Training End Users: An Exploratory Study

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Abstract

This article presents and empirically evaluates a conceptual model of how training can impact the acceptance of information systems within the organization. Specifically, the training of end users is explored via an extensive field study of 100 middle- and upper-level managers from 20 companies. The results indicate that (1) a positive relationship exists between the computer-related training an individual receives and his/her computer-related ability, and (2) a positive relationship exists between the computer-related ability of an end user and his/her acceptance of information systems products and technologies.

Keywords: Education, training, integration, end-user computing, information systems, user-system interface

ACM Categories: H.0, H.1.2, K.3, K.6.1

Introduction

A recent study conducted by the Society for Information Management (SIM) and the MIS Research Center at the University of Minnesota identified the ten most important information systems (IS) management issues [6]. Third on the list was "the facilitation of organizational learning and the usage of information systems technologies." Implicitly stated in their findings is that IS-related education/training begets the acceptance and usage of IS technologies throughout the organization.

Research suggests that most IS failures stem from a lack of user acceptance rather than poor technical quality. Why don't managers make better use of the computer? An early hypothesis blamed a lack of education on the part of many top and middle managers concerning how best to use computers and computer-generated information in decision making [5]. The same study concluded that the computer can have a significant positive impact on the organization if the firm provides adequate computer training for both middle and top management. Despite the obvious importance of IS training, there has been little previous empirical research in this area.

The research described in this article is intended to (a) offer a conceptual model (Figure 1) of how training can impact IS acceptance, and (b) present the results of an attempt to validate (empirically) the relationships set forth in the conceptual model. Specifically, the training of end users—the people who ultimately use the computer's output—is explored via an extensive field study of 100 middle- and upper-level managers from 20 companies.

The Research

Model and Variables

The model for this research, presented in Figure 1, describes the components of the educational process within the context of an organizational IS environment. In the process of constructing this relatively specific representation of the impact of training on the end-user community, we were able to draw from a number of IS research frameworks that cite train-

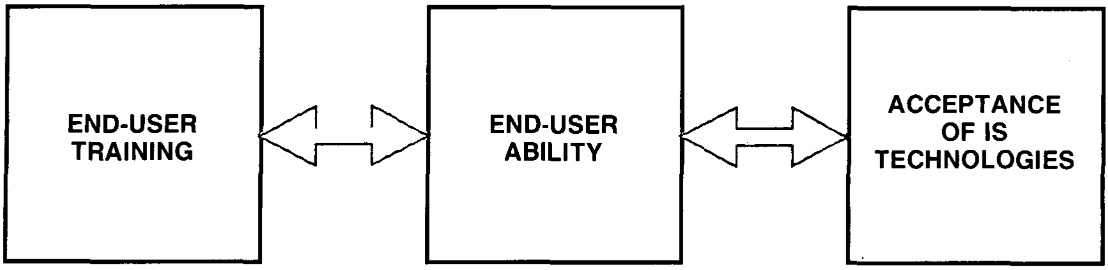

Figure 1. A Descriptive Model for Organizational Learning and Acceptance of IS Technologies

ing, either directly or indirectly, in their general description of the IS environment.

As depicted in Figure 1, three variables (training, ability and acceptance) form the foundation for this research. A brief description of each variable follows.

Training

The terms *education* and/or *training* are used in this study to refer to formal efforts to transfer required IS knowledge. The topics include IS concepts, technical skills, organizational skills, and knowledge about specific IS products. Whereas education involves an understanding of abstract theory, training is involved in gaining the skills necessary to accomplish a task. While both terms are relevant to this research, training will be the primary focus.

The process of organizational learning is closely related to the problems of organizational change identified by Lewin [19] and described in action form by Schien [26] as an unfreezing, moving, and refreezing process. Unfreezing is necessary because the end user comes already replete with ingrained habits of feeling, thought and action. To change an end user through training, his/her normal habits first have to be questioned and disturbed, or *unfrozen*. Training can do this by focusing attention on needs that end users cannot satisfy by habitual behavior. The trainer then introduces other methods which allow participants to try new ways of behaving, that is, *moving*. If they find the new behavior more useful in meeting their "new" needs, the individual will establish personal continuity by *freezing* the new behavior. Miles [22] conceptualizes this process as a "change-inducing temporary system."

The guiding principles for training strategies lie in the dynamics of the development process and in the minimum critical concentration of effort required during each stage of it. This basic process can be shown as an evolutionary model. (See Figure 2).

