DOCUMENT RESUME

ED 263 095 SP 026 789

AUTHOR Jorde, Paula
TITLE Computer Technology in the Educational Setting: The Role of Administrators in the Innovation Decision Process.
PUB DATE Jul 85
NOTE 20p.; Paper presented at the World Assembly of the International Council on Education for Teaching (32nd, Vancouver, British Columbia, Canada, July 22-26, 1985).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Administrator Role; Computer Oriented Programs; Cost Effectiveness; *Decision Making; *Microcomputers; Needs Assessment; *Program Implementation

ABSTRACT

This paper examines some of the theoretical and practical issues confronting educational administrators who must make decisions regarding the implementation of microcomputers in their schools. A conceptual framework is offered for understanding the stages involved in the innovation decision process. Several attributes of innovations are discussed and the objective and subjective judgments involved in any decision to adopt new educational practices are considered. Among the factors involved in decisions about introducing microcomputers are cost effectiveness, social approval, complexity, efficiency, and compatibility with current practices. The nature of adoption and rejection decisions are briefly discussed. Finally, some factors influencing adoption decisions as well as unanticipated consequences of adopting computer technology in the educational setting are examined. One such issue, for example, is the physical and psychological consequences of prolonged computer use and the stress involved in interacting with electronic media over an extended period of time. (JD)

ED263095

COMPUTER TECHNOLOGY IN THE EDUCATIONAL SETTING: THE ROLE OF ADMINISTRATORS IN THE INNOVATION DECISION PROCESS

Paula Jorde, Ph.D.

National College of Education

2840 Sheridan Road

Evanston, Illinois 60201

Paper presented at the thirty-second ICET World Assembly, Vancouver, British Columbia, July 23, 1985.

Microcomputers are playing an increasingly important role as both a managerial tool in the school office and as an instructional aid in the classroom. As a managerial tool, some administrators find the technology is helping them stretch limited resources and cushion the effect of rising educational expenditures (Dede, 1983). Indeed, the microcomputer's impressive potential to streamline operations and increase program efficiency has already taken it out of the realm of the esoteric and made it an organizational necessity for many schools. As an instructional aid, the microcomputer is challenging established traditions of what constitutes "teaching" in the classroom environment. Many believe the computer provides a new kind of interactive medium that helps teachers manage instruction in more individualized ways, thus facilitating students' learning of important concepts (Papert, 1980; Taylor, 1980).

The decision of whether or not to implement microcomputers is a complex one, however, for one cannot assume that the innovation is uniformly useful for all individuals or all programs. Unfortunately, in this age of futuristic thinking it is tempting to view opposition to a new innovation as if it were a question of morality. Those who staunchly defend the status quo are often labeled "resisters" or "laggards" while those who are vanguards of change are considered "pioneers" (Giacquinta, 1975). These are emotionally charged terms that convey an obvious value judgment. Rogers (1983) labels this tendency to accept new technology uncritically as the "pro-innovation bias," noting that it is a subtle yet pervasive pressure that confronts all who must make adoption or rejection decisions regarding new innovations. Weinberg (1966) refers to a similar phenomenon, the "technological fix," as an overdependence on technological innovations to solve our complex social problems.

The pro-innovation bias is particularly strong when one looks at computer technology. The pressure to get on the technological bandwagon is strong even for administrators who have limited information about specific applications of the innovation. It is not difficult to see why. As Brod

(1984) notes, computers are being hailed as the most significant advance in the history of civilization, an indispensable adjunct to daily life. He states that the selection of the computer as the "Machine of the Year" by Time magazine dramatizes it as the central hero and metaphor of our time. Consequently, many individuals fear obsolescence if they do not embrace the technology. They fear they will become relics of a backward culture and viewed as old-fashioned. The problem is compounded because many administrator's have not kept pace with technological advances. Some feel that computers are infallible. Consequently, they blame themselves for their failure to grasp the intricacies of the technology and harbor reservations about their ability to implement the innovation.

This paper will examine some of the theoretical and practical issues confronting educational administrators who must make decisions regarding the implementation of microcomputers at their schools. It will first provide a conceptual framework for understanding the stages involved in the innovation decision process. It will then look at some of the attributes of innovations and the objective and subjective judgments involved in any decision to adopt new educational practices. Finally, it will examine some the factors influencing adoption decisions as well as unanticipated consequences of adopting computer technology in the educational setting.

