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ABSTRACT

This study sought to determine the role that perceptions played in the adoption of an instructional innovation. According to current diffusion theories, an innovation is more likely to be adopted if potential adopters have favorable perceptions in regard to its complexity, compatibility, relative advantage, observability, and trialability. Three computer-based learning (CBL) modules represented the innovation in this study. These modules were developed for use in three weather forecasting agencies and were to be used as on-site training for forecasters. The research design involved the use of questionnaires and interviews to determine the perceptions of the potential adopters in regard to the CBL modules. A total of 29 potential adopters were interviewed for this study. Results showed that potential adopters consistently used three of the attributes listed above to discuss their perception of the innovation. The researchers concluded that compatibility, complexity, and relative advantage can be important considerations when introducing an innovation into instructional settings. The researchers also concluded that Rogers (1983) theory of perceived attributes can be a valuable tool for instructional developers working to increase the utilization of their products. (Contains 22 references.) (Author/JLB)

The Role of Perceptions in the Adoption of Computer-Based Learning

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Running head: ROLE OF PERCEPTIONS IN ADOPTION OF CBL

Abstract

This study sought to determine the role that perceptions played in the adoption of an instructional innovation. According to current diffusion theories, an innovation is more likely to be adopted if potential adopters have favorable perceptions in regard to its complexity, compatibility, relative advantage, observability, and trialability. Three computer-based learning modules represented the innovation in this study. Potential adopters consistently used three of the attributes listed above to discuss their perceptions of the innovation. The researchers concluded that compatibility, complexity, and relative advantage can be important considerations when introducing an innovation into instructional settings. The researchers also concluded that Rogers (1983) theory of perceived attributes can be a valuable tool for instructional developers working to increase the utilization of their products.

The Role of Perceptions in the Adoption of Computer-Based Learning

Potential adopters of innovations form their initial impressions of an innovation based upon the attributes of the innovation (Rogers, 1983). According to Rogers, all innovations can be thought of as having five general attributes: relative advantage; complexity; compatibility; observability; and trialability. If potential adopters have favorable perceptions of an innovation's attributes, then adoption of the innovation will be more likely. Many researchers (e.g., Clinton, 1972; Kivlin, 1960; Weinstein, 1986; Wyner, 1974) have examined the role that perceptions played in the adoption of various innovations. The present study builds on the previous studies by applying Rogers' theories to the products of instructional technology and computer-based instruction.

THE PROBLEM

Many of the products and practices of instructional technology have failed to make a major impact on education. Burkman (1987) writes that many endeavors which use the research-development-diffusion (RDD) paradigm suffer from a lack of utilization. Instructional technology is one endeavor that makes extensive use of the RDD paradigm. Burkman also writes that instructional technology has experienced a lack of utilization in all contexts for education and training, including primary and secondary schools, colleges and universities, and even in industry and the military. One reason for this lack of utilization could be that instructional developers do not understand and account for the perceptions of potential adopters during the development process. Referring to educational technologists in general, Dalton (1989) writes that "although we can fill instructional gaps with fervor, we never seem to examine our solutions in light of the wants of the implementors" (p. 22). Instructional developers commonly believe that products which result in more "effective and efficient" instruction will automatically be attractive to potential adopters (Burkman, 1987). Ralph W. Tyler (1980) writes "many developers of technology accept the view that as time passes, there will be increasing use of the innovation until it has become a common element in school practice" (p. 11). From these statements, we can see that many developers assume that if they develop more effective instruction, adoption and diffusion will follow in time. This might be a false assumption.

