campaign planners are interested in making the most of those aspects of the communication under their control. They are

Figure 3

MESSAGE LEARNING THEORY



concerned about how a communication variable should be set in order to have maximum impact (McGuire, 1981, p. 12 and Parcel et al, 1989, p. 5). These issues include the message content, the channel(s) to use, the source person(s), and the media mix, etc.. In this process, campaign planners consider 'the options for constructing the communications that are offered by each variable, evaluating their likely impact on each dependent variable by which persuasion is acheived ' (McGuire, 1981, p. 13).

PROCEDURES

METHOD

As part of the evaluation research for the MMCSHE, a questionnaire was mailed to the Superintendents of Michigan school districts to probe their experience with the diffusion of MMCSHE. The survey was mailed in the Spring of 1989, the fourth year of diffusion. A sample of 190 public and 190 private school districts was drawn randomly from the 500+ public and 500+ private school districts of the state of Michigan. The response rate was 48.4 % (184 of 380).

Approximately 92% of the sample had earned a masters degree and 18% owned a PhD (Table 2). Sixty nine percent of the respondants had taken at least a few courses in health education, 33% reported no health education preparation and 3.5% had earned an undergraduate major in health (Table 3). The sample included 61 private districts (33%) and 123 public districts (67%) (Table 4).

VARIABLE DEFINITION

The Superintendants were asked the intention of their district to adopt the MMCSHE: 'Which of the following best describes the intent of your school district to adopt the Michigan Model for Comprehensive School Health Education (MMCSHE)?' The response catagories were, (1) have adopted all or part of the MMCSHE, (2) have made a commitment to adopt the MMCSHE within the next three years, (3) are considering whether to adopt the MMCSHE in the near future,

Table 2

HIGHEST DEGREE EARNED
BY FREQUENCY

DEGREE:	FREQUENCY	PERCENT
BACHELORS DEGREE	14	8.1
MASTERS DEGREE	126	74.1
DOCTORATE	30	17.8
TOTAL	170	100.0

Table 3

HEALTH EDUCATION PREPARATION
BY FREQUENCY

PREPARATION:	FREQUENCY	PERCENT
NONE	56	32.9
A FEW COURSES	96	56.4
UNDERGRADUATE MINOR	16	09.4
UNDERGRADUATE MAJOR	6	03.5
TOTAL	170	100.0

Table 4

TYPE OF SCHOOL DISTRICT
(PUBLIC / PRIVATE) BY FREQUENCY

DISTRICT:	FREQUENCY	PERCENT
PRIVATE SCHOOLS	61	33.0
PUBLIC SCHOOLS	123	67.0
TOTAL	184	100.0

(4) have considered the MMCSHE but at this time have decided not to adopt, (5) have not considered the MMCSHE for adoption, and (6) was unaware of the possibility to adopt the MMCSHE. For analysis the dependent variable was recoded to (1) unaware, (2) aware but not yet considering, (3) considering, (4) committed to adopt but not yet implementing and (5) implementing. The reasons for excluding those who decided not to adopt are addressed in the limitations section.

The resulting variable, innovation decision process (IDP) is presented by frequency in Table 6. There were 27 cases (16.8%) unaware, 10 cases (6.2%) aware but not yet considering, 19 cases (11.8%) considering, 24 cases (14.9%) committed but not yet implementing and 84 cases (52.2%) in the process of implementing.

The Superintendants were asked the extent of their knowledge of features of MMCSHE: 'Rate the degree to which you are knowledgeable about the following features of the MMCSHE.' The scale ranged from 1 = not at all knowledgable to 4 = very knowledgable. The items are listed in Table 5. The analysis included knowledge of the availability of teacher training (KTT), knowledge of multiple grade levels (k-8) (KMGL) and knowledge of effectiveness (KEFF). KEFF is a composite of two highly correlated items, knowledge of effectiveness and knowledge of benefit to students.

The Superintendants were asked to evaluate the

helpfullness of sources of information: 'Please check each source listed below that you have seen. For each source you have checked rate the helpfulness of the source in making your decision to adopt or to not adopt the MMCSHE.' The scale ranged from 1 = not at all helpful to 4 = very helpful. The items are listed in Table 5. The analysis includes two source items, workshops (WS) and meetings for administrators (FF). Meetings for administrators is a composite of three highly correlated source evaluations: meetings for administrators, meetings with resource people, and face to face interactions.

The Superintendants were asked to identify their district as public or private (P/P) (Table 5). P/P was included in the analysis as a context variable. Frequencies are in Table 4.

Descriptive statistics for all variables in the path model are in Table 7. The variation about these means is within reasonable limits. And the distributions are not skewed (Table 16).

MANN WHITNEY U

Mann Whitney U is used in the limitations section to explore a problem in the conceptualization of the dependent variable. MWU can be used to test the hypothesis that two independent samples come from populations having the same distributions. The hypothesis test is similar to the two independent sample t-test, however the normality and

Table 5

VARIABLE LIST

(1) ADOPTION - 'Which of the following best describes the intent of your school district to adopt the Michigan Model for Comprehensive School Health Education (MMCSHE)?'

