DOCUMENT RESUME

ED 422 953 IR 057 111

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TITLE End User Training: A Decade of Research.

PUB DATE 1997-00-00

NOTE 12p.; In: Proceedings of the International Academy for Information Management Annual Conference (12th, Atlanta, GA, December 12-14, 1997); see IR 057 067.

PUB TYPE Information Analyses (070) -- Reports - Research (143) -- Speeches/Meeting Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS *Educational Principles; Higher Education; Individual Characteristics; Information Science Education; Literature Reviews; *Management Information Systems; Research Needs; Research Reports; Scholarly Journals; Tables (Data); *Training; Training Methods; User Satisfaction (Information); *Users (Information)

IDENTIFIERS Training Needs

ABSTRACT

End user training research has uncovered principles applicable to many forms of training and education. In an attempt to determine useful principles for IS (information systems) educators, the top 12 MIS (management information systems) journals were systematically reviewed to locate all of the end user training articles that were published in those journals from 1980 to 1996. A total of 20 articles were found, spanning the decade from 1987 to 1996. These articles were divided into seven streams of research: (1) training and user acceptance/satisfaction; (2) training methods; (3) trainee characteristics; (4) the need for training; (5) evaluating training; (6) the training environment; and (7) the organizational environment. The articles within each stream of research are discussed and the results evaluated. Possible directions for future research are given, and some conclusions on the current state of end user training research are offered. (Contains 29 references.) (Author/AEF)

END USER TRAINING: A DECADE OF RESEARCH

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End user training research has uncovered principles applicable to many forms of training and education. In an attempt to determine useful principles for IS educators, the top twelve MIS journals were systematically reviewed to locate all of the end user training articles that were published in those journals from 1980 to 1996. A total of twenty articles were found, spanning the decade from 1987 to 1996. These articles were divided into seven streams of research: training and user acceptance/satisfaction, training methods, trainee characteristics, the need for training, evaluating training, the training environment, and the organizational environment. The articles within each stream of research are discussed and the results evaluated. Possible directions for future research are given, and then some conclusions on the current state of end user training research are offered.

INTRODUCTION

Almost twenty years ago, a crisis was realized. Data processing departments were unable to meet the demand for their products, causing a backlog of IS's waiting to be developed (McLean 1979). McLean proposed that allowing end users to work as developers was the only solution with the potential to avert this crisis. With the growth in end user computing (GSA Office of Personnel Research and Development, U.S. Government 1995), researchers began investigating the issues associated with training end users.

End user training shares several similarities with IS education. In both cases, instructors are attempting to improve the students' skills at working with technology. Perhaps more importantly, in both cases these technology skills are being used by the students to develop systems that support organizational tasks (Brancheau & Brown, 1993). Based on these similarities, it appears reasonable that principles uncovered by end user training research could be used by instructors to further improve IS educational programs.

Considerable research has occurred in the area of end user training. Lamentably, there has been no systematic evaluation of the findings contained in these articles. This paper, therefore, reviews all of the training research published in the top twelve MIS journals since 1980. The published articles are organized into major streams of research and the findings from these articles are compared and contrasted to determine their overall contributions to IS education.

METHOD

Walstrom, Hardgrave and Wilson (1995) provided a recent ranking of the top MIS journals. The top twelve journals are listed in Table 1, in rank order of importance. The researchers searched through those twelve journals, looking for articles on end user training. Since the first end user computing article appeared late in 1979 (McLean), each issue in the selected journals from 1980 to 1996 was examined. Searching through the journals involved scanning the table of contents for each issue to determine whether any of the articles dealt with end user training. If there were any article titles that were questionable, the abstract was consulted to make a final decision.

TABLE 1

LISTING OF TOP MIS JOURNALS THAT WERE SEARCHED TO LOCATE END USER TRAINING ARTICLES

Journal	Code
MIS Quarterly	MISQ
Communications of the ACM	CACM
Information Systems Research	ISR
Management Science	MS
IEEE Trans. on Software Engineering	IEEESOFT
ACM Trans. on Database Systems	ACMTRANS
Journal of MIS	JMIS
Decision Sciences	DS
Harvard Business Review	HBR
ACM Computing Surveys	ACMCOMP
Decision Support Systems	DSS
Information and Management	INFO&MGMT

Unfortunately, some of the journal issues were not available during the search process.
Table 2 lists which issues were not searched, and the reason why they were excluded from the search process. It seems likely that the amount of coverage is nearly exhaustive; the issues which have not yet been searched may contain a few more end user training articles, but it is doubtful that those few articles would substantially alter the results reported by the rest of the articles.