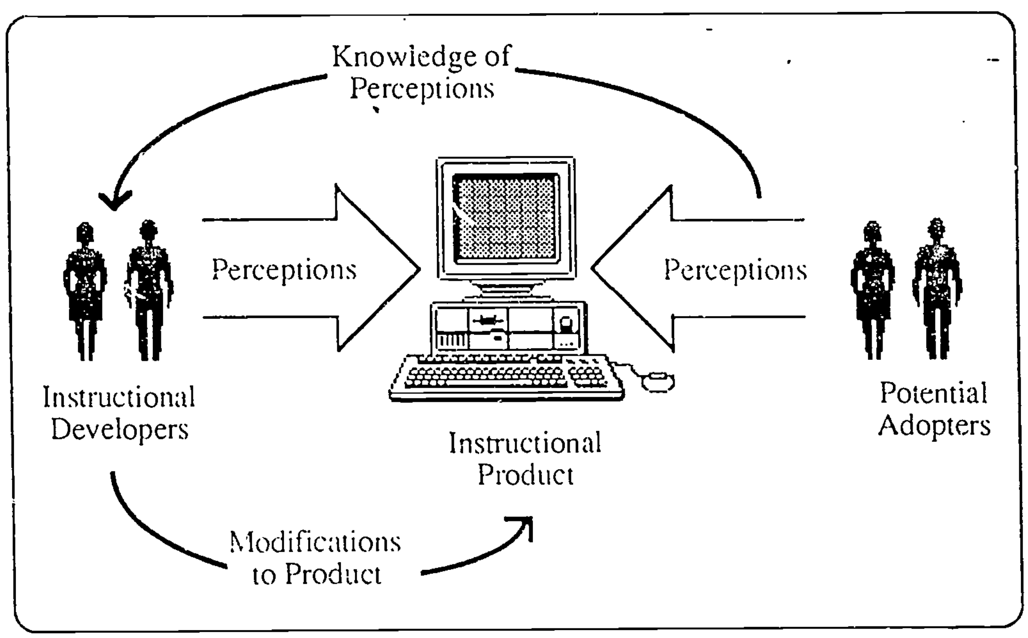

Figure 1. A model showing how knowledge of perceptions could affect the development of an instructional product.

Burkman (1987) writes that a more user-oriented approach to instructional development is needed to increase utilization. He adds that, as part of this user-oriented approach, instructional developers must seek to understand and positively manipulate the perceptions of potential adopters in regard to the attributes outlined by Rogers (1983). A user-oriented approach, one that seeks to understand and take into account the perceptions of potential adopters, might lead to the increased use of instructional innovations.

Figure 1 is a model showing how knowledge of the perceptions of potential adopters might result in modifications to an instructional product. These modifications, in turn, might lead to changes in the perceptions of potential adopters in regard to the product. This process of development, knowledge gaining, and modification would result in the circular model depicted in Figure 1. The use of such a model by instructional developers could lead to the increased adoption and use of their instructional products

CONTEXT

The study described here was part of an evaluation study of three multi-media computer-based learning (CBL) modules. These modules were developed for use in three weather forecasting agencies. The three modules investigated in this study represented the first in a series of twenty-one modules to be developed for the agencies. The modules were to be used as on-site training for forecasters in each of the three agencies. Computer delivery and independent study were intended to enhance opportunities for realistic study of forecasting knowledge and skills. The modules were an innovative method of training offered on-site to weather forecasters. The purpose of the overall evaluation was to determine how the content, strategies, procedures, and implementation of the modules might be modified to enhance cognitive and affective outcomes. Information gathered in the evaluation of the first three modules would be used to inform the design of succeeding modules.

The adoption situation examined in this study was somewhat unique because there were two groups of potential adopters. The operational forecasters in the field who would use the modules were one group of potential adopters. The organizations that commissioned the production of the modules were the other group of potential adopters. In order for the CBL modules to be fully utilized, it was necessary for both groups to adopt the modules. For purposes of this study, the forecasters were the potential adopter group whose perceptions were examined by the researcher. The forecasters' perceptions were selected because the forecasters were the intended end users of the modules. Examining the perceptions of the end users linked the present study more directly to Burkman's (1987) suggestion that a more user-oriented approach to instructional development could increase adoption of the innovation.

This study sought to answer four research questions:

1) What were the perceptions of the weather forecasters in regard to the relative advantage, complexity, compatibility, trialability, and observability of the computer-based learning modules?
2) Which perceptions of potential adopters were strongest or had the most impact upon the adoption of the computer-based learning modules?
3) Do the results of the study support the theory of perceived attributes put forth by Rogers (1983)?
4) Is Burkman's hypothesis of user-centered instructional design supported by the adoption situation examined in this study?

REVIEW OF THE LITERATURE

This study is based upon three key literature sources. The first, and primary source, is E.M. Rogers' writings related to the communication and diffusion of innovations. Chief among these writings are Rogers (1983) *Diffusion of Innovations* (3rd edition) and Rogers and Shoemaker (1971) *Communication of Innovations: A Cross-Cultural Approach* (2nd edition). These books provide the theoretical basis for many of the studies cited in this review, especially those studies primarily concerned with the perceived attributes of an innovation.

The model described by E.M. Rogers is widely recognized as a comprehensive model of innovation diffusion. Rogers' *Diffusion of Innovations* (1983) presents an informative account of the process of innovation development, including the principle that pre-diffusion activities, such as development, play an important role in the diffusion of an innovation. Rogers and Shoemaker's (1971) *Communication of Innovations: A Cross-Cultural Approach* (2nd edition.) is important for two reasons. The first reason is its large bibliography related to the diffusion of innovations cross-referenced by each of 103 generalizations. The second reason is that it is among the first works to comprehensively discuss the many factors which influence an innovation's rate of adoption.