(1) have adopted all or part of the MMCSHE
(2) have made a commitment to adopt the MMCSHE within the next three years
(3) are considering whether to adopt the MMCSHE in the near future
(4) have considered the MMCSHE but at this time have decided not to adopt
(5) have not considered the MMCSHE for adoption
(6) was unaware of the possibility to adopt the MMCSHE

(2) KNOWLEDGE: 'Rate the degree to which you are knowledgeable about the following features of the MMCSHE.' Scale: 1 = not at all knowledgable, 4 = very knowledgable.

a) availability of teacher training
b) availability of instructional materials
c) comprehensiveness of MMCSHE content
d) quality of the instructional materials
e) cost relative to other health education programs
f) state sanction of the program
g) nature of instructional materials
h) multiple grade levels (K - 8)
i) state subsidy of program costs
j) instructional time requirement
k) advocated by seven state agencies
l) evidence of effectiveness
m) relationship of MMCSHE to MEAP
n) health related benefits to students (K, A, B)

Table 5 (cont'd)

(3) SOURCES: 'Please check each source listed below that you have seen. For each source you have checked rate the helpfulness of the source in making your decision to adopt or to not adopt the MMCSHE.' Scale: 1 = not at all helpful, 4 = very helpful.

a) brochure
b) newsletters
c) letters from the state
d) news releases
e) articles
f) sample materials
g) health fair
h) workshops
i) meetings for administrators
j) conferences
k) face to face meetings
l) word of mouth
m) meetings with consultants and resource people
n) fact sheets
o) demonstration programs
p) scope and sequence charts
q) teacher training requirements

(4) TYPE OF SCHOOL DISTRICT: 'Your school district is:'
(1) public (2) private

Table 6

INTENTION TO ADOPT MMCSHE
BY FREQUENCY

VALUE	VARIABLE	FREQUENCY	PERCENT
1	UNAWARE	27	16.8 %
2	AWARE BUT NOT CONSIDERING	10	6.2
3	CONSIDERING	19	11.8
4	COMMITTED	24	14.9
5	ADOPTED AND IMPLEMENTING	84	52.2
TOTAL		164	100.0 %

Table 7

PATH MODEL STRUCTURES
BY DESCRIPTIVES

VARIABLE	MEAN	STD DEV	MIN	MAX
KNOW - TEACHER TRAINING (KTT)	3.20	1.04	1	4
KNOW - MULTIPLE GRADE LEVELS (KMGL)	3.12	1.04	1	4
KNOW - EFFECTIVENESS (KEFF)	2.69	.92	1	4
SOURCE - WORKSHOPS (WS)	3.37	.75	1	4
SOURCE - FACE TO FACE MEETINGS (FF)	3.35	.70	1	4
CONTEXT - PUBLIC / PRIVATE (P/P)	1.34	.47	1	2
ADOPT - INNOVATION DECISION PROCESS	3.78	1.52	1	5

equality of variance assumptions are not needed. Mann Whitney U is based on an average rank, observations are sorted ascending and assigned a rank (ties are given an average rank), and an average rank is found. If the two groups are from the same population we would expect similar ranks in the two groups. If one of the groups has more than its share of small or large ranks, there is reason to suspect that the two underlying distributions are different (Kenkel, 1984).

PATH ANALYSIS

Path analysis is a method for studying patterns of correlation (causation) among a set of variables. It allows a modeling of the corelation between the variables of a causal system as a function of the underlying processes

represented by the paths. Path analysis allows a correlation to be decomposed into simple and compound paths, which can reveal processes and effects not apparent in descriptive analysis.

The flow of a path model reflects a theoretical formulation regarding the relations among the causal structures. These sets of hypotheses are put to an empirical test, if confirmed, there is more confidence in the appropriateness of the model for the given data and in the explaining power of the theoretical meanings (Pedhauzer, 1982, p. 614-620).

Several statistical tests are associated with a path analysis, including, the Chi Square test (W), the F test and the T test. The Chi Square tests whether the causal model is consistent or not consistent with the data. It assumes causal independence, that the direct effect of one structure on another is negligible (zero) (Pedhauser, 1982, p. 614). The reader is refered to Pedhauzur (1982) for an explanation of the mechanics of the Chi Square test and of the F test and T test which are applied in the multiple regression procedures used in path analysis.

Path coefficients are derived through regression analysis where the dependent variables are regressed on a set of independent variables and the standardized Betas are interpreted as indices of the effects of each of the independent variables on the dependent variable.

ANALYSIS AND RESULTS

MODELING THE DIFFUSION OF MMCSHE

The Superintendant (CSO - Chief School Officer) is generally a very credible source within their organization (school district), a key influence within the school social system, an important agent of change and a key person to persuade in gaining access to the educational organization (Portnoy, p. 13). Knowledge of how to reach this group would be very useful in packaging and disseminating the Michigan Model.

Part of modeling the diffusion of MMCSHE is understanding the managerial context of the decision. For instance, the Chief School Officer (CSO) acts as an agent for the school district, including responsibilities at interfaces with the board of education, the staff, the community, the unions, and governments (state, local and federal). The decision to adopt MMCSHE was a staged process where there were other alternatives to investigate, there would be some preliminary data gathering and decisions to investigate further, etc.. Thus, in the course of the decision, the CSO would have worked with several groups, including a board of education, an executive commitee, curriculum committees, parent groups etc..

Part of modeling the diffusion system concerns a knowledge base that is integral to an adoption decision, the kind of information they need in order to make their

decision. The decision to adopt MMCSHE is about including the training, theory, materials, sequencing, and content etc. as part of the school curriculum. MMCSHE poses a change in the curriculum structure, in the task structure, in the personnel training, and in the professional techniques etc. (Iverson, 1981, p. 63). Thus, a CSO might be concerned that there is a good theoretical basis for the curriculum program, for the teacher training model and for the teaching methodology. They might consider the content and process of the classroom instruction model, the pace of exposure, the amount of content presented, and spacing (Green, 1980, p. 22). These concerns reflect the decision criteria of an educational organization in this context.

And part of modeling the diffusion process is concerned with the ways the CSO learned of the MMCSHE. The dissemination strategy would make some kinds of information available through various channels (interpersonal and media). Logically a series of consequences would follow exposure to the channels and message content including a change in knowledge of the proposal and perhaps a change in adoption behavior.