The Innovation Decision Process

The literature dealing with the innovation decision process as it relates broadly to adopter and organizational characteristics, and more specifically to the application of computer technology, cuts across several fields and disciplines including psychology, education, communications, and organizational management. Studies vary widely in scope and conceptual clarity as well as in the assumptions they make about organizations and human behavior. In general, though, the innovation decision process has been conceptualized as a sequence of stages which characterize how individuals first become aware of a new innovative practice, form an attitude or opinion about that new practice, evaluate its merits in light of existing circumstances, and ultimately decide whether or not to adopt it. If the decision is affirmative, then implementation of that specific innovation and confirmation or reassessment of that decision follow (Rogers, 1983). Researchers such as Rogers (1983), Hall and Loucks (1975), Havelock (1973), and Ettlie (1980) have all described the innovation decision process in slightly different ways, but the sequential stages in their models seem to reflect a similar pattern. Figure 1 is a synthesis of these stage-model conceptualizations depicting five steps in the innovation decision process.

Insert Figure 1 about here

The stage-model approach is an appealing way to conceptualize the decision process because it rests on the assumption that there is a progression of identifiable phases or categories of behaviors which bring the individual (or organization) closer to an ultimate decision. But detailing the stages in the innovation decision process provides more than heuristic value for understanding the sequence of events in implementing an innovation. Not all individuals in a social system adopt innovations at the same rate. Therefore, the stage model also has value for assessing the degree of innovativeness exhibited by an individual or an organization. "Innovativeness," as Rogers (1983) explains, is a relative dimension. It is essentially the degree to which an individual is relatively earlier in adopting new ideas when compared to others in the social system.

Evidence supporting the broad outlines of the stage model is found in several studies. For example, in a study of 34 innovations, Ettlie (1980) found that the stage model adequately described the decision making sequence in about 60% of the cases studied. In an educational context, LaMar (1966) found that a sample of over two hundred teachers reported that their experience of adopting innovative educational practices proceeded through a sequence of stages, as did a sample of 58 superintendents in a study conducted by Kohl (1966).

Attributes of the Innovation

Embodied in the innovation decision process is the assumption that the individual responsible for the adoption/rejection decision weighs alternatives to discern the relative advantages of a particular innovation over existing practices or other potential innovations. These alternatives generally center on various attributes of the innovation and thus serve as incentives for adoption. The individual's perceptions of these attributes are of considerable importance because they help explain why some innovations enjoy rapid and widespread dissemination, others fade to obscurity, and still others evoke such strong resistance.

Drawing predominantly on the work of Zaltman and Lin (1971), Rogers (1983), and Fliegel and Kivlin (1966), it is possible to develop a taxonomy of some of the characteristics used to evaluate microcomputers as a type of innovation. Taken together these attributes represent a fairly comprehensive set of criteria for making adoption decisions.

Cost-effectiveness. Cost is clearly a critical factor for innovations involving technological hardware. Economic considerations also involve more than initial capital investment when supplies and ongoing maintenance may be an issue. Cost-effectiveness is a relative attribute and is generally assessed in relation to other variables such as increased output or reduced operating costs.

Social approval. Social approval is a non-economic attribute associated with the status and prestige that different innovations confer. It is interesting to hypothesize about the potential ramifications of social approval and status with respect to computer technology. Sproull (1983) maintains that when you introduce people to computing, you do more than simply give them the skills to use a new kind of machine. You are also introducing them to a whole new culture -- a culture with its own jargon and mega bits and bytes, its own social network, and its own code of ethics. The aura associated with microcomputers may well be a very potent influence on the adoption decisions made by school administrators.

Complexity. Some innovations are readily understood; others are more complicated. Microcomputers, in particular, are usually regarded as a technically complex innovation, requiring specialized skills such as typing, problem solving, logical thinking, and the ability to abstract operations.

Efficiency. Efficiency is a broad attribute that can be measured both in terms of time saved and the avoidance of discomfort. With respect to computers, increased efficiency appears to be one of the strongest motivators for individuals considering the technology for managerial uses.

Trialability. The degree to which an innovation can be experimented with on a limited basis before full-scale adoption also influences adoption decisions. Trialability reduces the uncertainty associated with complex or costly innovations.

Observability. The degree to which the results of implementation are visible to others also has an impact on adoption decisions. Generally, the easier it is for individuals to see the results of an innovation, the more likely it is that it will stimulate peer discussion.