The second literature source upon which this study is based is Earnest Burkman's (1987) chapter entitled "Factors Affecting Utilization" that appears in *Instructional Technology: Foundations* (Gagné, 1987). In this chapter, Burkman calls for a more user-oriented approach to instructional design. Part of this new approach calls for instructional designers to determine the attributes most important to potential adopters, and, based upon that knowledge, to design products that present positive perceptions of those attributes (Burkman, 1987).

The third key literature source that serves as a basis for the present study is the body of research related to the perceived attributes of innovations. Hurt and Hibbard (1989) write that "it is well-documented in the diffusion research that the characteristics of innovations as perceived by potential adopters play a critical role on the rate of acceleration of the adoption curve" (p. 214). Many of the studies cited in this review were based directly on Rogers' theory of perceived attributes.

The first large-scale studies to examine the relationship between perceptions and an innovation's rate of adoption took place in the early 1960s. The chief investigators of the relationship at that time were Joseph Kivlin and Frederick Fliegel. The investigators, who primarily examined the perceptions of farmers in regard to numerous agricultural innovations, conducted several of the seminal studies (Kivlin, 1960; Fliegel & Kivlin, 1966; Kivlin & Fliegel, 1967a; Kivlin & Fliegel, 1967b). Kivlin (1960) found that relative advantage, complexity, and mechanical attraction were the attributes most significantly related to innovation adoption for farmers he studied. Fliegel and Kivlin (1966) studied the perceptions of the same farmers as Kivlin's 1960 study and found that trialability was the most significant attribute related to adoption. Relative advantage, one of the most significant attributes in the earlier study, emerged as the second most significant attribute in the 1966 study.

Kivlin and Fliegel (1967a) studied the different perceptions that small-scale farmers and middle-scale farmers had in regard to various agricultural innovations. They concluded that the difference in the rate of adoption between the two groups was not only a "function of production scale but also . . . a result of differences in perceptions" (p. 90). Another study by Kivlin and Fliegel during this period (1967b) found that relative advantage was the most influential attribute related to rate of adoption.

Clinton (1972) studied the role that perceived attributes played in the acceptance of innovations by 337 teachers in Canada. He found that teachers categorized innovations according to the attributes they perceived and that the actual acceptance of the innovation depended upon the perceived attributes. Clinton arrived at two major conclusions. The first was that how teachers perceived an innovation was as important as the innovation itself. The second was that innovation is, during its early stages, a mental process not a physical act.

Wyner (1974) used attributes to study teachers' perceptions in regard to an educational innovation in an elementary school. She concluded that the perceptions of those who use an innovation can provide valuable data to change agents. Hahn (1974) studied the perceptions of over 200 high school teachers in regard to educational innovations. Observability was the attribute that was most significantly related to the adoption of an innovation in Hahn's study. Holloway (1977) studied the perceptions of high school principals in regard to an educational innovation. He found that relative advantage and compatibility were the attri butes most influential in the principals' adoption decisions. Holloway's results are similar to educational innovation studies by Moallemian (1984) and Eads (1984). Moallemian found that perceptions of relative advantage and trialability had significant influence upon an innovation's rate of adoption by college instructors. Eads, however, found that compatibility was the most influential attribute for students and administrators.

Allan and Wolf (1978) analyzed the perceptions of 100 innovative educators. Their study suggests that the attributes of Rogers and Shoemaker (1971) may not be applicable to educational settings. Allan and Wolf found that only complexity had a significant influence on the likely adoption of educational innovations. They conclude by writing: "Results of this investigation . . . suggested innovation attributes selected for study provided marginal insight into adoption of educational innovations" (p. 336). This was the only published study found in this review that suggested perceived attributes had little influence on the adoption process.

Rogers, Daley, and Wu (1982) studied the diffusion of home computers. They determined that perceptions of relative advantage, compatibility, observability, and trialability were important, positive influences on their subjects' adoption decisions. Complexity and cost were found to be important, negative factors in the adoption decisions. That is, the more complex and expensive computers were perceived to be, the less likely they were to be adopted.

In 1985, Dozier examined how the perceived attributes of electronic text might influence the diffusion and adoption of that innovation. Dozier writes, based on his own review of the literature, that "prior research indicates that perceived attributes are powerful predictors of adoption" (p.18). He adds that perceived attributes of an innovation "particularly its relative advantage, provide the energy needed to overcome thresholds or barriers to adoption" (p. 49).