A PATH MODEL OF THE DIFFUSION OF MMCSHE

In application of Message Learning Theory (MLT) and the Innovation Decision Process (IDP) as an overarching theoretical structure, a path model was constructed to investigate the diffusion / dissemination of the MMCSHE. The

model explains an organizational adoption process as measured by the Innovation Decision Process in terms of the dissemination system, as represented by the MLT, in the interrelatedness of the independent variables (message, channel, recipient and source variables) and the internal mediating processes (knowledge acquired). The path model is in Figure 4.

The analysis is concerned with the school district managerial context of the adoption processes of MMCSHE. It attempts to provide insight into how this decision was understood / decoded and the underlying heuristic decision rules of the school district organization in this regard. In making decisions of this kind, the Superintendant is an active filterer of information, some kinds of information would be more salient and receive more attention than others. Thus, analysis reflects the underlying evaluative criteria and provides clues to the knowledge schemas and information needs necessary to an adoption decision.

The analysis is concerned with how alternative dissemination strategies were received and their effectiveness in conveying key message arguments. Some kinds of information were available through various sources / channels and some sources / channels were more effective than others in communicating the key arguments.

The analysis is concerned about the effect of type of school district (Public / Private) on the adoption processes

of MMCSHE. Early on in the program, dissemination efforts were focused on the public school districts because the private schools were not eligible for state subsidies and budget limits required that States resources be channeled toward the school districts more likely to adopt. Consequently, a public school district would have experienced a different diffusion process than the private school district.

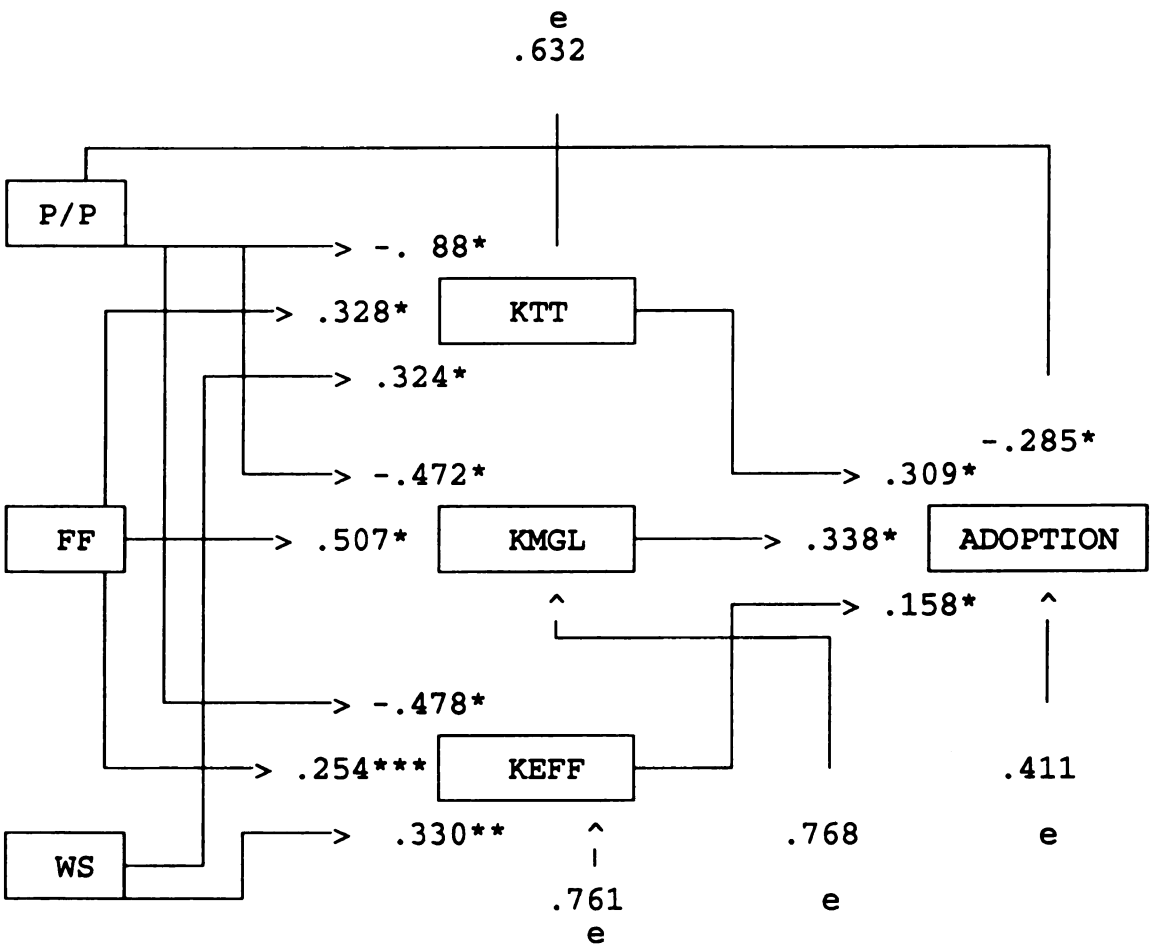
Thus, the flow of the model reflects sets of theoretical propositions regarding the interrelatedness of the factors. For instance, a behavior change in the desired direction, which is measured by the innovation decision process, is associated with the learning of the message arguments (acquiring knowledge) which is associated with exposure to channels of communication and favorable attitudes toward their usefullness. The recipient is predicted to be more persuasible when this source, channel and message configuration is used, they are more likely to learn the key arguments, which in course, would lead to an adoption decision.