The articles that were found in the selected journals were examined chronologically in an attempt to uncover trends within the past decade of training research. Those articles that considered conceptually similar aspects of the training process were placed into broad categories or streams of research. These categories provided a framework within which the results reported by the articles could be examined and compared to each other.

TABLE 2

COVERAGE OF THE SELECTED JOURNALS (ITALICS INDICATE COMPLETE COVERAGE)

Journals	Coverage	Comments
MISQ	1980-1996	The 12/96 issue is in the process of being bound.
CACM	1980-1996	
ISR	1990-1996	The first issue was in 1990.
MS	1980-1996	
IEEESOFT	1980-1996	
ACMTRANS	1986-1996	The issues from 1980-1988 were not in the library.
JMIS	1985-1996	The first issue was in 1985.
DS	1980-1996	
HBR	1980-1996	
ACMCOMP	1980-1996	
DSS	1985-1990, 1995-1996	The first issue was in 1985; the issues from 1991-1994 were missing.
INFO&MGMT	1980-1996	

RESULTS

A total of twenty articles were found that were published between 1980 and 1996. It appears that a steady rate of research (of about two or three articles per year) has occurred over the past decade.

These articles were placed into broad categories, given in Table 3, in an attempt to identify streams of research that have occurred within the

past ten years. These categories enable one to compare and contrast the results from each of the articles, as well as determining the knowledge that has accumulated from these articles. This should allow researchers to determine where gaps still exist in our knowledge of end user training, and where researchers could most profitably direct their efforts in future research studies. Each of the rows in the table represents a different year from 1987 to 1996, allowing one to examine the chronological sequence of the research studies within each of the categories.

As can be seen in Table 3, the first empirical research was conducted in 1987 by Nelson and Cheney. They began one of the more popular research streams: a series of articles that attempted to link end user training with user satisfaction and acceptance. The only research stream that was more popular was one that attempted to compare various teaching methods. Some of these articles also examined the interaction between trainee characteristics and training method (Davis and Davis, 1990; Santhanam and Sein, 1994). The remainder of the trainee characteristics articles (Bostrom, Olfman and Sein, 1990; Mackay and Lamb, 1991) attempted to determine whether there were distinguishable groups of trainees that required different forms of training.

TABLE 3

CATEGORIZATION OF THE END USER TRAINING ARTICLES

Opinion	Training Accept. & Satisfaction	Training Methods	Trainee Char.	Need for Training	Eval. of Training	Training Environ.	Org. Environ.
Mdskr87	Nelson87						
	Cronan90	Davis90	Davis90	Cronan90			
			Bostrm90				
			Mackay91	Nelson91			
	Yavrbm92						
		Davis93					
		Ahrens93					
		Ngwenyma93					
		Snthanam94					
		Olfman94					
	Lee95	Compeau95		Nelson95	Carroll95	Galletta95	Fitzgrld95
	Simon96	Simon96	Simon96				

Nelson, after his initial article exploring the link between training and satisfaction (Nelson and Cheney, 1987), began a separate stream that attempted to provide a method for determining the users' need for training (Nelson, 1991; Nelson, Whitener and Philcox, 1995). Cronan and Douglas (1990) and Carroll and Rosson (1995) examined methods for evaluating the effectiveness of training. Galletta et al (1995) and Fitzgerald and Cater-Steel (1995) looked at the context surrounding the training to determine whether it had an impact on the training's effectiveness.

Training/Acceptance/Satisfaction

Nelson and Cheney (1987) correlated hours of training with measures of ability and information systems (IS) acceptance from the results obtained by surveying managers and professionals. They

found a significant positive correlation between training and ability, but the correlation between ability and acceptance was nonsignificant. This contradicts the later findings of Lee, Kim and Lee (1995) who found a significant path between ability and acceptance when using path analysis on data collected from structured interviews with managers and questionnaires completed by end users. However, a closer examination of the measures used by the two different papers reveals the probable reason for these contradictory findings.

