

Logistic Regression Modeling for Predicting Task-Related ICT Use in Teaching

Petek Askar

Department of Computer Education and Instructional Technology
Faculty of Education, Hacettepe University, 06800, Beytepe, Ankara, Turkey
Tel: + 90 312 2977180
Fax: + 90 312 2977176
paskar@hacettepe.edu.tr

Yasemin Kocak Usluel

Department of Computer Education and Instructional Technology
Faculty of Education, Hacettepe University, 06800, Beytepe, Ankara, Turkey
Tel: +90 312 2978569
Fax: + 90 312 2977176
kocak@hacettepe.edu.tr

Filiz Kuskaya Mumcu

Department of Computer Education and Instructional Technology
Faculty of Education, Hacettepe University, 06800, Beytepe, Ankara, Turkey
Tel: +90 312 4207924
Fax: +90 312 4207274
filiz.kuskaya@tbmm.gov.tr

ABSTRACT

The main goal of this study is to estimate the extent to which perceived innovation characteristics are associated with the probability of task related ICT use among secondary school teachers. The tasks were categorized as teaching preparation, teaching delivery, and management. Four hundred and sixteen teachers from secondary schools in Turkey, completed a questionnaire, which was designed to determine the task-related usage and the perceptions of the teachers in regard to ICT. Logistic stepwise regression analysis showed that complexity or ease of use was found to be a common perceived innovation characteristic for teaching delivery, preparation and managerial tasks in schools. Another result of this survey lead one to conclude that observability is a perceived attribute in teaching delivery in some specific tasks performed during the class period whereas relative advantage and compatibility are for teaching preparation tasks.

Keywords

Innovation characteristics, Logistic regression, ICT, Secondary schools

Introduction

The way of the influence on education system exerted by innovations in information and communication technologies (ICT) had previously been confined to training individuals for technology-literacy. This function, has gradually changed, and developed into a new dimension, affecting the learning-teaching processes in a direct way. Indeed, when looked at the National Educational Technology Standards (NETS) of the International Society for Technology Education (ISTE), it is seen that the skills required for teachers were no longer limited to knowing the basic processes and concepts related to technology, but developed into a wider spectrum, comprising the integration of technology into education, and knowing and implementing to ethical principles related to the use of these technologies (ISTE 2004). Apart from these skills that teachers are expected to have, it has also been put forward through researches that teachers, in connection with the use of ICT in classes, have developed their own principles, ideas and judgements, and have influenced their implementation (Galanouli, Murphy, & Gardner, 2004; Cope & Ward, 2002; Mumtaz, 2000). For this reason, it is seen that teachers have important role in ICT use in schools. Furthermore, the fact that educational changes rely largely on the adoption of this change by teachers (Van den Berg, Vandenberghe, & Slegers, 1999; Fullan, 1991; Hall & Hord 1987), is also indicated in literature study.

Diffusion of ICT in Education

Use of ICT in schools for the purpose of teaching and learning is a kind of diffusion process in which ICT is an innovation which is defined by Rogers (2003, p.12) as "any idea, practice or object that is perceived as new by

an individual or other unit of adoption". In fact, ICT as a relatively new building block in the educational system, causes innovations which ranges from way of communications, and interactions to teaching methods, and materials (Askar & Usluel, 2005). Rogers' (2003, p. 11) research indicates, "Technological innovations are not always diffused and adopted rapidly, even when the innovation has obvious, proven advantages". Along with a process for adoption, Rogers provides a theory of how the innovation itself can affect this process. He identified five innovation characteristics that influence the decision to adopt an innovation.

The literature on diffusion of innovation highlights the factors that may influence a teacher's likelihood of utilizing computers for instructional purposes. Dooley and Murphrey (2000) stated that how teachers perceive and react to these technologies is far more important than the technical obstacles in influencing implementation and use. Four main elements in the diffusion of innovation are stated by Rogers (2003) as innovation, communication channels, time, and social system.

The characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption. Five attributes of innovations (Rogers, 2003) are; relative advantage, compatibility, complexity, trialability, and observability. In other words, when an innovation is perceived by users as having greater relative advantage, compatibility, trialability, observability, and less complexity, the innovation will be adopted more rapidly.