The model reflects four general propositions (hypotheses), from right to left in the diagram (Figure 4):

(1) It tests for the impact of knowledge of the MMCSHE on the innovation decision (adoption) process, as reflected in knowledge of effectiveness (KEFF), knowledge of teacher training (KTT) and knowledge of multiple grade levels

Figure 4

CAUSAL DIAGRAM



SIGNIFICANCE AT .001 = *, .01 = **, .05 = ***

LEGEND

FF = SOURCE FACE TO FACE / MEETINGS WITH ADMINISTRATORS
WS = SOURCE WORKSHOPS
KTT = KNOWLEDGE OF AVAILABILITY OF TEACHER TRAINING
KEFF = KNOWLEDGE OF EFFECTIVENESS
KMGL = KNOWLEDGE OF MULTIPLE GRADE LEVELS
P/P = PUBLIC / PRIVATE
ADOPTION = INNOVATION DECISION PROCESS

Table 8

PATH COEFFICIENTS

R SQUARE	.60	.42	.41	.831
VARIABLE:	KTT	KEFF	KMGL	ADPT
P/P	-.588	-.478	-.472	-.264
FF	.328	.254	.507	
WS	.324	.330		
KTT				.309
KEFF				.158
KMGL				.338

Table 9

CORRELATION COEFFICIENTS

	ADPT	P/P	WS	FF	KTT	KEFF	KMGL
P/P	-.674	1.0					
WS	.220	.039	1.0				
FF	.369	.117	.457	1.0			
KTT	.677	-.612	.425	.497	1.0		
KEFF	.497	-.498	.349	.533	.617	1.0	
KMGL	.656	-.470	.375	.683	.795	.603	1.0

(KMGL). Posing these key factors have direct effects on adoption.

(2) It tests for the impact of message sources on an adoption decision. Posing the indirect effects of sources on adoption through knowledge acquired and posing no direct connection between sources and adoption. Message sources are a direct cause of change in knowledge thus indirectly influencing a decision to adopt.

(3) It tests for the impact of source / channels on learning of key message arguments (knowledge acquired), as reflected in the effect of workshops (WS) and face to face / meetings for administrators (FF). Posing the direct effect of message sources on acquiring key knowledge of the program.

(4) It tests for the effect of context (P/P = public / private) on knowledge and adoption. Posing the observed interrelatedness could be traced to whether the district was a public or a private school system. P/P has direct effects to adoption as well as a complex of indirect effects through key knowledge variables.

Adoption, KEFF, KTT and KMGL are the endogenous variables. The model focuses on these factors as dependent variables, explained by the causal system. The FF, WS and P/P are exogenous variables, not considered as dependent variables. The error terms represent the effects of other causes not included in the analysis.

The path coefficients in Figure 4 are also in Table 8. The paths (Beta coefficients) to adoption (ADOPTION) include: knowledge of teacher training (KTT), .309, knowledge of effectiveness (KEFF), .158, knowledge of multiple grade levels (KMGL), .338, and type of school district (P/P), -.264. This configuration accounted for 83% of the variation in adoption. Workshops (WS) and meetings for administrators (FF) did not have a direct effect on adoption. The error term (e) .411 on adoption in Figure 4 represents the influence of variables not included in the system. Computed as the square root of (1 - adjusted r square).

Paths to knowledge of effectiveness (KEFF) include: workshops (WS), .330, meetings for administrators (FF), .328 and type of school district (P/P), -.588. This configuration accounted for 42% of the variance in knowledge of effectiveness. The error term on KEFF is .761.

Paths to knowledge of teacher training (KTT) include workshops (WS), .324, meetings for administrators (FF), .328 and type of school district (P/P), -.588. This configuration accounted for 60% of the variance in KTT. The error term is .632.

Paths to knowledge of multiple grade levels (KMGL) include meetings for administrators (FF), .507 and type of school district (P/P), -.472. Workshops (WS) did not have direct effects to KMGL. This configuration accounted for 41%

of the variance in KMGL. The error term is .768.

The correlations relevant to the causal system are in Table 9. Adoption is highly correlated with knowledge of teacher training (KTT, .677), knowledge of effectiveness (KEFF, .497), knowledge of multiple grade levels (KMGL, .656) and type of school district, (P/P, -.674). Knowledge of teacher training is correlated with workshops (WS, .425), face to face meetings for administrators (FF, .497) and type of school district (P/P, -.612). Knowledge of effectiveness (KEFF) is correlated with workshops (WS, .349), face to face meetings (FF, .533) and type of school district (P/P, -.498). Knowledge of multiple grade levels (KMGL) is correlated with workshops (WS, .375), face to face (FF, .683) and type of school district (P/P, -.470).

The factors included in the analysis were selected on the basis of intuition and their contribution to variance explained. It was important to build a parsimonious causal model that would account for the diffusion of MMCSHE and the posed structural interrelatedness.

However, this screening meant that certain factors were excluded for the sake of parsimony or a lack of explaining power. For instance in develping the model we tested knowledge of cost relative to other health education programs and knowledge of state subsidies of program costs, but these logical determinants were excluded. Similarly, we tested several other media source alternatives, including,

letters from the state and sample materials etc.. These situations are discussed as contradictions in another section of the paper.

THEORY TRIMMING

The analysis began with a fully recursive system, presuming all variables included in the model are causally related. Then applied an algorithm, using an .05 alpha criterion, which systematically reduced the number of coefficients. Eliminating a path this way translates into an hypothesis that one variable is not a direct cause of another, for example, the direct effect of WS (workshops) and FF (face to face), on adoption is posited to be zero. The resulting over identified model is in Figure 4.

After theory trimming, Chi Square observed (.36908, 164 cases) is less than critical (7.815, .05, 3df), which means the proposed pattern is empirically supported and the model fits the data (Table # 10). The reader is referred to Pedhauzur (p. 616, 1982) for an explanation of the mechanics of the Chi Square test.

The order of analysis moves from right to left as in Figure 4. First looking at the regression of causal determinats on IDP, then the regression of determinants on key knowledge, then the context variable P/P.

REGRESSION ON ADOPTION

The analysis poses that adoption is determined by: (1) knowledge of teacher training, (2) knowledge of

Table 10.