As Culnan [9] points out, when an IS is first introduced, end users will require a large amount of training and support in order to become comfortable with the system's command language. The design of systems with on-line help and menus to facilitate initial learning may promote the initial use and acceptance of an IS. This set of relationships, which extends throughout the useful life of a system, can be traced through our conceptual model (Figure 1). Essentially, through its impact on end-user ability, training serves to enhance acceptance by impacting the per-

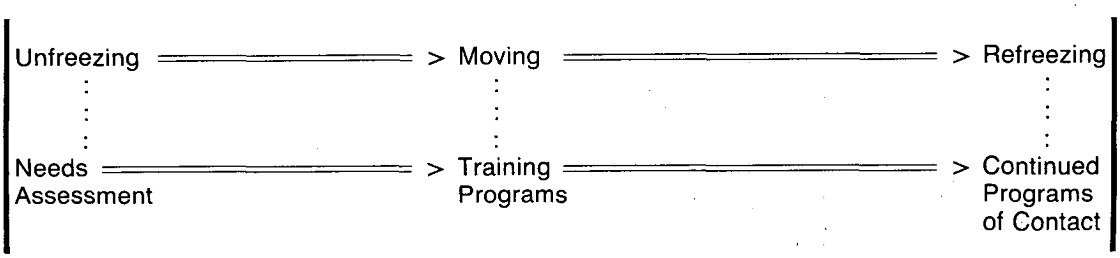

Figure 2. Evolutionary Model of Training

Table 1. Training Techniques

1.	Tutorial	Each user is individually taught by an instructor or colleague. There are usually few instructional materials, and the material is covered in an order determined by the interests of the student (i.e., user).
2.	Courses, Lectures or Seminars	The instructor is an internal or external "expert" in IS. There are instructional materials, and the instructor determines course content. The course is conducted inside the organization.
3.	Computer-Aided Instruction (CAI)	The original term for on-line use of a computer to administer instruction directly to one or more people. In many areas CAI has come to mean computer-based drill and practice; in other areas any computer-based tutorial, particularly one aimed at teaching the use of a particular technology, is referred to as CAI.
4.	Interactive Training Manual (ITM)	A combination of tutorial and CAI. This is an application-oriented IS and a guidebook which are used together. The guidebook contains lessons and the application system provides the examples and exercises. ITM is reported to be effective in DSS settings. [12].
5.	Resident Expert	This is a passive version of the tutorial technique in that training is user initiated. It takes advantage of the fact that users are more likely to ask when they need to know rather than to attend a course or consult a book or the system itself.
6.	Help Component	Most IS contain at least primitive "help" components which give error messages when the user makes mistakes. In some cases short explanations of commands are also provided. "Layered" help components let the user proceed through successive layers of instructional materials, each involving more detail. The "bottom" level may be a CAI system.
7.	External	This includes relevant college courses such as these present in an MBA program, vendor sponsored seminars and independently sponsored seminars. The courses are conducted at sites away from the organization.

ceived accessibility of the system [9,17].

Recent literature on the subject of end-user computing (EUC) has devoted a fair amount of attention to the development of IS training programs. In a survey of 67 end users, Benson [4] identified where end users tend to receive their training (e.g., vendor, college, company, and/or self) and noted that "a significant number of them expressed interest in further training for themselves." Based on a separate survey, Rockart and Flannery [25] made five recommendations for the development of a substantial end-user education program. Within their program, the "type" of computer-related education varied depending on the "type" of end user(s).

In seeking to operationalize training in the present study, we first identified potential sources and instructional formats frequently encountered by end users. We then attempted to define an appropriate measure for each. Benson's four training sources (listed above) and a total of seven instructional formats (techniques) were selected (six of which were originally identified by Sprague and Carlson [27]; see Table 1). Measurement of training received was done via a self-report of quantity within (a) each of the four sources, and (b) each of the seven instructional formats.

Ability

The variable ability in this study refers to the quality of having sufficient computer-related skill to accomplish an objective. An organization's desire to improve white collar productivity through more effective IS utilization is the primary motivation for the measurement and analysis of end-user abilities. Productivity benefits from IS result from both efficiently supplied and effectively utilized IS outputs. In addition, the rampant decentralization of computer usage via EUC has prompted arguments that utilization is directly related to the user community's computer- and system-related skills.