The first characteristic, relative advantage of an innovation, as perceived by the members of a social system, is positively related to its rate of adoption. Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. If the technology provides some type of increased effectiveness or efficiency, then individuals are more likely to adopt the technology (Rogers, 2003). The nature of the innovation largely determines what specific type of relative advantage is important to adopters expressed as economic profitability, social prestige, decrease in discomfort, low initial cost, time savings, savings in effort, and immediacy of rewards, or other benefits. The degree of relative advantage is often expressed in economic profitability and in status giving. This suggests the need to focus on the specific pedagogical advantages of the instructional technology over more conventional teaching tools in the in-service training program (Bennett & Bennett, 2003). So, relative advantage is the degree to which a teacher perceives a new technology as superior to existing substitutes.

The second characteristic, compatibility of an innovation, as perceived by the members of a social system, is positively related to its rate of adoption. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters (Rogers, 2003, p. 15). Socio-cultural values and beliefs, previously adopted ideas and the needs determine compatibility or incompatibility. So, compatibility is the degree to which ICT in education is perceived as being consistent with the teachers' values, past experiences and needs.

The third characteristic, complexity of an innovation, as perceived by the members of a social system, is negatively related to its rate of adoption. Complexity is the degree to which an innovation is perceived as difficult to understand and use (Rogers, 2003). Complexity refers to the extent to which an innovation is difficult to understand; the greater the difficulty, the more reluctant potential adopters will be to embrace the change. To ensure that the fear of technical complexity does not present itself as an obstacle, it is important that the content and outcomes of the development and training program be consistent with the knowledge, skills, and abilities of the teacher involved. Complexity often found to be inversely related to the diffusion of an innovation, while simplicity, or ease of use, makes for wider and more rapid acceptance (Serow & Zorowski, 1999)

The fourth characteristic, trialability of an innovation, as perceived by members of a social system, is positively related to its rate of adoption. Trialability is the degree to which an innovation may be experienced with on a limited basis. New ideas which go through the experimental process can be adopted faster (Rogers, 2003).

The last characteristic, observability in the results of an innovation is positively related to the rate of adoption. Observability is the degree to which the results of innovation are visible to others (Rogers, 2003). If the technology has a high degree of observability, it will be relatively easy for the teacher to learn about it and judge its potential benefits. This, in turn, can increase the likelihood of adoption.

Bennett and Bennett (2003) studied the perceived characteristics of instructional technology that may influence a faculty members' willingness to integrate it in his/her teaching. They have expressed that the most important barrier that teachers face using technology is not lack of technology or funds but teachers' lack of willingness and their belief that technology is not useful. Butler and Sellbom (2002) examined the factors affecting teachers

in adopting new teaching technologies and barriers emerging during adoption. Surveys have been mailed to 410 teachers, about 30% have responded. As a result of the research, trust in technology has been identified as the most important factor in teachers' decision whether or not to adopt. Know-how, difficulty in learning and time required to learn appear as the second most important factor in adoption. Believing that technology enriches and improves education, difficulty using technology and management support appears as other factors affecting adoption. Another study investigating the rate of adoption with respect to computers in three primary schools was conducted by Askar and Usluel (2003). During the research, the factors such as perceived attributes of computers and some characteristics of schools which have an effect on the rate of adoption were taken into consideration. For this purpose, in the year 2000, 27 teachers and in 2002, 31 teachers from the same schools were interviewed. Changes in the ratio of computer use were identified over two years. Four variables which might be effective in the differences were: relative advantage, observability, factors which are encouraging and hindering the use of computers in the schools. Mumcu (2004) highlighted in her research on the diffusion of ICT in vocational and technical schools that the most critical obstacles were found as insufficient budget, hardware and in-service training. In addition, a positive relationship between relative advantage, compatibility and visibility with the use of ICT were reported.

Dooley, Metcalf, and Martinez (1999) explained that public schools are installing computer technology in classrooms at an alarming rate. However, the training for this infusion of technology does not always transfer to integration of the technology into the curriculum. With the introduction of computers in schools, there are significant changes in the school organization and the roles of the teachers, administrators, parents and students. For institutional change, it is imperative that school personnel understand the diffusion process and its implications for success or failure of innovations.