COEFFICIENTS OF DETERMINATION
FOR CHI SQUARE TEST

VARIABLE:	FULL MODEL	OVER IDNTFIED
KNOW: MULTIPLE GRADE LEVELS (KMGL)	.42223	.40764
KNOW: AVAILABILITY OF TEACHER TRAINING (KTT)	.60370	.60370
KNOW: EVIDENCE OF EFFECTIVENESS (KEFF)	.42598	.42598
DEPENDENT VARIABLE: ADOPTION	.84431	.83150

Formulae: W = - (N - D) log(e) Q
Q = 1 - r sqr(full model) / 1 - M(over identified)
r sqr(F) = 1 - (1 - rsqr(1f)) (1 - r sqr(2f))...
M(OI) = 1 - (1 - r sqr(1oi)) (1 - r sqr(2oi))..

Q = .997710231 LOG(e) Q = .0022924 N = 164
D = 3

W = .3690764 CHI SQR = 7.815 (.05, 3 df)

Table 11

REGRESSION ON ADOPTION

CODE	VARIABLE	BETA	SIGNIF (t)
KMGL	know: multiple grade levels	.338	.0000
KTT	know: teacher training	.309	.0000
P/P	Public / Private	-.264	.0000
KEFF	know: effectiveness	.158	.0046

R SQR ADJUSTED = 83.15 F = 176.183, SIGNIF = .0000

effectiveness, (3) knowledge of multiple grade levels and the context (4) public / private. Results of a regression on adoption are in Table # 11.

This information can be expressed as an equation that would predict the location of the school district in the innovation decision process:

ADOPTION = .338KMGL + .309KTT - .264P/P + .158KEFF + ERROR

For each independent variable in the equation there is a path coefficient (Beta) indicating the amount of expected change in the dependent variable that would result from a unit change in that independent variable. For instance, when KTT changes by one unit the dependent variable changes by .338 standard deviations. The equation indicates this configuration has distinguished the district CSO who is unaware of the possibility of adopting the MMCSHE from one that is considering from one that is committed from one that is implementing. Adoption is more likely as district decision makers learn of the effectiveness of the program, of the teacher training model and of the multiple grade levels.

This equation explains 83% (adjusted r square = 83.15) of the variation in adoption. The F statistic is 176.183, significant at .0000, and each variable is significant at .005 level ($p < .005$, t values).

DISCUSSION

Logically, the school Superintendant making a curriculum adoption / change decision would be concerned about the training program. They might consider, how the training would be done, what kind of results to expect, when and where the training takes place and how much time is involved etc.. Generally, elementary and middle school staff are not trained in health education, in fact, there are very few elementary teachers who would have a health education specialization.

Perhaps the Superintendant avoids many administrative problems when the staff is adequately trained, able to do a good job and to acheive desired outcomes. Training could be connected to many things that help administration, such as, satisfaction (morale), job stress, work climate, and administrative credibility.

The Michigan Model training program is different from other health education training programs. Apparently, most models use outside trainers and their training happens at a central office, and when this training is complete, the school district is left on its own. The MMCSHE makes use of 'inside' trainers, the coordinators are hired by the regional education centers (REC) of the public school system, and they are in touch with the program in each school on an ongoing basis. The Michigan Model training program is also convenient and flexible. There is a 30 hour

minimum, which can be suited to the needs of the district (Don Sweeney and Pat Morgan, MMCSHE steering committee, 1990).

The regional coordinators provided evidence of the effectiveness of the curriculum through the SHEE test information and feedback from parents of students enrolled in the program. The SHEE studies are comparative analyses that show the positive effects of health education, such as reduced risk of developing health problems. Feedback from parents was compiled from survey data by the evaluation committee and made available to coordinators. This included parent reactions to the program and their observations of change in their childs' health behaviors.

Logically, Superintendants are cautious about using new, unproven programs. The State of Michigan has Laws that restrict experimentation with the curriculum. The MMCSHE is not an experimental curriculum, it is a delivery format, adapted from existing programs into a better delivery system. Thus, it makes use of proven resources, those from other models that have been tested and proven effective in the classroom (Don Sweeney, member of MMCSHE steering committee, 1990).

Logically, those aware of the different grade levels may have a good overview of the program, its comprehensiveness and a grasp of what is taught at each level. They may have some insight into what is expected of

a student, a teacher and an administrator throughout the curriculum. And they might have an understanding of what training is needed.

SOURCES / CHANNELS FOR MESSAGE ARGUMENTS

This section is concerned with the way the key messages reached the Superintendant. Some sources were more effective than others in communicating key arguments and in influencing the learning of key messages. As Allwin and Hauser explain, 'how much of a given effect occurs because the manipulation of this antecedent variable leads to change in other variables which change the consequent variable' (Allwin and Hauser, 1975, p. 39).

The path model poses the direct effect from message sources to adoption is zero or negligible. That is the correlation between adoption and WS (workshops) or adoption and FF (face to face / meetings for administrators) is represented as a complex of indirect effects through knowledge of teacher training and knowledge of effectiveness and knowledge of multiple grade levels.

REGRESSION ON TEACHER TRAINING

Results of a regression of public/private (P/P), face to face / meetings for administrators (FF), and workshops (WS) on the key knowledge variable, teacher training are in Table 12.