Nelson and Cheney developed their own measure of end user ability, and Lee, Kim and Lee used that same measure in their later research. Any results related to this measure of ability should be comparable between the two studies. On the other hand, Nelson and Cheney used a surrogate measure for end user acceptance: the Ives, Olson and Baroudi (1983) questionnaire on user satisfaction. Lee, Kim and Lee used an instrument developed by Davis, Bagozzi and Warshaw (1989) to measure user acceptance. They also included user satisfaction in their model; like Nelson and Cheney, they used the Ives, Olson and Baroudi questionnaire to measure user satisfaction. Nelson and Cheney used the same instrument, but called it by a different name: user acceptance instead of user satisfaction. When conducting the path analysis, Lee, Kim and Lee found no direct path between ability and satisfaction, which actually confirms the results found by Nelson and Cheney. Furthermore, Lee, Kim and Lee found that there were significant paths between ability and IS acceptance and between acceptance and IS satisfaction, indicating that user satisfaction is indirectly related to ability.

Cronan and Douglas (1990) asked supervisors and end users to evaluate the effectiveness of an end user training program; therefore, this article is primarily discussed in the "Evaluation of Training" section. In addition to measuring the effectiveness of the program, though, they also reported that "... a high degree of satisfaction resulted from the EUC [end user computing] program."

Along these same lines, Yaverbaum and Nosek (1992) examined the effects of IS education and training on user satisfaction. They requested MBA students to complete the Ives, Olson and Baroudi (1983) questionnaire on user satisfaction at the beginning and end of a semester during which an introductory MIS course was offered. Satisfaction changed significantly after the students completed the course. The researchers concluded that after the course students were less tolerant of the poor attitudes in the MIS organization, more understanding of the functions and concerns of the MIS organization, and more critical of the systems produced by the MIS organization.

Simon et al. (1996) explored the effect of training method on performance and user satisfaction. The three training methods used by Simon et al. included lecture, exploration (or self-study) and behavior modeling. They found significant differences between the treatments in relation to user satisfaction, with those groups assigned to behavior modeling reporting the highest levels of user satisfaction. The results they found regarding performance are discussed in the next section, Training Methods.

Training Methods

The research that has explored the effectiveness of training methods has examined various methods for presenting the content of the training (lecture, self-study and behavior modeling), as well as examining the content of the training itself (procedural versus conceptual training). Davis and Davis (1990) was the first study to compare training methods. Students in an introductory undergraduate IS course participated in the study by completing three exams and five programming assignments after receiving their assigned treatment. They were divided into two groups; one group listened to lectures, while the other group received self-study materials. The lecture group significantly outperformed the self-study group, indicating that an end user would need fairly unique characteristics to effectively use self-study materials. When the researchers compared the two groups, they found that concepts were retained better by the students who had received the lecture treatment and that procedures were retained better by the students who had completed the self-study materials. Davis and Davis also analyzed several demographic characteristics of the students in their study. Those results are discussed in the next section, "Trainee Characteristics".

Compeau and Higgins (1995) compared the lecture teaching method to behavior modeling using managers and professionals as their subjects. They hypothesized that behavior modeling would increase the subjects' self-efficacy and perceived expected outcomes. Both groups received general computer training in Word Perfect and Lotus 1-2-3. The lecture treatment group received a standard lecture presentation, while the behavior modeling treatment group watched a videotape in which an actor portrayed using the two software programs. The script for the videotape was designed to show the actor experiencing difficulty with the computer at first, but then gradually achieving some degree of mastery over the two programs. The subjects were given performance tests at the end of the experiment.

Somewhat contrary to the researchers' hypotheses, those subjects exposed to behavior modeling outperformed the other subjects only with Lotus. There was no significant difference between the groups' performance on Word Perfect. The researchers proposed that their subjects may have had a stronger conceptual foundation for word processing tasks than for spreadsheet tasks, so behavior modeling provided a more effective method for learning more difficult tasks. Also contrary to the researchers' hypotheses was a negative relationship between outcome expectations and performance. The researchers proposed that the time frame of the training period was too short (it occurred over two days) for performance to reach the level of outcome expectations. Since the subjects were novices, their expectations may have represented a long-term view of their potential which they had not yet had a chance to achieve.