This connection, however obvious it may seem, can only be traced indirectly through prior studies and research frameworks in the IS literature. The organizational behavior literature, on the other hand, has consistently recognized performance as a function of ability and motivation. Ability moderates the effect of motivation on performance (i.e., at a given level of motivation, performance can increase with increased ability). [8] At high levels of ability, however, motivation can cause even higher performance levels to be obtained [18].

In order to measure end-user abilities, the authors developed an instrument by which end users could report (1) the perceived importance of the ability as it affected an end user's propensity to use IS products and technologies, and (2) the current skill level the end user felt he/she possessed in each ability area. Initially, a list of fifteen abilities was created from the literature, personal experience, and discussions with information center personnel and end users. A group of four information systems faculty reviewed the list and made individual recommendations for the addition, deletion and/or modification of these ability factors. During several iterations they recommended the deletion of six factors, the addition of two factors, and the modification of four others. Twelve information systems professionals were then asked to comment on the revised list. The practitioners recommended no additions or deletions, but they did request a further explanation and definition of each factor.

Acceptance

Acceptance is the degree of willingness of an individual or group to utilize information systems [17]. As Bair [3] observes, system acceptance involves changes in the most basic habits embedded in one's daily activities: how one thinks, composes materials, and communicates. End-user acceptance of an IS involves not only learning new skills and habits, but extinguishing old habits as well. The successful introduction of an IS thus requires not only good system design [11], documentation [12], and workstation availability [9], but also the enhancement of a user's abilities via a computer-related training program [13] (unfreezing, moving, and refreezing).

Acceptance is a subjective factor and not easily measured. "Ideally, one would supplement the amount of use as an indicator with subjective ratings of a system's acceptability and potential benefits (satisfaction)" [17, p. 58]. In this study, we attempted to measure both factors. Since our study involved middle- and upper-level managers, we decided to employ the same technique utilized by Brady [5] two decades ago, when he sought to evaluate the role that the computer plays in an individual manager's decision-making process. Therefore, as a surrogate measure for IS usage, we asked the question: To what extent is the computer utilized in each of the six phases of decision making (from identification of a problem/opportunity through the actual implementation of a selected course of action)?

It should be noted that all of the managers interviewed were voluntary users in the sense that their employing organization did not require them to use the computer in their decision-making processes. In such instances Hiltz and Turoff [15] point out, use of IS products and technologies can be considered a valid measure of their acceptance, but non-use does not necessarily imply rejection.

Satisfaction was also addressed through a surrogate measure: The Ives, Olson, and Baroudi [16] short-form questionnaire on user satisfaction. This instrument was chosen for several reasons: brevity (an important consideration when dealing with managers), the inclusion of questions on both IS product and service, and validity and reliability, as tested by its developers.

Research Questions

Based on the relationships presented in Figure 1, two primary research questions were derived:

Q1: What is the relationship between the computer-related training an individual receives and his/her computer-related ability?

Q2: What is the relationship between the computer-related ability of an end user and his/her acceptance of information systems products and technologies?

In order to approach acceptance from the dimensions of use and satisfaction, two secondary questions were proposed:

Q2.1: What is the relationship between an end user's computer-related abilities and his/her utilization of IS products and technologies?

Q2.2: What is the relationship between an end user's computer-related abilities and his/her satisfaction with IS products and technologies?

Given the exploratory nature of this study, we chose the above research questions in lieu of formal hypotheses.

Procedures

McFarlan and McKenney [21] note that for some organizations, IS activities represent an area of great strategic importance. In other organizations they play only a supportive role. It can be argued that organizations of the latter type will devote a smaller amount of organizational resources to IS training programs. To eliminate possible confounding effects from the standpoint of strategic relevance, this research chose only firms that have a high strategic dependence on existing operating systems, determined using the Operational Dependency Questionnaire developed by McFarlan and McKenney [21]. Theoretically, these firms will be more likely to place a high emphasis on training.

Five managerial users were selected from each of 20 firms located throughout the Southeastern United States. The interviewees were selected at random from a list of managerial users provided by each company's information systems director. The unit of analysis constituted all systems that were currently in use and being supported by the IS department, as well as any EUC technologies being employed by the end user.

A structured, taped interview with the director of IS ascertained *facts* concerning company sales, number of employees, IS budget, IS staff, hardware and software, and IS training program characteristics. Training personnel were also interviewed to gain further information about the IS training program. Follow-up telephone interviews gathered additional information when necessary. Prior to undertaking the research project, pretesting of all data-gathering instruments occurred at two sites.