Table 12

REGRESSION ON KNOWLEDGE OF TEACHER TRAINING

CODE	VARIABLE	BETA	SIGNIF(t)
P/P	Public / Private	-.588	.0000
FF	Meetings for administrators	.328	.0033
WS	Workshops	.324	.0035

R SQR ADJUSTED = 60.37 F = 25.37, signif = .0000

Table 13

REGRESSION ON KNOWLEDGE OF EFFECTIVENESS

CODE	VARIABLE	BETA	SIGNIF (t)
P/P	Public / Private	-.478	.0001
WS	Workshops	.330	.0125
FF	Meetings for Administrators	.254	.0520

R SQR ADJUSTED = 42.6 F = 12.87, signif = .0000

Table 14

REGRESSION ON MULTIPLE GRADE LEVELS

CODE	VARIABLE	BETA	SIGNIF (t)
FF	Meetings for Administrators	.507	.0000
P/P	Public / Private	-.472	.0001

R SQR ADJUSTED = 40.76 F = 21.827, signif = .0000

This information can be expressed as an equation:

KTT = - .588(P/P) + .328(FF) + .324(WS) + ERROR

This model explains 60.4% of the variation in the knowledge variable (adjusted r sqr = 60.37, F = 25.37, signif = .0000). And each variable is significant within .005 ($p < .005$, t statistic). A response on these items would distinguish a district that has reported very knowledgable of teacher training from one that has reported not very knowledgable at all. It indicates that the meetings for administrators and the workshops were effective in increasing knowledge of teacher training. The model also provides some indication of causal strength and order of importance. For instance, whether a district is public or private is a better predictor of knowledge of teacher training than either source / channel.

REGRESSION ON KNOWLEDGE OF EFFECTIVENESS

Results of a regression of type of school district (P/P), face to face meetings for adminstrators (FF) and workshops (WS) on the key knowledge variable, evidence of effectiveness KEFF), are in Table 13.

This information can be expressed as an equation:

KEFF = - .478(P/P) + .330(WS) + .254(FF) + ERROR.

The equation explains 42.6% of the variation in the knowledge variable (adjusted r sqr = .42598, F = 12.87, significant at .0000) and each variable in the model is significant at .05 level (t statistic). Responses to these

items would distinguish the district that is very knowledgable of the effectiveness of MMCSHE from one not very knowledgable.

REGRESSION ON MULTIPLE GRADE LEVELS

Results of a regression of type of school district (P/P), and face to face meetings for administrators (FF) on the knowledge of multiple grade levels (KMGL) are in Table 14.

Thus the model of knowledge of multiple grade levels is:

KMGL = .507(FF) - .472(P/P) + ERROR.

This equation explains 40.8% of the variance in the key knowledge variable (r sqr = .40764, F = 21.827, signif at .0000) and each variable included is significant at .000 (t statistic). Face to face meetings has more explaining power than public/private and together they can be used to determine how knowledgable a CSO is of multiple grade levels. Theory trimming indicated that workshops did not have significant explaining power on KMGL, and the causal analysis posits this path at zero. Hence, workshops were not included in this equation. Workshops were not as effective as face to face meetings for administrators with consultants and resource people in conveying the message about multiple grade levels.

DISCUSSION: WORKSHOPS AND MEETINGS FOR ADMINISTRATORS

Dissemination of MMCSHE took advantage of the state public education organization which includes the regional

education centers (REC) and the intermediate school districts (ISD). There are 26 regional centers in Michigan and each has a regional MMCSHE coordinator who is liason / manager in dissemination through implementation processes.

Most coordinators made initial contact with the Superintendants at the monthly meeting held by their Intermediate School District, all public school Superintendants attend. There are elementary and secondary associations, Superintendant roundtables, and other local groups where they would have presented the MMCSHE.

Most coordinators began their contact in the school district with an awareness building workshop. Generally, these meetings included the internal administrative structure, (Superintendant, Curriculum Directors etc.), and would lead to an understanding of what kind of team was needed in working toward adoption. This team usually invited the coordinator back to the district for more discussions and presentations. Then there were workshops with the instructional support body and the instructional council, which included the administrators, teachers and parents (Helen Truchen, past president MMCSHE coordinator group, June, 1990).

The meetings for administrators with consultants and resource people and in face to face interaction were the more effective source / channels in communicating the key arguments. Clues to the meaning of this finding can be found

in Social Psychology theory, Persuasion theory and in Management theory.

Social Psychological theory indicates that communication effectiveness in an interpersonal context will depend on the familiarity, similiarity and credibility of participants (Petty and Caccioppo, 1981, p. 60-67). Perhaps these qualities were a part in the workings of the meetings with colleagues and resource people.

Logically, other Superintendants served as models of the program. They would have had first hand experience with MMCSHE, their students had been working with it, their teachers had been trained, and their schools were in the process of implementing. These colleagues were available to the decision maker in meetings and in discussion. Similarly, the members of the administrative staff, had access to their management peers, people with considerable expertise, specialized knowledge and experience. And key decision makers had access to a credible resource person, one who had thorough understanding of the program and had worked through the problems of adoption and implementation with other districts. In this way, access to credible associates and friends may have contributed to the CSOs' confidence in the Michigan Model Health Education Curricula.

Persuasion theory suggests that channel effectiveness will depend on the complexity of the message to be communicated (Petty and Caccioppo, p. 70-83). The meetings

for administrators and resource people were the more effective channels because of the far reaching implications of the issues: effectiveness of the program, benefit to students, comprehensiveness, multiple grade levels and teacher training, etc.. In this situation it is better to have personal contact with a change agent who is available for questions and discussion, and can provide more detail and evidence if needed.

Management theory suggests this curriculum change is the work context of a very non-routine, unstructured problem (Daft, 1983, p. 304). MMCSHE poses many uncertainties, including, implications across functional divisions and far reaching implications for the organization as a whole. When the work requires much coordination of effort and consensus seeking, there is need for more frequent group meetings between members of the management team including change agents. In this context, it is more appropriate to work with the consultant / resource persons, who would work through the change with the organization in meetings with administrators.

Clues to the meaning of this finding can also be found in what did not work or what was less effective. The analysis tested other interpersonal channels, including: health fairs, conferences, demonstration programs, word of mouth, as well as other media alternatives including: brochures, newsletters, and letters from the state etc.,

however, these factors did not provide meaningful explaining power and for parsimony, were excluded from the model. The face to face meetings with adminstrators and consultants proved to be the more useful of all channels tested.