In addition to ICT usage, Internet adoption is attracting the researchers. Jebeile and Reeve (2003) reported the findings of a study of teacher adoption of Web technology in a secondary college. The results showed that the innovation adoption variables of relative advantage, compatibility, visibility, ease of use, results demonstrability, and trialability should be considered by school administrators seeking to increase the use of e-learning within their organizations. Braak (2001a) examined the factors influencing the use of computer-mediated communication (CMC) by teachers in secondary schools in Brussels. The survey compared a group of CMC users with non-CMC users. It was demonstrated that language teaching was the best predictor for the use of CMC. The main reason for this is that education policy within the area under investigation has developed a specific CMC project that is primarily oriented towards a target group of language teachers. A second predictor of CMC use was the degree of technological innovativeness. This instrument is a measure of the willingness of the teacher to adopt technological innovation in his own teaching practice. A third predictor was perceived CMC attributes. This instrument indicates the degree to which users observe any congruence between the characteristics of CMC as a medium and their own teaching practice. Martins, Steil, and Todesco (2004) conducted a survey on 92 language schools in Brazil. Results revealed that the Internet is adopted in 55% of the schools analyzed. Both the model of linear multiple regression and the model of logistic regression predicted 77% of the cases of adoption and, therefore, represented satisfactorily the data from the questionnaire used. The variables observability and trialability were found to be the two most significant predictors of adoption.

In one of the studies (Braak, 2001b), logistic regression analysis results showed that technological innovativeness, teaching a technology-related subject, and computer experience were more important in explaining the computer use in the classroom than the computer attitude, general innovativeness, age, and gender.

In summary, as Surry and Gustafson (1994) concluded, compatibility, complexity and relative advantage can be important considerations when introducing an innovation into instructional settings. In parallel Bussey, Dormody, and VanLeeuwen (2000) stated that the strongest predictor of the level of adoption of technology education was the perception of the teacher of the attributes of technology education. The researchers also concluded that Rogers' theory of perceived attributes can be a valuable tool for instructional developers working to increase the utilization of their products.

ICT in schools in Turkey

ICT was first introduced to schools in Turkey in 1984. Since then, Ministry of National Education has allocated considerable amount of budget for the diffusion of computers in the teaching and learning process. For the diffusion of ICT into schools, so many efforts have been undertaken such as in-service training of teachers and administrators, courseware and educational material development and training of computer coordinators.

The body of authority is the key policy makers in the Ministry of National Education for all levels of schools in Turkey. However the implementation of any innovation, including ICT is under the responsibility of the schools. In a longitudinal and qualitative study (Askar & Usluel, 2003) held in three primary schools, the change in the situation of teachers related to their use of computers were observed throughout the two years (2000 and 2002) with respect to each school; and it was seen that there were differences, with respect to each school, in the use of computers by teachers. Therefore the adoption rate varies due to schools and teachers. To install a computer lab or to get a trained teacher (computer coordinator) don't imply that adoption is successful even it is an authority innovation-decision. Indeed, as a result of the analysis of the data obtained through questionnaire from 638 teachers in 27 primary schools with the aim of identifying the purposes of Turkish teachers in using ICT, it was noticed that computers in schools have become widely used in administrative work – such as, preparation of lecture plans and unit plans, organizing scores and reports of students, writing official letters. However, this wide use of computers has not yet been observed in the instructional activities – either using a presentation tool during class or using computers for experiments (Usluel & Askar, 2002). In addition it was observed that instructional usage could be grouped as teaching preparation and delivery (Askar & Usluel, 2003).

It is supported by literature that ICT have entered the lives of teachers and are used in administrative tasks at schools, but not in instructional tasks. Studies pointed out that teachers' use of ICT for instructional purposes is insufficient (Martins, Steil, & Todesco, 2004; Askar & Usluel, 2003; Szabo & Suen, 1998; Proulx & Campbell, 1997). Hence task-related analyses in the framework of innovation characteristics (Rogers, 2003) would be important for developing strategies in the diffusion of ICT in schools.

Research Questions

This research investigates the adoption of task-related ICT by teachers. The task-related ICT usage was modeled by the four perceived attributes: relative advantage, compatibility, complexity, and observability. The trialability was not considered to be a differentiating attribute to ponder on, since almost all teachers respond to trialability questions affirmatively.

Do the four ICT innovation characteristics discriminate the users and non-users on the following tasks?