Each user was (a) questioned via a 30-minute structured interview on IS training and use, (b) given the Ives, Olson, and Baroudi [16] short-form questionnaire on user information satisfaction (UIS), and (c) given an eleven-item Abilities Questionnaire.

Following the collection of data, an attempt was made to assess both the reliability and validity of the Abilities Questionnaire. The degree of reliability, defined as the absence of measurement error, was determined using the Cronbach alpha test applied to inter-item scores. The resulting reliability coefficient was .803. The acceptability of this score led us to assume the reliability of the instrument.

As part of a construct validation process, the factorial validity of the instrument was investigated. The varimax-rotated principal components solution is depicted in Table 2. The items loaded on three factors (labeled technical, modeling and application abilities) and together accounted for 54 percent of the variation in the data. We believe that this analysis suggests two potential improvements to the ability questionnaire. First, we need to clarify two items: "understanding and interpreting output" (this item loaded on two factors) and "handling data communications" (presumed to be more technical than applications-oriented). The second improvement is that these three factors can be used in future analysis rather than the eleven independent questions separately or the sum of the eleven questions as a single overall ability measure.

Table 2. Principal Components Analysis on the User Abilities Instrument

	Ability to:	Factor 1 (Technical Abilities)	Factor 2 (Modeling Abilities)	Factor 3 (Application Abilities)
1.	Program	0.75512	0.10443	-0.05770
2.	Use Application Development Software	-0.03460	0.74111	0.11260
3.	Use Packaged Application Software	0.07564	0.17113	0.67623
4.	Use Office Automation Software	0.07880	0.18046	0.62318
5.	Build Models	0.16182	0.77829	0.08843
6.	Access Data	0.12187	0.03361	0.73006
7.	Handle Data Communications	-0.03698	0.07054	0.60740
8.	Use Hardware	0.78635	-0.08444	0.32528
9.	Utilize Graphics Techniques	0.23144	0.74739	0.29788
10.	Use Operating System	0.57578	0.17294	0.01513
11.	Understand and Interpret Output	0.44927	0.16305	0.48869

Note: Underlining indicates that the item loads onto a particular factor (greater than .50).

Presentation of Findings

Profile of Training Programs

The IS directors at the 20 survey companies were asked to describe their computer training programs in terms of:

1. percentage of IS budget devoted to training,
2. number of employees devoted to computer-related training, and
3. current use of seven different training techniques. (See Table 1.)

Most (80%) of the survey companies reported training budgets between 0 and 2 percent of the IS budget, with anywhere from zero to five people assigned to their training staffs.

Each of the seven training techniques was well represented in the survey companies. A minimum of 11 companies used each technique; all 20 companies used the resident expert technique.

Profile of Subjects

The 100 respondents include 34 top-level managers (e.g., chief executive officer (CEO), vice president, or corporate controller) and 66 middle-level managers (e.g., senior analyst, assistant vice president, assistant director, or manager of compensation). A large majority (61%) used both mainframe and microcomputer facilities, while 4% used only microcomputers and 35% used only mainframes.

Benson indicates that managers generally become direct users of computer technology either because of: (1) their need to retrieve specific kinds of information relating to their jobs, or (2) their need to analyze data and develop projections, models, and various kinds of "what if" procedures. Other complementary uses of both mainframe and microcomputer facilities, such as word processing, graphics, and electronic mail, have also evolved. Within this study, the largest percentage (45%) of use was for data retrieval and analysis, substantiating the results of Benson's study.

Mainframe products such as EASYTRIEVE, RPG, FOCUS, and RAMIS found frequent use for applications such as financial reports for board meetings, tracking mortgages, and

Table 3. Quantity and Quality of Training Experienced (N=100)

Technique	Average Quantity (Hours/Technique)	Average Quantity (Contacts)	Quality (Mean Rating*)
Tutorial	14.78	3.01	3.33
Course/Seminar	44.11	4.49	3.32
CAI	18.43	5.43	2.86
ITM	7.82	2.20	3.42
Resident Expert	104.82	23.32	3.96
Help Component	9.41	4.63	2.73
External	35.63	2.26	3.07

*Means are based on a 5-point Likert scale (1 = Very Low 5 = Very High) and do not include those subjects who have not experienced the training technique.

tracking specific insurance claims. The microcomputer products most frequently used were LOTUS 1-2-3 (65%), Wordstar (35%), dBase II and III (30%), and Symphony (20%).