Simon et al. (1996) compared all three of the training methods: lecture, self-study and behavior modeling with members of an active duty U. S. Naval Construction Battalion serving as subjects. The training covered general computer information and also the use of Micro-SNAP, a DOS-based application used for ordering, tracking and issuing material. Behavior modeling, again, provided superior retention of knowledge and transfer of learning compared to the other two training methods.

Instead of comparing the form of presentation of the training, some studies have compared the content of the training. Olfman and Mandviwalla (1994) and Santhanam and Sein (1994) both compared conceptual and procedural training. Olfman and Mandviwalla (1994) trained university employees on Windows, dividing the subjects into two treatment groups: one receiving conceptual training, and the other receiving procedural training. The researchers found no significant difference in the amount learned between the two groups.

Santhanam and Sein (1994), on the other hand, not only compared the two training methods, they also attempted to measure the mental models formed by their subjects. They recruited undergraduate students in an introductory IS course and trained them on the usage of e-mail. Similar to Olfman and Mandviwalla (1994), they found no significant difference between the two methods, but when they considered whether the subjects formed conceptual or procedural mental models, they found that conceptual training outperforms procedural training if the subject forms a conceptual mental model. Also, subjects were better able to perform on complex tasks if they had formed conceptual mental models. Unfortunately, over a three week time period, those subjects with a conceptual mental model appeared to regress to a procedural mental model.

Davis and Bostrom (1993) examined two variations of self-study materials, exploratory and instructional booklets, and found no significant difference in the performance of the two groups. Their subjects consisted of undergraduate students from an introductory IS course. In addition to comparing the structure of the self-study materials, they also compared the performance of the subjects based on the type of interface used. One group used a direct-manipulation interface (the Macintosh Finder), while the other group used a command-based interface (DOS). They found that subjects trained with the direct-manipulation interface performed better than the other group; however, it seems unlikely that the performance of the two groups could be directly compared. The two interface types are based on extremely different paradigms, and require the users to perform very different tasks. It seems unlikely that the researchers used performance tests for these two interfaces that accounted for some of their fundamental differences.

Computer-assisted instruction (CAI) was examined by Ahrens and Sankar (1993) in an attempt to determine whether it provides a suitable tool for training end users. They developed two different tutors for training users on entity-relationship diagrams. One tutor merely presented the information to the subjects in a passive manner; the other tutor asked questions and then immediately evaluated the answers that were given. The researchers used undergraduate IS students as subjects and assigned them to one of the two tutors. The results indicated that the subjects had better retention of procedural tasks than conceptual material. Also, performance was higher when the tutor asked questions. This seems to provide evidence that CAI tutors may be effective in training users on procedural tasks. They also appear to be more effective than written self-study materials since the subjects using the question-and-answer tutor outperformed those that used a tutor that only presented information (similar to reading a self-study booklet). The ability of CAI to interact with the user and provide immediate feedback seems to increase the user's retention of the material presented by the program.

As opposed to single training sessions, Ngwenyama (1993) proposed a method for continuously increasing end user competence. He called the method Collaborative Action Learning (CAL) and basically proposed that "... the participants collectively engage in a continuous cycle of experiential learning ..." CAL begins with project initiation, then cycles through information requirements definition, application prototyping, system implementation, post development discussion, and then repeats again with information requirements definition. The researcher conducted a case study with an organization that used CAL, and concluded that it allowed for the "... maintenance of an adequate level of end-user competence."

Trainee Characteristics

In addition to the training method used, some researchers have hypothesized that the personal characteristics of the end users may have an impact on the effectiveness of training. For example, Davis and Davis (1990) examined age, formal educational level, human information processing style and gender. The variables with significant differences were age, formal educational level and information processing style. The oldest age group, those from 25 to 39 years old, performed better than younger subjects. This seems to fit anecdotal evidence that students above the traditional ages generally perform best in class. Also, those subjects who had twelve years of education or more than fifteen years of education performed better than those subjects with thirteen to fifteen years of education. This seems to fit the anecdotal evidence, also. The researchers found significant differences with the information processing style variable for those subjects with a thinking style as opposed to a feeling style. This seems to indicate that those end users with a preference for a feeling style of information processing may be somewhat at a disadvantage compared to other end users and may require special consideration in designing training sessions. There were no significant differences in gender.