1. Preparation for a lesson such as developing worksheets or internet search for course content (Teaching preparation)
2. Preparation of lesson plans, unit plans and yearly plans (Teaching preparation)
3. Use of educational multimedia while giving lectures, doing practices reviewing lessons (Teaching delivery)
4. Using a presentation tool during class. (Teaching delivery)
5. Using ICT for experimental study in the laboratories (Teaching delivery)
6. Preparation of examination or organizing student scores (Management)
7. Writing and saving official letters (Management)

Methodology

This research was based on causal-comparative research design. In causal-comparative research, investigators attempt to determine the cause or consequences of differences that already exist between or among groups of individuals (Fraenkel & Wallen, 2003). The concern of this study was to identify of membership of users and non users given in the research questions according to the perceived attributes. Since the outcome variable was dichotomous the binary logistic regression model was used.

Participants

The participants of the study were 416 teachers from 8 secondary schools in Ankara, capital of Turkey. There are 8 counties in the provincial capital of Ankara. One county has been chosen among these, and efforts have been exerted to reach all secondary school teachers. There were 710 teachers in the secondary schools of that county; 548 of them have been reached through the survey, 425 of them have replied and 416 questionnaire forms have been evaluated. The demographical information is shown on Table 1.

Table 1. Demographical information of the teachers

Demographical Information		TOTAL	
		f	%
Gender	Female	286	68.8
	Male	130	31.2
Age	20-29 age	44	10.6
	30-39 age	170	40.9
	40-49 age	174	41.8
	50-59 age	28	6.7
Years in teaching	1-5 years	42	10.1
	6-10 years	74	17.8
	11-15 years	119	28.6
	16-20 years	82	19.7
	21-25 years	69	16.6
	26 years and more	30	7.2
Years in this school	1-5 years	191	45.9
	6-10 years	94	22.6
	11-15 years	80	19.2
	16-20 years	48	11.5
	21-25 years	3	0.7
TOTAL		416	100

Data Collection and Analysis

The questionnaire were developed by the researchers and administered to the teachers one by one. Since the items in the questionnaire were used individually in the data analysis, the total score was meaningless. The questionnaire was divided into three sections. Section 1 consisted of demographical information dealing with gender, age, educational qualifications, years in teaching, and years in this school concerning the respondents. Section 2 included tasks eliciting the views of the teachers toward the use of ICT in teaching preparation, teaching delivery, and management. Section 3 consisted of the views of the teachers regarding the innovation characteristics toward the use of ICT on the tasks.

An example was given for section 2 and for section 3;

Section 2 “Do you use educational multimedia while giving lectures, doing practices or reviewing lessons?”
The responses were taken as ‘yes’ or ‘no’.

Section 3 “Rate your opinion whether the following task is observable or not.”
Use of educational multimedia while giving lectures, doing practices reviewing lessons.
The responses were taken as ‘not observable’, ‘undecided’, and ‘observable’.

“Rate your opinion whether the following task is complex or not.”
Preparation of lesson plans, unit plans and yearly plans
The responses were taken as ‘not complex’, ‘undecided’, and ‘complex’

“Rate your opinion whether the following task is compatible with your job.”
Using a presentation tool during class.
The responses were taken as ‘not compatible’, ‘undecided’, and ‘compatible’

Since the outcome variable is dichotomous (binary) the binary logistic regression model was used. It was defined as $Y=0$ (non-use), or $Y=1$ (use). X denotes the vector of independent variables or predictors. The independent variables are perceived attributes of innovation; relative advantage, compatibility, complexity and observability. The binary logistic regression is stated in terms of the probability that $Y=1$ given X :

$$P(Y = 1 | X) = \frac{1}{1 + \text{Exp}(-\beta X)}$$

$Z = \beta X$ is called the linear predictor and stands for $\beta_0 + \beta_1 X_1 + \dots + \beta_p X_p$. By solving this equation Y, the form for the binary logistic regression model is obtained:

$$\ln \frac{P(Y = 1 | X)}{P(Y = 0 | X)} = \text{logit}(Y) = \beta X \quad (\text{Kořmely \& Vadnal, 2003}).$$

The recommended sample size for this kind of research is calculated by taking into consideration the minimum ratio (sample size/ predictor variables) of 10 to 1, with a minimum sample size of 100 or 50, plus a variable number that is a function of the number of predictors (Peng, Lee & Ingersoll, 2002). It was satisfied in this study.

Findings

Task 1: Preparation for a lesson such as developing worksheets or internet search for course content (Teaching preparation)

The binary logistic stepwise regression was conducted of four innovation characteristics: relative advantage, compatibility, complexity and observability on the dependent variable task 1 (use or not use). Out of 407, 175 teachers coded as users and 232 non-users. Variables in the equation are complexity and relative advantage (for complexity $\beta = -1.014$, $SE = 0.141$, Wald's $\chi^2 = 51.401$, $p = 0.000$ and for relative advantage $\beta = 0.789$, $SE = 0.397$, Wald's $\chi^2 = 3.942$, $p = 0.047$).