CONTEXT: PRIVATE/PUBLIC

The path analysis revealed that the type of school district (P/P) had direct effects on adoption as well as a complex of indirect effects through key knowledge factors. Thus private school superintendants were more apt to be unaware of the possibility of adoption and were apt to be less familiar with key messages than the public superintendants.

Early on in the program, dissemination efforts were focused on the public system primarily because of legal and cost considerations. The State of Michigan has Laws which restrict the use of public dollars to pay for materials in private school districts. Consequently, the MMCSHE was a much more expensive program for the Private school, about $8,000 dollars for the materials. Also, MMCSHE operates within a limited budget, which requires that the time, staff and money resources must be channeled toward target school districts that are likely to adopt. Private districts were much less likely to adopt.

Further, the private schools are generally outside of the flows of information provided by the state public education system. Their Superintendants do not usually

attend the public system ISD meetings.

Since the implementation of the Federal Drug Free Schools and Communities Act of 1986, many more private schools have adopted the MMCSHE. This Law contains provisions to override the State laws, which has made MMCSHE an affordable alternative for the private district. Since the possibility of adoption has improved, the coordinators have been encouraged to contact the private district.

CONTRADICTIONS

The analysis revealed a contradiction regarding the role of cost considerations in the adoption process. Logically, the costs of adopting the program, which include planning, training, implementing, materials, staff and management etc., would be a central point of evaluation for the school district. However, in developing the model I tested cost as a knowledge variable and it did not have significant explaining power.

This effect can be explained by the cost structure. MMCSHE is funded through federal, state and local subsidies. At this time the Intermediate School District (ISD) is required to pay only 20% of the total cost. And many ISDs receive grants from community organizations and agencies that would cover all these costs. Thus, MMCSHE is not a major financial committment for the school and cost is not a major obstical to adoption.

The analysis revealed a contradiction regarding the

role of media channels in the dissemination process. In developing the model I tested several media alternatives including, brochures, newsletters, news releases, articles, letters from the state, sample materials, fact sheets, scope and sequence charts, etc.. However, these factors did not make significant explaining power. Logically, media channels offer many advantages in reaching a large number of people quickly and efficiently or as a more permanent record that can be processed at ones own pace and reprocessed if necessary. Thus, the results pose a contradiction, the media channels were no where near as effective in disseminating the MMCSHE as the interpersonal channel.

LIMITATIONS

I recognize that some researchers may object to the dependent variable, Innovation Decision Process, as not interval and therefore, questionable to apply regression analysis. But there is a definite order and sequence represented in IDP as framed and coded.

Some researchers would object to analysis of the diffusion process using the dependent variable, Innovation Decision Process (IDP) as framed. That a state of not adopting is quite different from a state of adopting. And including these contexts as framed in sequence, conceals the reality of the dissemination / diffusion processes.

At this time more than 90% of all public schools in the state of Michigan have adopted MMCSHE. In our sample 9 % or

just 17 cases had decided not to adopt. Those school districts that did not adopt were primarily from counties that had already made a committment to other health education programs, such as the Growing Healthy model, and/or were from a church affiliated context which had some objection to content etc. (Don Sweeney, MMCSHE steering committee, Department of Public Health, 1990). For these reasons the causal analysis redefined the dependent variables IDP without the negative side, decided not to adopt.

However, the analysis tested this proposition and compared those who adopted to those who did not adopt as a dichotomous variable in a Mann Whitney analysis of distributions (Table 15). Compared to those deciding not to

Table 15

ADOPTER / NONADOPTER COMPARISON

CODE	VARIABLE	Z*	SIGNIF
KTT	KNOW - TEACHER TRAINING	-2.4816	.0131
KEFF	KNOW - EFFECTIVENESS	-3.6165	.0003
KMGL	KNOW - MULTIPLE GRADE LEVELS	-1.0312	.3024
WS	SOURCE - WORKSHOPS	-1.7729	.0762
FF	SOURCE - FACE TO FACE MEETINGS	-2.4908	.0127
P/P	CONTEXT - PUBLIC / PRIVATE	-1.7092	.0874
	HEALTH EDUCATION PREPARATION	-1.2088	.2267
	HIGHEST DEGREE EARNED	- .1836	.8543
	GENDER	- .4324	.6654

* Mann Whitney U

adopt, those adopting tended to report more: (1) knowledge of teacher training, (2) knowledge of effectiveness, and (3) reported more favorable evaluations of the meetings for administrators. Adopters were no different from nonadopters by, gender, amount of health education preparation, highest degree earned (education), type of school district (public / private), reactions to workshops and / or knowledge of multiple grade levels. The results of this test were parallel to the findings of the causal analysis. Those who adopt tend to report more knowledge of the teacher training program and of the effectiveness of the program and to report more favorable reactions to the face to face channel.

CONCLUSIONS

PROPOSED CAUSAL CONNECTIONS

The analysis provided support for the story (causal connections) of the diffusion of MMCSHE as represented and posed in the path model. The modeling revealed the adoption processes were primarily determined by a state of knowledge of, teacher training, evidence of effectiveness and of multiple grade levels. These information needs are presumed to reflect the underlying priorities, objectives and values of the organization and are key components of the knowledge schemas necessary to the decision processes.

Analysis also focused on the effectiveness of various alternative channels / sources. There was support for the workings of these channel / sources as posed, that adoption can be traced to the indirect effects of communication channels which were integral to the learning of key message arguments. The workshops and the face to face contacts with administrators, resource persons and consultants were the more effective ways of communicating the key information. The model also provides support for the posed effects of the public / private school district context through out the causal structure.

RELEVANCE TO A THEORETICAL STRUCTURE

This research and data analysis has attempted to contribute to the theoretical structure of health promotion science. The analysis has provided insight into the

diffusion of comprehensive school health education curricula, and into the persuasion theory underlying its dissemination. It is hoped that Message Learning Theory would provide theoretical bases for conceptualizing and analyzing these diffusion processes and dissemination systems.