Kehr (1986) studied the diffusion of personal computers among 412 full-time faculty members in college level business administration and teacher education programs. Cost was the most important adoption consideration for both groups, followed by the perceived attributes of the product. Weinstein (1986) studied the perceptions of civilian and military educators. He found that, for both groups, the attributes of relative advantage, trialability, compatibility and observability were positively correlated with adoption, while the attribute of complexity was negatively correlated. Weinstein concluded that perceptions play an important role in the adoption decisions of both military and civilian educators.

Most of the studies found in this review of the literature found that the perceptions of potential adopters played an important role in the adoption of innovations. The majority of studies cited here found that relative advantage was the most important perception for their potential adopter groups. In addition, each of the other four attributes was found to be an important perception in at least one adoption situation. The results of this literature review support Rogers' (1983) and Burkman's (1987) hypotheses that perceived attributes play an important role in the adoption of an innovation.

METHODOLOGY

The research design employed in this study involved the use of questionnaires and interviews. Questionnaires and interviews are two of the most commonly-used methods of data gathering in studies related to diffusion research in the field of education (Rogers and Shoemaker, 1971). The questionnaire and interview protocol were designed to determine the perceptions of the potential adopters in regard to the CBL modules when the modules were first introduced at the forecasting sites.

An interview guide was used to focus the content of all the interviews. The guide began with broad questions that sought to determine the forecasters' overall impressions of the modules. The scope of the questions was gradually narrowed until they asked specifically about each of the five attributes identified by Rogers (1983).

Potential adopters at each of six forecasting sites where the CBL modules were in use at the time of the study were selected for the interviews. The forecasting sites represented a geographically diverse population and included both military and civilian settings. The researchers attempted to interview all of the potential adopters who had used any of the three CBL modules at the six sites. A total of twenty-nine potential adopters were interviewed for this study. All interviews were conducted in person by one of the researchers at the forecasting sites.

All forecasters who had used at least one of the CBL modules at each of the six forecasting sites were selected to complete the potential adopters' questionnaire. The questionnaire included a series of statements related to each of the five attributes of an innovation identified by Rogers (1983). Potential adopters were asked to respond to each statement with a five point scale ranging from "Strongly Agree" to "Strongly Disagree." Questionnaire data were collected from a total of 32 potential adopters of the CBL modules.

RESULTS

Potential Adopter Questionnaire Data

Questionnaires were distributed to the six operational forecasting sites included in this study. A total of thirty-two completed questionnaires were received from five of the forecasting sites. While thirty-two questionnaires represent a minority of all the forecasters who work at the six sites, they represent a majority of the forecasters who had used the modules at the time for the study. The researchers estimate that between 40 and 45 forecasters had used at least one of the modules at the time of the study.

Relative Advantage

Relative advantage is defined as the extent to which an instructional innovation is seen as being superior to, or an improvement over, existing or competing products. The questionnaire contained six items related to relative advantage. The responses to the six questionnaire items referring to relative advantage are reported in Table 1.

As shown in Table 1, responses to the questionnaire items on relative advantage were mostly positive. For example, 84.4% of the forecasters reported that they agreed or strongly agreed the modules "are a better way to do on-site training than the way we used to do on-site training."

Also, 75.1% of the forecasters agreed or strongly agreed with the statement "I enjoy on-site training a lot more now than I did before we had the modules."

Table 1

Responses to Statements Related to Relative Advantage

Statement	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
The modules are a better way to do on-site training than the way we used to do on-site training.	34.4%	50%	12.5%	3.1%	0%
I enjoy on-site training a lot more now than I did before we had the modules.	18.8%	56.3%	21.9%	3.1%	0%
I am really looking forward to using future modles.	15.6%	59.4%	21.9%	0%	3.1%
I think the modules are effective training tools.	25%	56.3%	15.6%	3.1%	0%
The modules are valuable training tools.	18.8%	65.7%	15.6%	0%	0%
I think computer based training is the best way for us to receive on site training.	15.6%	40.6%	28.1%	12.5%	3.1%

Complexity

Complexity is defined as the extent to which an instructional innovation is seen as easy to use and user friendly by potential adopters. Seven items related to the perception of complexity were included on the questionnaire. The items refer primarily to the complexity of the user interface of the modules. The responses to the seven questionnaire items referring to complexity are reported in Table 2.