Communicabilty. Communicability is the extent to which an innovation can be easily explained or demonstrated to others, particularly to a novice in a learning situation. It is easy to see how the communicability attribute overlaps with the complexity criterion. Innovations that are difficult to master are generally also more difficult to teach others to use.

Compatibility. The individual's present values and past experiences have a considerable influence on adoption decisions. If an innovation is too incongruent with current practices, it may be perceived as unacceptable.

Terminality and Reversibility. This final characteristic relates to the finality of the adoption decision. Innovations that are more easily reversed are more apt to be adopted.

It is important to underscore the salience of individual differences in people's perceptions with respect to these innovation attributes. What may appear to be a simple and easily understood innovation to one person may seem like a highly complex and intimidating one to another. Even so, microcomputers present somewhat of an enigma when one looks a their broad appeal. Microcomputers do not fit the standard paradigm of what constitutes a readily accepted and easily implemented type of innovation. They require specialized skills and they are complex, difficult to communicate to novices, and not easily reversed without considerable cost.

The Nature of Adoption and Rejection Decisions

It is the program administrator who is the catalyst that senses the need for change, sets the pace for the change process, and then monitors its progress as each new idea is translated into a program of action (McGeown, 979). But in deciding on an appropriate course of action with respect to the adoption of any innovation, the administrator is caught in a double bind with two conflicting responsibilities. On the one hand, there is a need to maintain the status quo to ensure continuity and stability in the program. On the other hand, there is a need to incorporate change so that program performs more effectively and educational goals are enhanced (Havelock, 1973). A certain degree of risk is involved in either strategy, of course. Administrators do not want to be viewed as antiquated in their methods and techniques nor do they want to create unnecessary turbulence in their programs by adopting unsound educational practices. It is not difficult to see why the logical reaction to potential change takes on a conservative thrust. Individuals are often reluctant to risk trading established imperfect order for possible disorder.

Judicious decisions regarding the adoption of a new educational innovation involve both objective and subjective elements. Together these serve as incentives for implementing a selected new practice. In an objective fashion, the administrator assembles information regarding the opinions and experiences of others in an effort to systematically evaluate the merits of an innovation given the unique set of circumstances in that individual's school. Questions of technical knowledge, work load, requisite skills, and educational goals and objectives are often dealt with in this objective manner. Issues pertaining to the cost effectiveness of a new practice, the time involved in implementing the innovation, the degree of difficulty or complexity in comprehending and communicating it, and the anticipated positive and negative outcomes all play an important role in this decision-making process.

Administrators also rely on their subjective intuitions and emotional reactions to a proposed innovation when deciding on an appropriate course of action. Emotionally-laden attitudes, those gut feelings about new experiences, can be strong motivators in situations calling for innovation acceptance or rejection.

Any attempt to understand the nature of resistance to a technological innovation such as microcomputers cannot ignore the power of emotions in regulating behavior. Computers have been stereotyped as being the antithesis of what it means to be human. They are portrayed in the popular media as being cold steel structures able to perform incredible feats with lightning speed (Barger, 1983). Consequently, computers often elicit strong emotional reactions -- people frequently either mistrust and fear them or they have a strong appreciation and respect for the technology (Lee, 1970; Rohner & Simonson, 1980).

Some recent research suggests that these dichotomous emotional reactions are not necessarily mutually exclusive. Raub (1981), points out, for example, that it may well be possible for an individual to have a high respect and appreciation for the capabilities of the computers and at the same time exhibit a strong anxiety about personally interacting with the technology.

Factors Influencing the Adoption of Microcomputers

There are many interrelating factors that can influence administrator's behavior with respect to adoption/rejection decisions about computer technology. The results of previous research (Jorde, 1985) indicate that eight personal and contextual variables appear to provide significant explanatory power in predicting innovation-acceptance behavior. These factors are:

Self-efficacy Expectations. Self-efficacy is concerned with judgments about how well one can organize and execute courses of action required to deal with prospective situations that contain ambiguous, unpredictable, and often stressful elements. These judgments are important because self-percepts affect not only the course of action that people pursue, but also their thought patterns and the emotional arousal they experience.

Experience with and Knowledge about Computers. Both direct and vicarious experiences are important in shaping expectations for success with respect to any new experience. This appears to be particularly true with computer technology. Since experience and knowledge go hand in hand, individuals with greater experience have more information and thus are better able to make informed decisions with respect to adoption of microcomputers.