The analysis attempted to contribute to the underlying methodology of this research tradition. Path analysis enables a modeling of causal connections, including complex interactions (indirect effects). Thus it is better able to answer why questions, and understand why & how these attitude, knowledge and behavior changes of the diffusion processes have occured. In course, the causal modeling provided a framework that would enable a researcher to generate hypothesis, predict outcomes, test propositions and to build models.

EVALUATE MMCSHE DIFFUSION SYSTEM

The analysis provided an evaluation of the dissemination / diffusion system of MMCSHE. It generated information that would enable management to improve use of its limited resources in time, money and staff. It was useful in the sense that it provided an assessment of the impact of alternative configurations, including the implications of choosing between alternatives and some indication of their relative effectiveness. Logically, this information is usefull in allocating resources, including,

the design of materials (what kind of information to generate) and the choice of channel strategy (which sources / channels are more useful in conveying necessary information). This information is also relevant to staffing decisions, (what kind of knowledge and skills are necessary to a good job), and usefull in providing direction to coordinators. Perhaps the coordinators should be more aware of how to work with administrators and consultants and to make use of information about effectiveness etc. in the meeting / workshop and / or the interpersonal context.

DIRECTION FOR FUTURE RESEARCH

It is hoped that this application of communication theory and path analysis to the problems of the diffusion of comprehensive health education programs would encourage future research. Much more work is needed on the improvement of our knowledge of the persuasion theory underlying the dissemination processes and of the organizational dynamics of the adoption processes. Further research should work toward the development of valid means to measure program dissemination and implementation, toward the identification of barriers and facilitators to effective dissemination, and toward the evaluation of the effectiveness of a diffusion system including the efficacy of the various mechanisms for the dissemination of comprehensive school health programs.

Future research might provide more detailed understanding of the effectiveness of comprehensive health

education curricula, of the value of inservice teacher training programs, of the workings of the interpersonal communication channels and of the position of media channels as they support the diffusion and dissemination of comprehensive health education programs.

APPENDICES

APPENDIX A

ASSUMPTIONS IN PATH ANALYSIS

APPENDIX

ASSUMPTIONS

Pedhauzer defines the assumptions of path analysis as: (1) relations among the variables in the model are linear, additive and causal, (2) disturbances (residuals) are uncorrelated with the independent variables in each equation as well as with each other (the residuals are assumed not to disturb the basic relationships of the system), (3) the causal flow in the model is unidirectional, the system is recursive, and reciprocal causation between variables is ruled out, (or at a given point in time a variable cannot be both a cause and an effect of another variable), (4) variables are at least interval, (5) the variables are measured without error and (6) and all assumptions of regression ordinary least squares analysis apply (Pedhauzer, 1982, p. 582).

Further, statistical analysis within the linear model makes assumptions: (1) errors are normally distributed in the population, (2) the error variance is equal for different values of x (homoscedasticity), and (3) residuals are independent of x (or of predicted values of y), (class notes professor Kaplowitz, fall 1989).

Gross departures from these assumptions will invalidate the tests of statistical significance and interpretations of regression coefficients. Violation of the assumptions leads to serious biases which suggest statistical tests are wrong

and applications of the theoretical description would be misleading (Kaplowitz, Fall, 1989).

In the appendix I have provided results of a skew test (Table # 16) which is used to test normality. A skew between + 1.0 and - 1.0 indicates the sample is a reasonable approximation of normality. All variables included in this model have skew between + 1.0 and - 1.0 and are therefore acceptable.

In the appendix I have provide results of homogeneity of variance tests (Table # 17). Cochrans' C should not excede 2/(k + 1). There are significant p levels for each variable included in the analysis, indicating we could reject the null hypothesis of equal variance. Apparently, the sample size is large enough so that small differences between sample variances are significant. But all variables nearly pass the rule of thumb test.

In the appendix I have provided results of correlation analysis of residuals and the other variables of the system (Table # 18). Using the alpha = .05 criterion, there are three significant correlations, between public/private (p/p) and the residuals of keff, ktt and kmgl, there are no other significant correlations.

Table 16

SKEW TESTS

CODE	RESIDUAL	SKEW
WS	SOURCE: WORKSHOPS	.265
FF	SOURCE: FACE TO FACE / MEETINGS	.053
KMGL	KNOWLEDGE: MULTIPLE GRADE LEVELS	-.085
KTT	KNOWLEDGE: KNOWLEDGE OF TEACHER TRAINING	-.469
KFF	KNOWLEDGE: KNOWLEDGE OF EFFECTIVENESS	-.567
ADOPT	DEPENDENT VARIABLE: ADOPTION	.291

Table 17

TEST OF HOMOGENEITY OF VARIANCE

CODE	ADOPTION BY	COCHRANS' C	SIGNIF (P VALUE)
WS	WORKSHOPS	.7366	.000
FF	MEETINGS FOR ADMINISTRATORS	.5279	.000
KMGL	KNOWLEDGE OF MULTIPLE GRADE LEVELS	.4405	.002
KTT	KNOWLEDGE OF TEACHER TRAINING	.3745	.045
KEFF	KNOWLEDGE OF EFFECTIVENESS	.4797	.000
P/P	PUBLIC / PRIVATE	.7995	.000

Table 18

TESTS OF RESIDUAL INDEPENDENCE

RESID:	VARIABLES AND RESIDUALS								
	P/P	FF	WS	KMGL RSD	KTT RSD	KEFF RSD	KMGL	KTT	KEFF
KMGL RSD	.58*	.09	.19						
KTT RSD	.59*	.15	.16						
KEFF RSD	.42*	.12	.09						
ADPT RSD	.31	.14	.22	.08	.01	.20	.19	.20	.30

* INDICATES SIGNIFICANT CORRELATION AT .05 ALPHA

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