Table 2

Responses to Statements Related to Complexity

Statement	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
The modules are user friendly.	21.9%	46.9%	9.4%	18.8%	3.1%
The directions are adequate for me to figure out what I am supposed to do.	28.1%	65.7%	6.3%	0%	0%
I had no trouble learning how to use the modules.	34.4%	59.4%	3.1%	3.1%	0%
I knew when I was supposed to read, watch a video clip, or answer a question.	40.6%	50.0%	0%	9.4%	0%
Sometimes I felt lost and didn't know how to get to the next screen.	0%	18.8%	21.9%	43.8%	15.6%
It took me a long time to figure out how to use the modules.	0%	3.1%	15.6%	65.7%	15.6%
The best thing about the modules is that they are easy to use.	9.4%	53.1%	34.4%	3.1%	0%

As shown in Table 2, responses to the questionnaire items on complexity were mostly positive. For example, 68.8% of the forecasters reported that they agreed or strongly agreed the modules "are user-friendly." Also, 93.8% of the forecasters agreed or strongly agreed with the statement "I had no trouble learning how to use the modules." The responses of the survey items related to complexity show that the potential adopters in this study perceived the innovation to have a low degree of complexity.

Compatibility

Compatibility is defined as the extent to which an instructional innovation is seen as consistent with the existing values, beliefs, environment, and tools of potential adopters. Six items related to compatibility were included in the questionnaire. The items related to compatibility deal primarily with the how the modules are compatible with the forecasters' work schedule and content knowledge needs. The responses to the six questionnaire items referring to compatibility are reported in Table 3.

Table 3

Responses to Statements Related to Compatibility

Statement	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
The modules cover topics I need to know about for my job.	21.9%	56.3%	9.4%	9.4%	3.1%
Breaking the modules into 20 - 30 minute segments is a good way to organize them.	37.5%	62.5%	0%	0%	0%
The modules provide realistic training for my job.	9.4%	75%	6.3%	9.4%	0%
The format of the modules makes it easy to fit training into my schedule and workload.	18.8%	46.9%	12.5%	15.6%	6.3%
I enjoy working with computers.	28.1%	43.8%	18.8%	9.4%	0%
The best thing about the modules is that I can use them whenever I want.	15.6%	75%	9.4%	0%	0%

Very strong positive responses were given in regard to the work schedule compatibility of the modules. All 32 respondents agreed that breaking the modules into 20 to 30 minute segments was a good way to organize the modules. In another item related to work schedule compatibility, 66% of the respondents agreed that the format of the modules made the modules easy to fit into the forecasters' schedule and workload.

All 29 respondents who expressed an opinion agreed that the best thing about the modules was that they could be used whenever the forecaster wanted. Generally speaking, the responses to the items related to work schedule compatibility were the most strongly positive responses given in regard to any of the perceived attributes.

Trialability and Observability

Trialability is defined as the extent to which potential adopters may test or experiment with an instructional innovation prior to adoption. Five items related to trialability were included in the questionnaire. Observability is defined as the extent to which the benefits and outcomes of an instructional innovation can be seen by potential adopters. Seven items related to observability were included in the questionnaire.

Many potential adopters expressed "No Opinion" responses to questionnaire items related to observability and trialability. For example, 84% of the respondents expressed no opinion when asked if they had seen an improvement in their own forecasting as a result of using the modules. Half of the respondents (16 of 32) expressed no opinion when asked if they had noticed that their co-workers seemed to enjoy working with the modules.

The short period of time that the modules had been in use at the work sites is the most likely reason for the high "no opinion" responses in regard to the perception of observability. At the time the forecasters completed the questionnaire, most of the modules had only been in use at the work sites for less than a year. At several sites, in fact, module three had been in use for only a week or two at the time of this study. As for trialability, the forecasters had little say in whether the modules were tried at their worksites. The forecasting organizations selected the sites where the modules would be used. As a result, from the forecasters' view, there was no perceived trialability associated with the modules.

Potential Adopter Interview Data

Twenty-nine weather forecasters from 5 sites were interviewed for the present study. A cross case analysis, grouping the responses of the forecasters in regard to each of the five attributes, is used in this section to summarize the interview data.

Relative Advantage

The relative advantage of the computer-based learning modules was mentioned by all of the twenty-nine potential adopters interviewed for this study. Responses related to relative advantage can be grouped into two categories of advantage. The first category is that the modules are advantageous because they can be used at any time by the forecasters. The second category is that the modules are advantageous because they are more motivational and interesting than other means of training. The first category appears to be a merger of the perceptions of compatibility and relative advantage. Many potential adopters felt the modules were advantageous because the modules were compatible with the work schedule of the forecasting office while other forms of training were not.