When managers categorized the source(s) of their computer-related training, the results substantiated earlier findings [4,5] which found "self-training" to be the dominant source of computer-related training. Interestingly, most respondents described the quantity of their computer-related training as being only slight to moderate. More specifically, 80% of those interviewed rated the four sources of training—(self-training, college training, company training, and vendor training)—as being none, slight or moderate. The five users from each of the companies were asked to describe all seven training techniques in reference to both the quantity and quality of training received. (See Table 3.) Average quantity (hours/technique) represents the total number of hours of training the interviewees had received since joining their present employer, whereas average quantity (contacts/ technique) represents the subject's estimate of the total number of times they experienced each technique. Finally, the last column of Table 3 summarizes quality ratings for each of the training techniques (i.e., via a 5-point Likert scale). The Interactive Training Manual, a combination of an applications-oriented tutorial and guidebook, and the "help" component scored significantly lower than the other techniques in terms of quantity. The resident-expert technique ranked superior in both quantity and quality, while CAI and the "help" component had the lowest quality scores.

When separated by organizational level, middle-level managers reported having had a total of 258 hours of training, significantly more than the 190 hours reported by upper-level managers.

Finally, each manager described the eleven computer-related abilities in terms of (1) their importance to his/her job performance, and (2) the current level of ability he/she felt they possessed. Table 4 ranks, in ascending order, the eleven abilities by both perceived importance and current ability level. These levels were rated on a 5-point scale, with mean ratings also being presented. Understanding and interpreting output, accessing data, and utilizing hardware ranked consistently high among the eleven abilities, while programming, model building and graphics scored among the lowest.

For ten of eleven computer-related abilities (all except programming) managers rated their perceived current level of ability significantly lower than the perceived level of importance attributed to each ability. (See Table 5.) In addition, when separated by organizational level, it is interesting, but not surprising, to note that upper-level managers rated their computer-related abilities significantly lower than did middle-level managers ($p < .01$).

Data Analysis and Results

To restate, the general objective of this study

Table 4. Ranking and Ratings of Computer-Related Abilities (Rating on 5-Point Scale 1 = Very Low 5 = Very High)

Ability to:	Perceived Importance		Current Ability Level	
	Rank	Mean Rating	Rank	Mean Rating
Understand/Interpret Output	1	4.41	1	3.86
Access Data	2	3.46	2	3.00
Use Hardware	3	3.30	3	2.79
Use Pkg. Appl. Software	4	3.20	4	2.63
Use Appl. Dev. Software	5	3.10	6	2.14
Use Operating Systems	6	2.58	5	2.40
Handle Data Communications	7	2.48	8	2.03
Utilize Graphics Techniques	8	2.45	11	1.95
Use Office Automation Systems	9	2.40	7	2.06
Build Models	10	2.34	10	1.96
Program	11	2.12	9	1.97

was to develop a better understanding of end-user training within the organization. In particular, its goal was to develop a better understanding of the impact that computer-related training has on management via an investigation of the use of existing IS products and technologies, the satisfaction of the end-user community, and the abilities of end users to employ computers in their work environment. Therefore, relationships representing three different variable classes (training, ability and acceptance) were investigated. Due to the varying metrics of the questions contained within the research instruments the data were standardized (Mean = 0, Std. Dev. = 1) prior to analysis.

Research Question 1 (Q1)

What is the relationship between the computer-related training an individual receives and his/her computer-related abilities?

In general, managers rated their current level of ability significantly lower than the corresponding level of importance they attached to each item. (See Table 5.) This evidence underscores the significance of examining the relationship stated in Q1.

To examine the relationship described in each of the research questions, correlation coefficients were generated. (See Table 6.) As depicted, statistically significant correlations exist between training source and ability ($r = .53$; $p < .01$), as well as between training hours/technique and ability ($r = .22$; $p < .05$). In this case, statistical analysis led us to conclude that there is a relationship between the computer-related training that a user receives and his/her ability to use the computer resource.

In addition, the relationship between each of the four individual sources of computer-related training and the eleven individual ability levels was examined via the analysis of zero order correlations (r). (See Table 7.) Over 50% of these pairings (33/60) represented significant relationships at the .05 level or better. Some significant correlations are:

1. Computer-related training received in college seemed to support programming, modeling and graphing abilities, as well as the ability to use application development software (e.g., LOTUS 1-2-3) and operating systems. It also better enabled users to understand computer-generated output.
2. Computer-related training received from the company tended to support the handling of data communications, hardware, graphics and operating systems.
3. Vendor training was significantly correlated with the ability to use packaged application software, as well as other proprietary-oriented abilities such as hardware manipulation and data communications.