Bostrom, Olfman and Sein (1990) examined the influence of an end user's learning style on the effectiveness of training. They used Kolb's learning style inventory (1976) to classify their subjects into four learning styles, and then examined the outcomes of four separate experimental studies (two of which used undergraduate students as subjects, one used MBA students as subjects, and the other used employees as subjects) to determine whether individuals with certain learning styles have a preference for training that uses certain conceptual models (abstract or analogical) and certain training methods (applications-based, an exploration-oriented approach focusing on tasks, or construct-based, an instruction-oriented approach focusing on specific features).

The researchers found significant differences between the four learning styles, leading them to recommend certain conceptual models and training methods for certain learning styles. Convergers[1] and assimilators performed best with abstract conceptual models, while divergers and accomodators performed best with analogical conceptual models. Applications-based training worked best with convergers and accomodators, while construct-based training worked best with assimilators and divergers.

Ruble and Stout (1993) criticized the Bostrom, Olfman and Sein article, claiming that the findings were not consistent with the hypothesized interaction between learning style and training method and that the learning style inventory that was used lacks reliability and validity. Ruble and Stout propose that the inconsistent findings may have resulted from the poor psychometric properties of the learning style inventory. Bostrom, Olfman and Sein (1993) countered these arguments by claiming "... that: (1) research on important issues cannot be (and is not, in practice) suspended until highly valid instruments are constructed, and (2) that imperfections in the KLSI-1976 did not significantly affect the operationalization of learning styles in our studies, and, thus, our findings are credible."

Simon, et al. (1996) used the Wonderlic Personnel Test to measure cognitive ability as a covariate in their research study, which examined the relationship between training method, performance and user satisfaction. Cognitive ability was found to be nonsignificant, but there was a slight interaction with some of the tasks. These tasks tended to require more abstract thinking and less procedural knowledge, leading the researchers to conclude that cognitive ability was not predictive of performance on concrete, procedural tasks, but may be useful for abstract, conceptual material.

Mackay and Lamb (1991) examined whether the training needs of end users differed depending on their possession of referent experience and task domain knowledge. They used twelve subjects, six health care marketing analysts and six accountants. These subjects were asked to locate sites for emergency medical clinics using demographic data that had been entered into a Lotus 1-2-3 spreadsheet. Protocol analysis was used to examine the cognitive problem-solving process used by each subject. The subjects were categorized into four groups, based on whether they were a novice or expert regarding referent experience (knowledge of Lotus 1-2-3) and task domain knowledge (health care marketing).

Those subjects who were expert in both referent experience and task domain knowledge solved the problem in a different manner than the other three groups, using a more complicated set of commands to achieve their solution. The other three groups were very similar to each other, leading the researchers to conclude that the content of training sessions may need to be tailored to areas in which the end users are novices.

Need for Training

Nelson (1991) began a stream of research that examined end users' needs for training. To that end, employees in eight different organizations completed a survey measuring the self-perceived need for training among IS and end user personnel. He found that both IS and end user personnel reported that they were deficient in general IS knowledge, that IS personnel were deficient in organizational knowledge, and that end user personnel were deficient in IS-related skills. These results seem to indicate that both groups require further training and that organizations should carefully consider their current training programs to ensure that they meet the needs of both groups.

Nelson continued his work with needs analysis by proposing a framework (Nelson, Whitener and Philcox, 1995) that would provide an effective foundation for an organization's training program. The framework consisted of a grid formed by intersecting three types of training content (personal, task and organizational) and three levels within the organization (individual, subunit and organizational). Each cell in the grid suggests issues that need to be addressed by the organization's training program.

To investigate the effectiveness of this framework, the researchers performed a case study on the Internal Revenue Service (IRS). The IRS had recently adopted a new initiative for training that included a more extensive needs analysis which utilized six of the nine cells in the proposed framework. After interviewing executive management and personnel responsible for end user training, and after examining documentation and archival records, the researchers concluded that the framework improved the needs-assessment process, even though all the cells in the framework had not been used.