The second category of relative advantage (Motivational and Interesting) was commonly cited by potential adopters as an important issue. Whenever any of the forecasters discussed the CBL modules in comparison to other methods of on-site training, they always mentioned that the modules were advantageous because they were more motivational and more interesting than the training alternatives. The following statements, taken from the interviews, are representative:

I enjoy working with the modules. They're more interesting than the manuals. Reading the manuals . . . you talk about dry, that's dry! But this is interactive, more interesting, that's what I like about it.

I think this is a better alternative than just sitting and reading a manual because this gives you a chance to participate. You have the pictures and animations whereas if you were reading a manual, you would get tired a lot quicker and get bored at a much quicker pace.

I think they're outstanding. These modules are different, they're interesting, you don't get bored like the other types of training.

The different types of training we've had, they're boring. These modules, they have a mix - video, animation, text. I like the mix, it makes it much more interesting.

Complexity

When given the opportunity to respond to open-ended questions about the modules, about half of the potential adopters interviewed for this study mentioned complexity as an important issue. Two typical responses are included here:

Complexity is a big issue, because when you're here on a midnight shift and something goes wrong - if you don't know how to fix it, if you hit a roadblock, then you would tend to shut the thing off and not come back to it for a couple of weeks.

What I like most about them is you can sit down and start using the training. You don't have to know how to use computers. They're very easy to use the first time - you don't have to learn how to use the modules.

One of the forecasters interviewed for this study used the open-ended questions to mention complexity as the worst aspect of the modules. This forecaster did not have substantial previous experience using computers. As a result, the forecaster found the modules to be somewhat complicated. A sample of this forecaster's comments are included:

Well, for me, they're very complicated. I'm not part of the computer generation. I'm just not comfortable with computers. I'm still learning to use them so I have that problem in addition to learning the material.

Compatibility

When given the opportunity to respond to open ended questions about the modules, all of the twenty-nine potential adopters interviewed for this study mentioned compatibility as an important issue. All twenty-nine mentioned that it was important for the modules to be compatible with the work schedule of the forecast office.

The weather is an unpredictable and capricious force. The workload in the forecasting office is largely dependent upon the current weather conditions. When the weather is favorable, forecasters can devote relatively long blocks of time to training. During times of severe weather, it maybe impossible for the forecasters to devote any time to training. Several forecasters mentioned that the weather has a major influence on how often they are able to use the modules. Sample comments related to the importance of compatibility to the forecasters are included here:

The forecaster has the opportunity when the weather is benign. When it's kind of quiet is a good time to work on the modules. He can spend 2 or 3 hours working on them.

If you have good weather (good weather evening shifts, especially) it's not too bad, you can get back there and use them. We only get scheduled about 4 extra shifts a month and we're lucky if we keep those. So, if you're going to use the modules, the best time is good weather evening shifts.

That's one of the strong points of the modules, that you can use them in 30 minute chunks of time. Most days you can keep an eye on the weather, take 30 minutes, and do the modules on shift. They're well geared to the type of job we have.

Fitting them into my schedule is a big thing, the schedule prevents me from using them as much as I'd like. When I get some free time, to be honest with you, I enjoy using them.

Trialability and Observability

When given the opportunity to respond to open ended questions about the modules, none of the twenty-nine potential adopters interviewed for this study mentioned trialability or observability as important issues. When asked specifically about the attribute of trialability, most of the forecasters reported that they were required to use the modules as part of their work and that they were not given the opportunity to experiment with the modules on a limited basis. There was, in effect, no trialability from the forecasters' standpoint. When asked specifically about the attribute of observability, none of the forecasters reported that they had seen any observable outcomes resulting from use of the CBL modules. The reason that most forecasters gave for not observing any outcomes from the module was that the modules had not been in use for very long. The modules had been in use for less than a year at most sites included in this study. Several forecasters reported that they anticipated that the modules would eventually result in observable benefits.

CONCLUSIONS

Research Question One: *What were the perceptions of the weather forecasters in regard to the relative advantage, complexity, compatibility, trialability, and observability of the computer-based learning modules?*

The potential adopters in this adoption situation had the following perceptions of the three CFL modules:

Relative Advantage - The majority of potential adopters perceived the modules to have a high degree of relative advantage compared to alternative methods of on-site training. Potential adopters consistently reported that the CBL modules were advantageous to other forms of on-site training because the modules were more interesting and could be used at any time.

Compatibility - The majority of potential adopters perceived the modules to have a high degree of compatibility. Most of the potential adopters felt the modules could be easily incorporated to the work schedule of the forecasting site. Most also commented that breaking the modules into 30-40 minute sections increased the compatibility of the modules.