Table 5. Difference Between Perceived Ability Importance and Perceived Ability Level (Rating on 5-Point Scale 1 = Very Low 5 = Very High)

Ability to:	Difference Between Importance and Ability	T
Program	.15	1.18
Use Application Development Software	.96	7.91**
Use Packaged Application Software	.57	4.85**
Use Office Automation Systems	.34	2.99**
Build Models	.38	2.84**
Access Data	.46	3.70**
Handle Data Communications	.45	4.07**
Use Hardware	.51	4.13**
Utilize Graphics Techniques	.50	3.92**
Use Operating Systems	.18	1.97*
Understand and Interpret Output	.55	5.94**
Total Ability Importance—Level	5.05	8.01**

*p < .05 **p < .01

Research Question 2 (Q2)

What is the relationship between the computer-related abilities of an end user and his/her acceptance of information systems products and technologies?

To facilitate operationalization of the variable acceptance, Q2 was further subdivided into two secondary questions.

Q2.1: What is the relationship between an end user's abilities and his/her utilization of IS products and technologies?

As displayed in Table 6, a correlation of .22 between ability and the use of an IS in the decision-making process was statistically significant at the .05 level. This led us to conclude that there may be a relationship between an end user's abilities and his/her utilization of information systems.

Q2.2: What is the relationship between an end user's abilities and his/her satisfaction with IS products and technologies?

Based upon our examination of the correlation between ability and satisfaction, we are unable to conclude that there is a statistically significant relationship between these variables at the .05 level. (See Table 6.)

Discussion

Research efforts have done little for the educational development of the IS user community. Indeed, our literature review, as well

Table 6. Correlations Between Variables in Research Questions

	Training 1	Training 2	Ability	Use	Satisfaction
Training 1	—				
Training 2	.33**	—			
Ability	.53**	.22*	—		
Use	.02	.07	.22*	—	
Satisfaction	.04	.10	.06	.20*	—

Note: Training 1 = Quantity of training as measured by all *sources*.
Training 2 = Quantity of training as measured by all *techniques*.

*p < .05 **p < .01

Table 7. Correlations Between Source of Training and Computer-Related Abilitites (N = 100)

Ability to:	Self-Trained	College	Company	Vendor	Source Overall
Program	.18	.49**	.10	.02	.31**
Use Application Development Software	.32**	.26**	.07	.09	.35**
Use Packaged Application Software	.26**	.11	.17	.44**	.46**
Use OAS	.14	.15	.30	.06	.19**
Build Models	.07	.22*	.02	.14	.05
Access Data	.32**	.17	.09	.22*	.36**
Handle Data Communications	.28**	.09	.32**	.06	.34**
Use Hardware	.32**	.10	.27**	.21*	.39**
Utilize Graphics Techniques	.27**	.33**	.24*	.05	.35**
Use Operating Systems	.31**	.21*	.25**	.02	.32**
Understand and Interpret Output	.11	.21	.02	.10	.11
Overall Ability	.42**	.36**	.26**	.14	.53**

* $p < .05$ ** $p < .01$

as what is actually being done in a number of organizations, indicates a lack of consensus that training is the critical link in getting managers to use computer-based information systems. Education/training seems to be taken for granted—an occurrence often mentioned, yet seldom acted upon.

This study of the current training practices in a number of different companies largely echoed our findings from the literature review. In each case, interviewees stated, time and time again, how important they felt training was to the successful integration of systems. Yet the resources formally committed to training remained relatively low across the 20 survey companies. In general, companies were found to be "spending" less than 2% of their IS resources (human and financial) on training end users.

Statistical examination of the two primary relationships described within our research model yielded these significant correlations:

1. Computer-related training is positively related to computer-related ability (Q1).
2. Computer-related ability is positively related to use of computer resources (Q2.1).

Apart from the testing of the research questions and the validation of the model itself, several other interesting relationships were statistically examined. For example, in general, managers rated their current level of ability lower than the corresponding level of importance they attached to each item. In addition, the relationship between the "sources of training" and the eleven variables describing ability levels for the 100 managers contained a number of interesting implications concerning where users seem to be developing various abilities.