The equation for task 1 is $Z = (-0.492) + (-1.014) * \text{Complexity} + 0.789 * \text{Relative Advantage}$. The Nagelkerke R^2 was reported for each predictor ($R^2 = 0.208$, $R^2(\text{complexity}) = 0.195$). Figure 1 shows the probability of a teacher using ICT while preparing a lesson as a function of complexity and relative advantage.

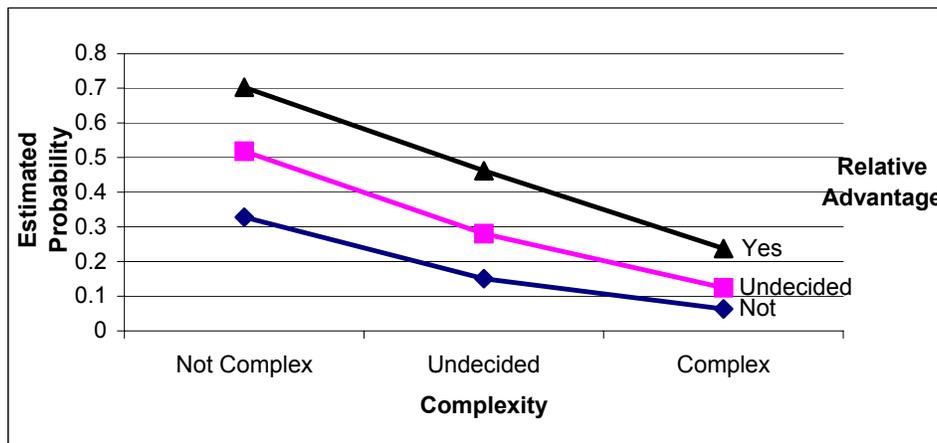


Figure 1. The likelihood of a teacher using ICT for task 1 by perceived complexity and relative advantage

Complexity and relative advantage are predictors that distinguish between the teachers who do and who do not benefit from ICT in preparing instructional activities. The highest probability of usage is the category of teachers who found computers for this task advantageous and who found it easy to use ($P = 0.7028$). The second highest probability is the category of teachers who couldn't decide whether it is advantageous or not, but found it easy to use ($P = 0.5180$). The lowest probability is the group who thought that it had no advantage to him (or her) and it was complex to use.

Task 2: Preparation of lesson plans, unit plans and yearly plans (Teaching preparation)

The binary logistic stepwise regression analysis for this task showed that two variables were significant for discriminating the users and non-users. Out of 406, 147 were non-users, 259 were users. Variables in the equation were complexity and compatibility (for complexity $\beta=-1.376$, $SE=0.177$, Wald's $\chi^2=60.674$, $p=0.000$ and for compatibility $\beta=1.330$, $SE=0.364$, Wald's $\chi^2=13.368$, $p=0.000$).

The equation for task 2 is $Z = (-1.305) + (-1.376) * \text{Complexity} + 1.330 * \text{Compatibility}$ ($R^2=0.354$, $R^2(\text{complexity})=0.307$). Figure 2 shows the probability of a teacher using ICT while preparing of lesson plans, unit plans and yearly plans experiments in the laboratories as a function of complexity and compatibility.

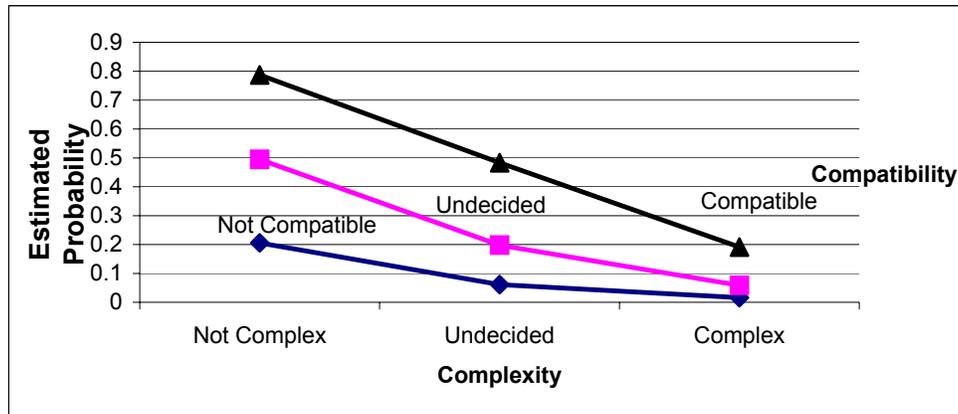


Figure 2. The likelihood of a teacher using ICT for task 2 by perceived complexity and compatibility