Complexity - The majority of potential adopters perceived the modules to have a low degree of complexity. Many of the forecasters reported that the CBL modules were easy to use and were very "user-friendly."

Trialabiltiy - Few of the potential adopters had any perceptions of the CBL modules in terms of trialability. As stated in the previous section, the forecasters had no chance to test the modules before they were introduced into the forecasting setting. The trialability of the CBL modules, if there was any, rested with the forecasting agencies and the perceptions of the forecasting agencies were not determined for the present study.

Observablity - Few of the potential adopters had any perceptions of the CBL modules in terms of observability. As stated in the previous section, the modules had not been in use for very long at the forecasting sites at the time of this study. As a result, the forecasters had not had time to observe any tangible benefits from the modules. Several forecasters did, however, report that they anticipated to observe tangible benefits in time.

Research Question Two: *Which perceptions of potential adopters were strongest or had the most impact upon the adoption of the computer-based learning modules?*

The potential adopters in this adoption situation had the strongest perceptions in regard to the attributes of compatibility, relative advantage, and complexity. The potential adopters did not appear to have strongly held perceptions in regard to the attributes of trialability or observability. Compatibility, complexity, and relative advantage were important perceptions in the forecaster's decision to adopt or not adopt the computer-based learning modules. Trialability and observability did not emerge as important perceptions to the potential adopters.

Most forecasters reported that the compatibility of the modules in regard to their work schedule was an important factor in their decision to use the modules. Many forecasters, when asked about the best or worst aspects of the modules, mentioned compatibility.

The complexity of the user interface was also an important issue for the potential adopters. Most potential adopters reported on the questionnaires and in the interviews that the modules were user-friendly and easy to use. User-friendliness was one of the issues most commonly cited by the forecasters when discussing why they like the modules.

Relative advantage was also an important issue to the forecasters. The relative advantage of the modules, from the potential adopters' viewpoint, was that the modules were more interesting than previous training methods.

Trialability and observably were not important perceptions to the potential adopters in this adoption situation. Trialability was not an important perception because the forecasters were not given the opportunity to try the modules before they were installed at the forecasting sites. Observability was not an important issue because the modules had not been in place at the forecasting sites for very long at the time of this study. As a result, the observable benefits of the modules, if there were to be any, had not, at the time of the study, become apparent to the potential adopters of the modules.

Research Question Three: *Do the results of the study support the theory of perceived attributes put forth by Rogers (1983)?*

The theory of perceived attributes (Rogers, 1983) is supported by the results of this study. The large majority of potential adopters discussed their opinions of the CBL modules in terms of the attributes defined by Rogers. When given the opportunity to respond to open-ended questions about the best and worst aspects of the modules, most of the forecasters described issues of compatibility, complexity, and relative advantage. Later, when asked specifically about each of the attributes, most of the forecasters agreed that compatibility, complexity, and relative advantage were important considerations in their decisions about use of the modules.

Research Question Four: *Is Burkman's hypothesis of user-centered instructional design supported by the adoption situation examined in this study?*

Burkman's (1987) hypothesis that instructional developers can increase the utilization of their products by determining and accounting for the perceptions of potential adopters is supported by the adoption situation examined in this study. The potential adopters in this study had identifiable and strongly-held perceptions of three of the five attributes. Also, most of the potential adopters reported that their perceptions of compatibility, complexity and relative advantage played an important role in their willingness to incorporate the modules into their training.

RECOMMENDATIONS

The findings resulting from the analysis of interviews with potential adopters and the potential adopter questionnaire lead the researchers to the following seven recommendations:

1. Developers of computer-based instruction should seek to determine the perceptions of potential adopters in regard to the compatibility, complexity, and relative advantage of their computer-based learning modules.

2. Developers of computer-based instruction should seek to develop modules that offer a high degree of compatibility from the potential adopters' viewpoint.

3. Developers of computer-based instruction should seek to develop modules that offer a high degree of relative advantage from the potential adopters' viewpoint.

4. Developers of computer-based instruction should seek to develop modules that offer a low degree of complexity from the potential adopters' viewpoint.

5. Developers of computer-based instruction should consider developing modules that offer observable benefits from the potential adopters' viewpoint. Even though observability did not emerge as an important perception in this study, a review of the research (Hahn, 1974; Rogers, Daley, & Wu, 1982) suggests observability can be an important perception.