Self-Perception of Innovativeness. Self-reports have been shown to be a consistently good predictor of behavior. The self-perception administrators hold with respect to the various dimensions of innovativeness (e.g., risk-propensity, creativity, conformity, flexibility) also provide a reasonably accurate predictor of innovation-acceptance behavior with respect to the adoption of microcomputers.

Previous Experience with Educational Innovations. An individual's past experiences with other types of educational innovations also appear to be an important indicator of general willingness to adopt microcomputers. The predictive power here is not as strong as it is with the other variables, though. It is possible that innovativeness is a situation-specific rather than a general construct.

Degree of Support and Encouragement. Support and encouragement can be strong motivators for pursuing a particular course of action, particularly in a situation where associated risks may be perceived as high and where the innovation itself perceived as complex.

Professional Orientation. The extent to which educational organizations change and are receptive to new ideas depends in large part upon the professional orientation of those involved in the planning. Professional orientation is characterized as an emphasis on research and change, skill based primarly on knowledge, the achievement of goals, rules stated as alternatives, and loyalty to clients and professional associations.

Gender. As a result of pervasive, cultural sex-role stereotyping, and other socializing influences, females often have reservations about their own competencies with activities typically associated with males. Females are also more risk-averse and show lower levels of innovative behavior.

Educational Background in Math and Science. Gender issues also relate to the amount of encouragement one has had to pursue coursework in math and science. Because computer technology is so closely related to math and science, it is not surprising that individuals who have had extended educational opportunities in this area would feel more comfortable with adopting a innovation such as microcomputers.

Unanticipated Consequences of Implementing Microcomputers

It is interesting to note that researchers have given little attention to the topic of the consequences of innovation adoption. There is often an underlying assumption that the adoption of a new practice will produce only beneficial results. Rogers (1983) believes that this assumption may not always be valid. He states that the consequences of innovation adoption depend upon whether the changes are recognized and intended by the individual or latent and unintended. The consequences of adopting most educational innovations are usually mixed and the implementation of microcomputers appears to be no exception.

Virtually all individuals experience some kind of frustration in their attempts to use a microcomputers. Negative experiences most often relate to the bewildering array of software available, the poor documentation accompanying software, and the unsubstantiated claims made by salespeople. Unanticipated costs associated with hardware, software, and the maintenance of equipment are also a surprise to many directors. For example, purchase of new hardware often leads to the purchase of new furniture to accommodate the equipment. In addition, few administrators anticipate other associated costs like increased insurance coverage or new security measures to insure the safety of the equipment.

Unanticipated consequences need not always be negative. For example, when microcomputers were first introduced into classroom environments, many educators feared the technology might have a detrimental effect on the social development of children. Deck (1982) states that many people envisioned a scenario where students would be totally isolated from human interaction during learning and as a result become robot-like, unsocialized, and conformists. A review of recent research in the area confirms that this stereotype is probably unfounded. Muller and Perlmutter (1984) found, for example, that children engage in cooperative problem-solving and peer instruction at the computer. While there is still much to be learned about the effects of computers on children's cognitive and social development, it appears that the microcomputer as an educational tool may well enhance social interaction and facilitate cooperative problem-solving in the classroom.

Perhaps the most common unanticipated consequence noted by administrators is the time element involved in the implementation process. Expectations that this complex transition will somehow take place overnight are not uncommon. Adjusting to lowered expectations regarding the time needed to gain familiarity in using the microcomputer and training others to use it often results in frustration.

The implementation of computer technology may also result in the redefinition of the use of time as it relates to the administrator's role and responsibilities. Although time is saved on specific tasks, many principals have found that their work as a whole tends to proliferate after the adoption of a microcomputer. This is because new kinds of jobs are done that were not previously possible. Thus, the microcomputer serves as both a labor-saving device and a labor-making device. Budget updates, enrollment projections, and other administrative reports that were commonly produced monthly or annually can now be done weekly. Joiner (1982) addresses this problem noting that with the introduction of microcomputers, a new kind of information problem has evolved -- the inability to manipulate and derive sense from information rather than an inability to store it. He believes an overabundance of data in undigested form can ·alyze the planning process. The result can be sheer information pollution -- too much data with little idea of what to do with it. Moreover, in many cases the computer also changes inner standards of perfection. Since it is easier to make small deletions, changes, and insertions in working drafts of correspondence and reports, many administrators find that they have changed their inner expectations of what is acceptable.