Preparing lesson plans, which is one of the teaching preparation tasks, indicates the highest usage probability. In this task, as well, compatibility and ease of use come to the foreground. The highest probability of usage is in the categories of teachers who found computers for this task compatible and who found it easy to use ($P=0.7873$). The second highest is the teachers who had no idea for compatibility, but found it easy to use ($P=0.4947$).

Task 3: Use of educational multimedia during lecturing, practices and reviewing lessons (Teaching delivery)

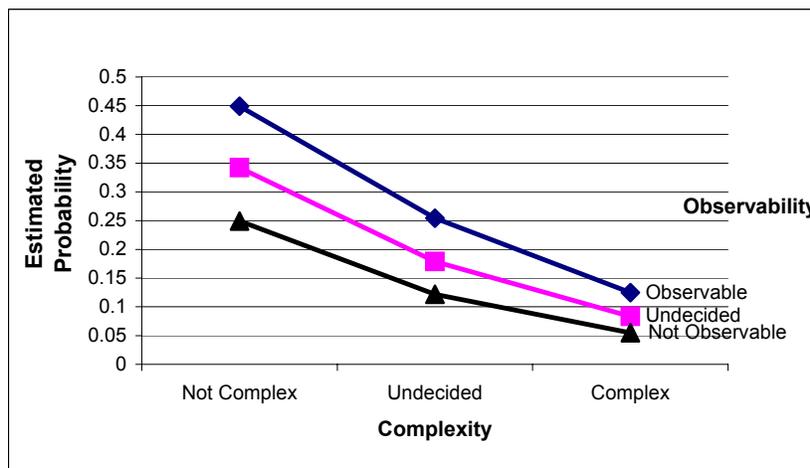


Figure 3. The likelihood of a teacher using ICT for task 3 by perceived complexity and observability

The binary logistic stepwise regression analysis for this task showed that two variables were significant for discriminating the users and non-users. Out of 406, 296 were non-users, 110 were users. Variables in the

equation were complexity and observability (for complexity $\beta=-0.871$, $SE=0.186$, Wald's $\chi^2=21.851$, $p=0.000$ and for observability $\beta=0.449$, $SE=0.155$, Wald's $\chi^2= 8.412$, $p=0.004$).

The equation for task 3 is $Z = (-0.680) + (-0.871) * \text{Complexity} + 0.449 * \text{Observability}$ ($R^2 =0.173$, R^2 (complexity) =0.145). Figure 3 shows the probability of a teacher using ICT for educational multimedia during lecturing, practices and reviewing lessons as a function of complexity and observability.

The probability of using multimedia during lessons has been found lower than the probability of using computers for preparation of instructional activities. This result indicates that diffusion of using ICT for preparation of lesson is more rapid than using ICT during lesson. The highest probability of usage is the category of teachers who found computers non complex for this task and who observed its usage ($P=0.4491$). However still the probability is lower than 0.50. While ICT usage during lesson is related to the teachers' skills in one respect, it may also be related to the infrastructure, technology, and physical features of classrooms.

Task 4: Using a presentation tool during class (Teaching delivery)

For this task out of 407, 323 were non-users, 84 were users. The variables in the equation were complexity and compatibility (for complexity $\beta=-1.447$, $SE=0.314$, Wald's $\chi^2=21.300$, $p=0.000$ and for compatibility $\beta=4.565$, $SE=0.570$, Wald's $\chi^2=7.533$, $p=0.006$).

The equation for task 4 is $Z = (-3.777) + (-1.447) * \text{Complexity} + 1.565 * \text{Compatibility}$ ($R^2=0.291$, R^2 (complexity) =0.248). Figure 4 shows the probability of a teacher using a presentation tool during class as a function of complexity and compatibility.