6. Developers of computer-based instruction should consider developing modules that offer a degree of trialability from the potential adopters' viewpoint. Even though trialability did not emerge as an important perception in this study, a review of the research (Fliegel & Kivlin, 1966) suggests trialability can be an important perception.

7. Developers of computer-based instruction should incorporate the Burkman's (1987) User-Oriented Development Model into their instructional development processes.

IN CONCLUSION

One of the major problems that instructional technologists face is that the products of instructional technology have not found wide acceptance. The underlying assumption of this study is that instructional developers can increase the acceptance of their products by determining and accounting for the perceptions of potential adopters in the development process.

The perceptions identified by E.M. Rogers were important to the potential adopters in this study. All of the potential adopters interviewed in this study used at least one of the attributes identified by Rogers to describe the modules. The language of Rogers was very much a part of the language of the potential adopters. The fact that potential adopters used the attributes identified by Rogers to describe the modules is an important result of this study. This result shows that the perceived attributes of an innovation can be important considerations for those attempting to facilitate the adoption and diffusion of instructional innovations.

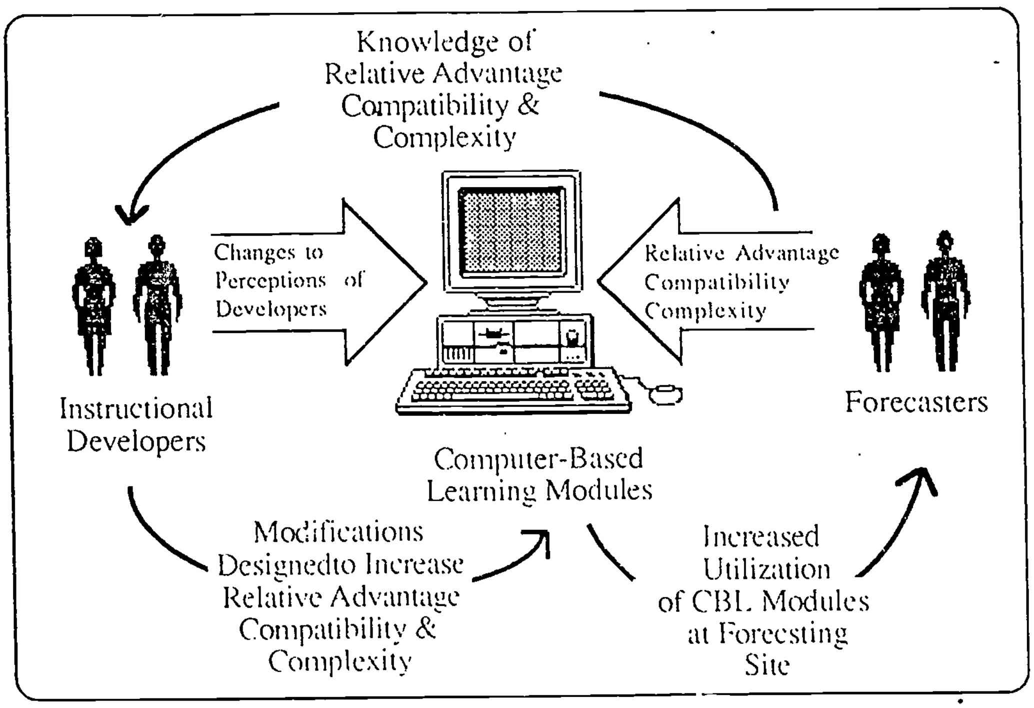

Figure 2. A model showing how the findings of the present study might lead to increased utilization.

Figure 2 is a model representing how the results of the present study might be used to increase the utilization of the three CBL modules. As shown in Figure 2, relative advantage, compatibility, and complexity were important perceptions to the potential adopters in this study. If the developers of the CBL modules determined the potential adopters' perceptions, that knowledge could affect the developers' own perceptions of the modules and result in modifications to the modules.

The purpose of any modifications would be to present the potential adopters with an instructional product that maximizes the positive aspects of the most important perceptions. For example, the developers could maximize the perceptions of compatibility by ensuring that all sections can be completed in 20-30 minutes. The modifications, if successful, would create more favorable perceptions of the CBL modules and would, in turn, lead to an increased utilization of the modules.

The present study sought to determine the relationship between perceived attributes and the adoption of an instructional innovation. The results of this study indicate that the perceived attributes theory identified by E. M. Rogers does have the potential to offer valuable insights to instructional developers and change agents who wish to increase the utilization of computer-based instruction. Also, the present study suggests that Burkman's hypothesis of user-oriented instructional development is valid and might, if incorporated into existing instructional development models, lead to the increased utilization of instructional technology.

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