Evaluation of Training

Cronan and Douglas (1990) evaluated the effectiveness of a training program at a public agency by requesting that end users and supervisors evaluate the program. The evaluations indicated that the training program had been effective. In addition, empirical measures indicated that the training had resulted in "... [a] 24 percent increase in productivity, a savings of approximately 7.6 hours per week, and a high degree of satisfaction . . . "

Carroll and Rosson (1995) provide a framework for managing training evaluation. They illustrate this framework by reporting a case study on an organization that used this framework. The case study indicated that the framework was effective, and they conclude that "... training evaluation coextends with the analysis, development, and deployment of training systems and requires a lifecycle-oriented management process."

Training Environment

Galletta, et al. (1995) investigated the effects of positive and negative word-of-mouth communication during a training session. MBA students worked through a packet of exercises that provided a series of step-by-step instructions on building a spreadsheet that included text and a graph. The positive and negative word-of-mouth groups had several students that acted as confederates in the experiment by giving positive or negative comments during the course of the training. After completing the training packet, students were given the opportunity to explore the software on their own. They then completed a quiz covering concepts that were taught in the training packet. Also, they completed a questionnaire measuring their attitude toward the software and intent to purchase the software.

The negative word-of-mouth groups scored significantly lower than the positive groups in attitude, intent to purchase or use the software, and performance on the quiz. There was no significant difference in the performance of the positive and negative word-of-mouth groups on the initial training task; however, a majority of students received a perfect score on the completed task, leading to a very low variance. There was also no significant difference in the amount of exploration that occurred in the positive and negative word-of-mouth groups, with nearly half the students spending no time in exploration.

The control group (which had neither positive nor negative outbursts) was nonsignificant with respect to the positive word-of-mouth group in all four of the scores that were measured. This led the researchers to believe that the outbursts in the positive word-of-mouth group had a distracting effect that lowered their scores, even though the positive comments increased the students' scores.

Organization Environment

Fitzgerald and Cater-Steel (1995) conducted a case study on an end user training program that operated within a low-cost budget. The trainees and trainers evaluated the strategy, and the results indicated that the training had produced productivity increases. Recommendations were made by the researchers, based on successful strategies used by this training program, for effectively designing other training programs within similar budgetary constraints.

DISCUSSION

Clearly, the past ten years of end user training research have reported findings important to the continued success of organizational training efforts. Reviewing the results found within each of the proposed research streams will provide educators with valuable suggestions for improving IS education programs and classes, as well as providing researchers with insight into areas still needing research, both within IS education and end user training. Those research streams which have articles that build upon past efforts have generally revealed consisted and replicable results, but there are still further questions remaining to be answered.

It appears, for example, that training does increase user satisfaction (Cronan and Douglas, 1990; Yaverbaum and Nosek, 1992), but only indirectly; user ability, which correlates with amount of training (Nelson and Cheney, 1987), is related to IS acceptance, which in turn is related to user satisfaction (Lee, Kim and Lee, 1995). Training that uses behavior modeling also seems to lead to higher user satisfaction than training designed around lectures or self-study (Simon, et al., 1996).

Regarding training methods, subjects trained with lectures outperform those trained by self-study (Davis and Davis, 1990). On the other hand, subjects trained with behavior modeling outperform those trained by either lectures or self-study (Compeau and Higgins, 1995; Simon, et al., 1996). If a self-study design is used, it appears that computer-assisted instruction (CAI) is the most effective form of self-study because of its ability to ask questions and evaluate the user's answers (Ahrens and Sankar, 1993). CAI was found to be more effective at teaching procedures than it was at teaching concepts, however.

Lectures seem to allow subjects to retain concepts better, while self-study seems better suited to learning procedures (Davis and Davis, 1990; Ahrens and Sankar, 1993). Conceptual training has been shown to be more effective than procedural training, but only if the subjects form conceptual mental models (Santhanam and Sein, 1994). It is still unclear, though, what the processes are that lead a student to form conceptual mental models.

Some researchers have hypothesized that trainee characteristics may have an impact on the effectiveness of training. Davis and Davis (1990) found that age, education and information processing style significantly impacted trainees' performance. The oldest and youngest trainees, and those with the most and least education, outperformed the others. Those trainees with a thinking style of information processing were found to outperform those with a feeling style.