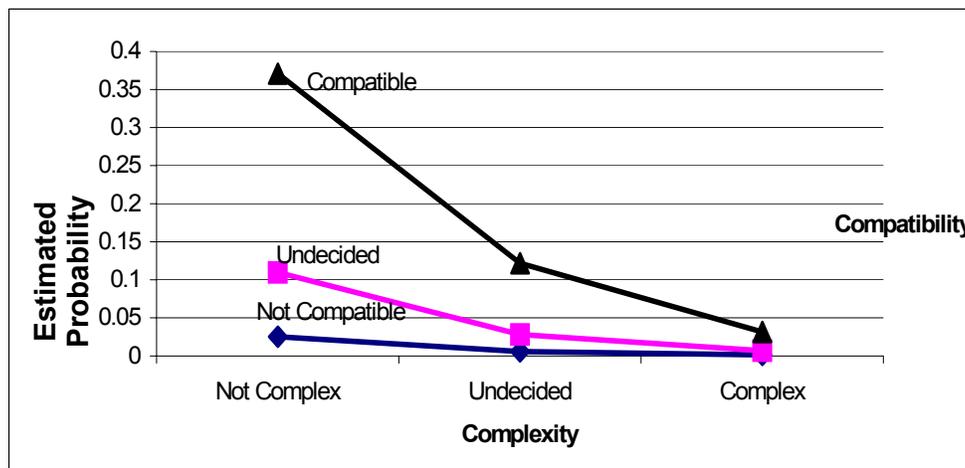


Figure 4. The likelihood of a teacher using ICT for task 4 by perceived complexity and compatibility

The two innovation characteristics which distinguish between the teachers who use presentation program during lesson and who do not are ease of use and compatibility. The group with highest probability is the one who find it easy to use and compatible ($P=0.3707$). What draws attention here is presence of compatibility characteristic together with the ease of use. As is known, one indication of compatibility is the habits and how compatible they are to the way of life. The reason why the probability of use of presentation program by teachers in classes is high is that they likely perceive the presentation program as the extension of the white-board and overhead projector.

Task 5: Using computers for experiments in the laboratories (Teaching delivery)

The binary logistic stepwise regression analysis showed that complexity and observability were significant for discriminating the users and non-users (for complexity $\beta=-1.614$, $SE=0.284$, Wald's $\chi^2=32.360$, $p=0.000$ and for observability $\beta=0.602$, $SE=0.170$, Wald's $\chi^2=12.562$, $p=0.000$). Out of 407, 313 were non-users, 94 were users.

The equation for task 5 is $Z = (-0.257) + (-1.614) * \text{Complexity} + 0.602 * \text{Observability}$ ($R^2=0.308$, R^2 (complexity) =0.266). Figure 5 shows the probability of a teacher using ICT for experiments in the laboratories as a function of complexity and observability.

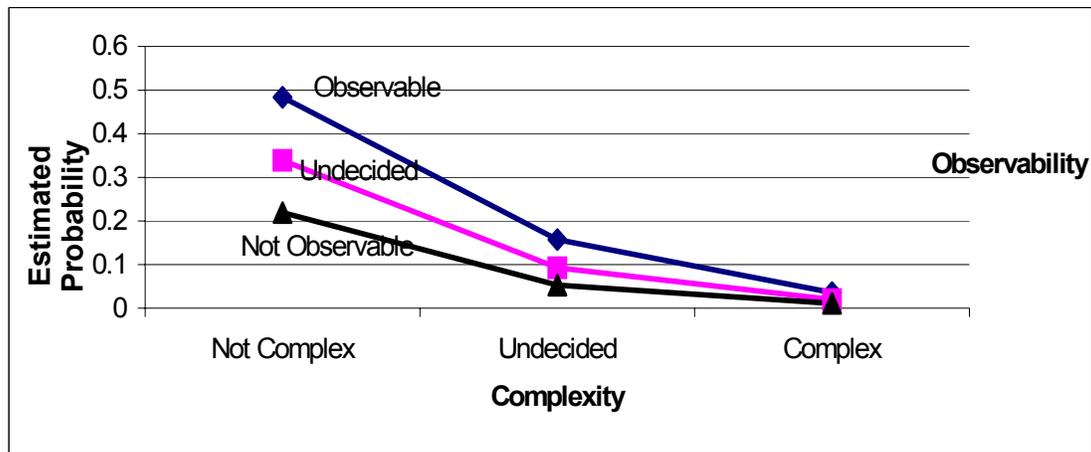


Figure 5. The likelihood of a teacher using ICT for task 5 by perceived complexity and observability

The highest probability of usage is the categories of teachers who found computers non complex and who observed its usage ($P=0.4837$). In this task, observability arises as a discriminating variable with ease of use. The highest probability for this task is category of teachers who find it observable and ease of use. This finding indicates that teachers should be given chances to observe the ICT integration done by their associates in the classroom.