Brod (1984) discusses the ramifications of these changes in the context of becoming a technocentered society. He believes that our fascination with the computer echoes our fascination with our own power to achieve. We see the computer as an extension of the human brain, yet better, faster, and without limits. Brod goes on to say that some individuals have unfortunately developed an unhealthy dependence on the technology. They have unwittingly internalized the computer's standards as their own and have come to expect from people the perfection, accuracy, and speed to which computers have made them accustomed. They have grown impatient with human imperfection, and their administrative style has become an extension of the machine model. In other words, they have lost the essence of what it means to be human as they "interface" with people in their daily interactions. Brod paints a very bleak picture of our technological future both in terms of individual consequences and societal consequences. While he may be overstating the negative aspects of the technology and downplaying the many benefits of adoption, it is clear that there are important issues related to the consequences of implementation that warrant further research.

One such issue that needs to be addressed is the physical and psychological consequences of prolonged computer use. Here research must look at some of the easily recognizable stress reactions of interacting with electronic media over an extended period of time. Symptoms such as blurry vision and eye strain, fatigue, headaches, and musculoskeletal aches and pains are serious and need to be more fully understood. In adults these symptoms may contribute to increased levels of stress and job dissatisfaction. For children whose bodies are still growing and developing, these physical reactions may well have a more permanent, detrimental effect.

The psychological consequences of prolonged computer use are more subtle and difficult to detect. One key factor that needs to be examined is the distorted sense of time that many computer users experience. Days, hours, and minutes take on a new meaning as time is compressed and accelerated. The recognition of what is humanly possible also changes. Jobs that previously took days now take hours. Brod (1984) cautions that the result of this may be increased psychological pressure and mental overload. As individuals internalize the rapid, instant-access mode of computer operations, their inner sense of time may become distorted to accommodate the machine. For adults this kind of accelerated tempo may create increased mental pressure and stress on the job. For children this altered sense of time may also change attitudes toward traditional learning media such as books that require a slower pace and deeper reflection.

Another consequence of implementing computer technology that needs to be explored is the changing perception of the educators' role and the interpersonal interaction behaviors of computer users. Teachers and administrators generally enter the field of education because they are people-oriented. As computer technology takes hold in the classroom and in the school office it will be important to learn if the educator's traditional helping role is changing and if those changes arc positive ones.

Linking Theory To Practice

Addressing some of the issues involved in the adoption of an innovation such as microcomputers links theory to practice in a very useful and pragmatic way. It may be possible, for example, to systematically provide preservice and inservice professional guidance for teachers and administrators that will give them a greater awareness of the some of the issues involved in adopting educational technology. Such guidance can also help educators understand personal factors that facilitate or impede acceptance of change. Reddin (1970) stresses, for example, that when people understand why they resist change, their resistance usually decreases or at least becomes more rational. Resistance, he states, is often a symptom of something else; fear of the unknown, fear of failure, or an unwillingness to alter the status quo. Moreover, the real reasons for rejecting technology may not be acknowledged or even within a person's awareness.

Uncovering these reasons and discussing them openly may help individuals better understand their reactions to new innovations and cope with organizational change in healthy and constructive ways.

Teachers and administrators need a forum to discuss the issues surrounding organizational change. They also need a support network that provides counsel, encouragement, and guidance to carefully evaluate new practices. Such a support network can temper the pro-innovation bias by promoting a healthy skepticism about new technology. It may also reduce stress and anxiety about change.

Programs must adapt and change, but they must also not accept uncritically all change as good. Rather, administrators must evaluate, assess, and then incorporate change in the most appropriate way given the needs of the organization and the individuals involved. Armed with concrete information that separates fact from fantasy, administrators can begin to objectively assess the merits of selected educational innovations and identify clearly the economic, social, and psychological costs of implementing those innovations.

References

Baldridge, J. (1975). Organizational innovation: Individual, structural, and environmental impacts. In J. Baldridge & T. Deal (Eds.), Managing change in educational organizations. Berkeley: McCutchan.

Bandura, A. (1981). Self-referent thought: A developmental analysis of self-efficacy. In J. H. Flavell & L. Ross (Eds.), Social cognitive development: Frontiers and possible futures. Cambridge: Cambridge University Press, 200-239.

Bandura, A. (1982). Self-efficacy mechanism in human agency. American Psychologist, 37, 122-147.

Berman, P., & McLaughlin, M. (1975). Federal programs supporting educational change. Santa Monica, CA: Rand Corporation.