Research indicates that learning style interacts with the training method that is used (Bostrom, Olfman and Sein, 1990), although there is some controversy over these findings. Cognitive ability was found to be only predictive (and even then, only slightly predictive) of performance on abstract, conceptual material (Simon, et al., 1996). There was no differentiation on concrete, procedural tasks. Trainees with varying levels of expertise with referent experience and task domain knowledge use software in differing ways. It may be that training sessions may need to be tailored to cover areas where the trainees are novices (Mackay and Lamb, 1991).

When developing an end user training program, an organization should consider the needs of its trainees. There is evidence that end users need training in IS-related skills (Nelson, 1991), and a framework has been proposed for performing a needs analysis for training (Nelson, Whitener and Philcox, 1995). This framework could also potentially aid IS departments in developing future educational programs. To establish and maintain high training standards throughout the lifecycle of a training program, training evaluations may be needed. A framework has been developed for performing training evaluations (Carroll and Rosson, 1995). Evaluations performed using this framework indicate that training can effectively increase productivity (Cronan & Douglas, 1990).

The research that has examined the context within which training occurs has found that the training context can have a significant impact on that training. Within the training session itself, negative word-of-mouth can have a significant impact on the attitudes of an entire group (Galletta, et al., 1995). Positive word-of-mouth does not seem to have the same amount of influence. Evidence was also indicates that, despite an organizational context of strict budgetary constraints (familiar to many IS educational programs), effective end user training programs can still be developed (Fitzgerald and Cater-Steel, 1995).

LIMITATIONS AND FUTURE DIRECTIONS

At least fifteen other journals that publish MIS research were not included in this paper. A more exhaustive search could examine these other journals, allowing the literature review to be more comprehensive. It does not seem likely, though, that this would substantially change the findings reported in this paper.

There are several areas where future research could be conducted. Research on teaching methods seems to have shown the superiority of behavior modeling over other methods, but it has not been established that it is equally effective with concepts and procedures (Davis and Davis, 1990; Simon, et al., 1996). It appears that a combination of lectures (to teach concepts) and computer-assisted instruction (to teach procedures) may be the most effective combination (Davis and Davis, 1990; Ahrens and Sankar, 1993). Unfortunately, this combination has not been tested.

While research on trainee characteristics has shown that the effectiveness of training methods may depend on characteristics of the trainees, this research has failed to provide practical suggestions for tailoring the training sessions to individual characteristics. Does a combination of all training methods (in an attempt to meet the needs of each of the trainee characteristics) produce more effective training sessions for all trainees or does the act of combining training methods produce interference that reduces the overall effectiveness of the training? Since the formation of conceptual mental models appear to improve the effectiveness of the training (Santhanam and Sein, 1994), what are the processes involved in forming conceptual mental models? Are there any factors that increase the probability of forming conceptual mental models?

Nelson, Whitener and Philcox (1995) and Carroll and Rosson (1995) both propose frameworks for improving training programs. Case studies are reported for both frameworks that appear to indicate that the frameworks are effective, but further research is needed to demonstrate the generalizability of these frameworks. Galletta, et al. (1995) demonstrated that the environment surrounding training sessions can have a significant impact on the effectiveness of those sessions; however, this studied only one factor, peer comments. Are there other factors that could have positive or negative effects on the effectiveness of training sessions? What strategies can be employed to control these factors to improve the effectiveness of training?

Future research is needed to more fully explore end user training. The foundation of training research has been built, and further research could determine how to continue to increase the effectiveness of training. Training and education efforts in all areas could potentially benefit from further research.

CONCLUSIONS

The past decade of research has provided a valuable beginning to a fuller understanding of training end users. This understanding can and should be applied to improving IS education. Models have been proposed that attempt to describe the processes inherent in the training process, and factors have been discovered that increase the effectiveness of training. Continuing this research to more deeply explore the issues of end user training will enable instructors to continue to increase the effectiveness of their training and classroom sessions.

The results generated by this research are applicable to training not only end users, but to all forms of training including IS education. Further research efforts with end user training could potentially benefit from examining other sources of training literature; for example, education and cognitive psychology. The promise of end user training research has not yet been achieved; working toward that goal will provide us with valuable insights and principles.

ENDNOTE

1. Convergers: abstract conceptualizers and active explorers. Assimilators: abstract conceptualizers and reflective observiers. Divergers: concrete conceptualizers and reflective observers. Accomodators: concrete conceptualizers and active explorers.

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