Task 6- Preparation of examination or organizing student scores (Management) and Task 7- Writing and saving official letters (Management)

The binary logistic stepwise regression analysis for task 6 and 7 showed that complexity is the only discriminating variable. For task 6, out of 407, 128 were non-users, 279 were users (for complexity $\beta=-1.416$, $SE=0.183$, Wald's $\chi^2=59.658$, $p=0.000$). For task 7, out of 407, 164 were non-users, 243 were users (for complexity $\beta=-1.416$, $SE=0.183$, Wald's $\chi^2=59.825$, $p=0.000$). While the probability of ICT usage by teachers who find it easy are 0.7835 (task 6), and 0.7164 (task 7), the probability of ICT usage by them who don't find it easy are 0.1756 (task 6) and 0.1107 (task 7). The equation for task 6 is $Z = 2.702 + (-1.416) * \text{Complexity}$ ($R^2 =0.245$). The equation for task 7 is $Z = 2.432 + (-1.505) * \text{Complexity}$ ($R^2 =0.264$).

Conclusion & Discussion

The role that perceptions play in the adoption of an innovation has been examined by different researchers (Martins, Steil, & Todesco, 2004; Bennett & Bennett, 2003; Jebeile & Reeve, 2003; Braak, 2001; Bussey, Dormody, & VanLeeuwen, 2000; Serow & Zorowski, 1999; Surry & Gustafson, 1994). These researchers also confirm the importance of the study of perceived attributes and rate of adoption.

As is seen, complexity comes out as the predictor variable in all tasks. While complexity and relative advantage comes forth in preparation for lesson activities, being predictor of compatibility together with complexity in presentation during lesson and preparation of lesson plans, and also coming forth of observability together with complexity in the use of multimedia during lesson and experiments in the lab, prove that perceived attributes could vary according to tasks.

Complexity or ease of use was found to be a common perceived innovation characteristic for teaching delivery, preparation and managerial tasks in schools. As a predictor variable, complexity (ease of use) explains the user/non user between 15% and 31% according to the tasks. Complexity as defined before is the degree to which

the technology is difficult to understand or use. The strategies for decreasing the perceived complexity are highly important for diffusion of ICT in schools. The design of staff development and the ongoing and immediate technical and educational support could be key considerations. The barriers teachers stated in several studies are likely to be related to the perceived complexity.

Another result of this survey lead one to conclude that “observability” is a perceived attribute in teaching delivery in some specific tasks performed during the class period. Besides professional development of teachers, the classroom activities should be open for all teachers in the school. Teachers should be given chances to observe the ICT integration done by their associates in the classroom. Therefore, it is easy to learn about it and judge its potential benefits. The importance of observability indicates how critical it is that the instructional technology be demonstrated in the in-service training program. Ideas that can easily be observed and communicated to others will be adopted more quickly than ideas that are more difficult to see and communicate.

It is recommended that the best practices in ICT integration in schools should be shared by the teachers with active participation are more useful than the traditional in-service teacher training programs. A program that focuses on the interactive instructional properties of the technology would be of greater interest to this teacher than one that failed to discuss how the technology is consistent with his/her teaching philosophy. Unfortunately, in many circumstances, the introduction of instructional technology will require the rejection of one set of values and ideas about education and the adoption of a new set with regards to what constitutes effective pedagogy (Bennett & Bennett, 2003).

It can be argued that installing ICT for schools solely as product doesn't carry much meaning. For this reason besides of the nationwide solutions, school based solutions will be more realistic in the diffusion of computers for instructional purposes. One of the results of this research is that, complexity comes out as the predictor variable in all tasks, and that other variables vary according to the tasks. School administration should focus their efforts on decreasing complexity. Technical support, on going teacher professional development, early familiarity with the ICT, sharing best practices as well as barriers and difficulties in real teaching-learning environments could be some strategies in the diffusion process. On the other hand, the importance of school's implementations according to a phased plan by way of determining its priorities with respect to ICT, and shaping it according to the task, cannot be ignored. Further detailed studies on the ICT diffusion in schools will illuminate this subject.

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