Barger, R. (1983, May). The computer as a humanizing influence in education. Technological Horizons in Education, 109-111.

Brod, C. (1984). Technostress. Menlo Park, CA: Addison Wesley.

Corwin, R. (1975). Innovations in organizations: The case of schools. Sociology of Education, 48, 1-37.

Deck, L. (1984, January). American schools and the adaptation of computer technology. Educational Computer Magazine, 24-26.

Dede, C. (1983, September). The likely revolution of computer use in schools. Educational Leadership, 22-24.

Eichholz, G., & Rogers, E. (1964). Resistance to adoption of audio-visual aids by elementary school teachers. In M. Miles (Ed.), Innovation in education. New York: Columbia University.

Estes, N., & Watkins, K. (1983, September). Implications of the microcomputer for educational administrators. Educational Leadership, 28-29.

Ettlie, J. (1980). Adequacy of stage models for decisions on adoption of innovation. Psychological Reports, 46, 991-995.

Fliegel, F., & Kivlin, J. (1966). Attributes of innovation as factors in diffusion. American Journal of Sociology, 72, 235-248.

Giacquinta, J. (1975). Status risk-taking: A central issue in the initiation and implementation of public school innovation. Journal of Research and Development in Education, 9, 102-114.

Hall, G., & Loucks, S. (1975). Levels of use of the innovations: A framework for analyzing innovations adoption. Journal of Teacher Education, 26, 52-56.

Havelock, R. G. (1973). The change agent's guide to innovation in education. Englewood Cliffs, NJ: Educational Technology Publications.

Joiner, L. (1982). Microcomputers in education: A nontechnical guide to inservice and school management. Kalamazoo, MI: Learning Publications.

Jorde, P. (1985). Factors influencing administrators' innovation-adoption decisions. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, Illinois.

Kohl, J. (1966). Adoption stages and perceptions of characteristics of educational innovations. Unpublished doctoral dissertation, Univeristy of Oregon.

LaMar, R. (1966). In-service education needs related to the diffusion of an innovation. Unpublished doctoral dissertation, University of California, Berkeley.

Lawrence, P. (1954). How to deal with resistance to change. Harvard Business Review, 32, 49-57.

Lee, R. (1970). Social attitudes and the computer revolution. Public Opinion Quarterly, 34, 53-59.

McGeown, V. (1979). School principals' decision-making behaviour in the management of innovation. CORE, 3(2), 1-26.

McIsaac, D. (1979). Impact of personal computing on education. AEDS Journal, 13, 7-15.

Melmed, A. (1983, February). Productivity and technology in education. Educational Leadership, 4-9.

Minnesota Educational Computing Consortium (MECC). (1980). A study of computer use and literacy in science education, 1978-1980. St. Paul, MN: MECC.

Molnar, A. (1978). The next great crisis in American education: Computer literacy. Journal of Technical Horizons in Education, 5(4), 35-38.

Muller, A., & Perlmutter, M. (1983). Preschool children's problem-solving interaction at computers and jigsaw puzzles." Unpublished manuscript, Institute of Child Development, University of Minnesota.

Office of Technology Assessment. (1982). Informational technology and its impact on American education (OTA #052-003-00-888-2). Washington, DC: U. S. Government Printing Office.

Papert, S. (1980). Mindstorms: Children, computers, and powerful ideas. New York: Basic Books.

Raub, A. C. (1981). Correlates of computer anxiety in college students. Unpublished doctoral dissertation, University of Pennsylvania.

Reddin, W. J. (1970). Managerial effectiveness. New York: McGraw-Hill.

Rogers, E. (1983). Diffusion of innovations (3rd ed.). New York: The Free Press.

Rohner, D., & Simonson, M. (1980). Development of an index of computer anxiety. Clear Lake, Iowa: Northern Trails Area Education Agency. ERIC Document Reproduction Service No. ED 207 512.

Sproull, L. (1983, March). Encountering the culture of computing. Paper presented at the Western College Association Annual Meeting, Berkeley.

Taylor, R. (Ed.). (1980). The computer in the school: Tutor, tool, tutee. New York: Teacher's College Press.

Weinberg, A. (1966, October). Can technology replace social engineering? University of Chicago Magazine, 59, 6-7.

Zaltman, G., & Lin, I. (1971). On the nature of innovations. American Behavioral Scientist, 14, 651-673.

THE INNOVATION DECISION PROCESS

Figure 1