First, the finding that programming, modeling, graphing, and the use of software such as LOTUS 1-2-3 are skills that are more apt to be learned in college is a logical expectation. However, the additional knowledge that managers rated their programming, modeling, and graphics skill levels to be among their lowest could be a cause for concern. (See Table 4.) Perhaps both colleges and companies alike need to become more cognizant of educational results.

Secondly, company training seemed to support the more "technically-oriented" abilities: use of data communications, hardware, and operating systems. Here, the question that comes to mind is "what are the company's training programs in LOTUS 1-2-3 accomplishing?"

Third, vendor training/support in the use of particular products has obviously been an important consideration in the purchasing decision for good reason. What the IS professional also needs to consider is "when is it cost effective to bring this training in-house?"

The findings suggest that the most successful computer-based information systems, from the standpoint of increased use, will be those in which users are able to utilize the computer resource for a variety of different purposes (e.g., modeling, accessing data, and/or interpreting output). Computer-related ability, therefore, joins other important factors such as the user-friendliness of a particular IS, the location of an access unit (terminal or standalone computer), and required use by a supervisor in determining the degree of utilization of an IS. All of these points are important to the practitioner, based on the premise that the more a system is used, the more potential that system has for success.

Given that ability enhances a manager's use of a system, the question now becomes "how can we enhance a manager's ability?" Research Question 1 examined this point via computer-related training.

IS practitioners and top management should be interested in the fact that managers do not feel they possess the necessary computer skills to do their jobs effectively (Table 5). Managers perceive a greater need for training in ten of the eleven ability areas—every area except programming.

Future Research

Both researchers and practitioners are encouraged to incorporate and build upon the research presented in this study. Further examination of this study's implications is required to gain a true understanding of the user-training problem.

In reference to the study's limitations, the companies and subjects included within the sample are not representative of all operational environments. We chose to examine (1) companies in which IS has a high strategic impact on existing operations, and (2) only top- and middle-level end users. Furthermore, the operationalization of the variables contained within the research model deserves close scrutiny. There is a myriad of ways to describe a research topic as new as this one.

We and other researchers are challenged to find new ways of testing educational relationships in the IS environment. The weak relationship described in Q2.2 calls for the design of new studies that incorporate different, perhaps more homogenous research instruments. For example, the development of a questionnaire specifically designed to measure *end-user satisfaction* is strongly encouraged. While the UIS questionnaire (Ives, *et al.* [16]) remains one of the only validated instruments in the field, based on our experience it seems unlikely that it is appropriate for measuring satisfaction with end-user computing. In addition, future researchers might attempt to measure training in terms of *content* (e.g., training received for programming, use of LOTUS 1–2-3, or data communication), much along the same lines as the ability questionnaire attempted to measure the ability to program, to use LOTUS 1-2-3, etc.

This exploratory study has indicated several specific areas requiring more explicit and extensive research in order to help the organization operate as an effective change agent in the integration of IS technologies:

1. It would be interesting to view the effects of computer-related training on ability and acceptance within a field or laboratory experiment, in which the variables are under some degree of control.
2. Somewhat related to 1 above would be research of a controlled nature on the

effectiveness of various instructional techniques within different educational scenarios. For example, it would be helpful to know under what circumstances the tutorial technique is most effective. Also, it would be interesting to note what combinations of techniques are effective, and under what circumstances.

3. More in-depth case research on a smaller number of companies would also be a productive research effort. Companies within similar industries, yet found to approach user education differently, could be compared and contrasted in terms of successful/unsuccessful experiences. Here, one might seek to include companies operating at different stages of technological development.
4. Related to 2 above would be research on the influence of a stage model (e.g., Nolan's Stage Hypothesis [10]) on the development of organizational education strategies [1]. Determination of a logical progression and time frame for a company's educational development would be very helpful to the practitioner.
5. There is also a process of "evolution" in user behavior [14,15], and that in itself should provide an interesting backdrop for future studies on the impact of training on acceptance over time. Indeed, the relationship between training and a user's behavioral evolution is certainly an appropriate application of the S-shaped learning curve phenomenon. Perhaps a series of phases or stages can be identified under which a user progresses from a state of uncertainty, during which the user must overcome feelings of anxiety, to a point of integration, where the technology has been effectively integrated into a user's work environment.

Most of the above areas of research are broad and interrelated. However, if the present research has brought these issues into clearer focus, an important objective has been achieved.

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