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Emerging themes in distance learning research and practice: some food for thought

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With the rapid spread of distance learning as a medium for delivering instruction, the practice of distance learning has outpaced research. This paper describes major themes identified in a review of selected research papers published in the past five years. Themes include the following: definitions of distance learning and why it should be studied; identification of the major learning theories on which research is based; how collaboration can be achieved via distance learning; the role that learner characteristics play in the success of distance learning systems, and issues related to measuring the effectiveness of distance learning. The authors conclude that more research is needed to identify critical success factors for distance learning.

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The past decade has witnessed the rapid growth of distance learning (DL) in education and industry (e.g. Benson 1994; Salas and Cannon-Bowers 2001). This explosion in non-traditional delivery of instruction has been facilitated by a combination of factors, including the growth of content on the Internet, developments in telecommunications technology, and the increased user-friendliness and affordability of personal computers (Anderson and Jackson 2000; Ricketts *et al.* 2000).

Currently, much of web-delivered content is limited by slow telephone modem speed, but ''cable modems, wireless modems and digital subscriber lines (DSL) technologies will continue to advance and offer high-speed, cheap connectivity'' (Ricketts *et al.* 2000, 137). Also, as personal digital assistants (PDAs) and similar technologies decrease in cost and increase in power, they will become alternatives to personal computers, further increasing the accessibility of Internet training (Ricketts *et al.* 2000). Essentially, as technological advances result in faster, cheaper tools, DL will become more attractive as an instructional delivery medium.

However, while educators and Human Resource (HR) practitioners in government

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and industry are eagerly embracing the use of DL (e.g. Johnson 1999), basic and applied researchers have conducted comparatively few studies on DL and have made only modest inroads in understanding how the technology-based delivery of instructional programs interacts with learning outcomes. Historically, the relationship between basic research (i.e. conducting empirical studies) and applied research (i.e. using study results to solve problems) was straightforward (Tannenbaum and Yukl 1992). First, theories based upon factors thought to promote learning would be developed by researchers from the science of training (e.g. industrial/organizational (I/O) psychology, cognitive, education), and these would be followed by empirical studies (Salas and Cannon-Bowers 2001). In time, the most robust theories would lead to training guidelines and recommendations based on the study results. Finally, trainers, instructional designers, and other educators would adopt the guidelines and incorporate them into their instructional programs. In this way, science could contribute by providing the research and recommendations that could be used to solve organizational problems (Salas *et al.* 1999).

Although basic research serves many goals, it is more readily accepted by the non-academic community when it can be applied to solve real-world problems. Furthermore, without empirical evidence supplied by basic research to guide them, practitioners would find themselves in an unending trial-and-error loop. Unfortunately, the chasm between research and practice is growing (see Salas *et al.* 1999). The chasm is only partly due to the rapid growth of technology, which is allowing practice to outpace research. A more troubling reason is that, although I/O psychology has taught us a great deal about how to deliver successful training, this has not always been effectively shared with organizations (Salas *et al.* 1999). The problem is compounded because HR practitioners, especially those who have pressing organizational problems for which they need solutions, are not communicating with researchers. Without improved communication between practitioners and researchers, I/O psychologists may be conducting research that has no practical value to organizations (Salas *et al.* 1999).

Having discussed the relationship between researchers and practitioners, we now turn to the purpose of this paper. Our goal was to stimulate HR practitioners' thinking about the state of research on DL. To that end, we conducted a literature review to identify research papers on DL that had been published since 1997. Our review was selective in that we did not intend to review all papers published or to summarize all research findings. Instead, we wanted to identify emerging research themes, report them, and ask questions about the direction of the research.

Briefly, our themes cover seven broad topic areas. HR practitioners are spending billions of dollars annually to implement DL programs, even though researchers have not yet definitively identified which learners will benefit the most and under what conditions (Themes 1 and 2). Effective DL programs must be based on sound instructional design principles derived from major learning theories. However, current learning theories were developed in traditional classroom settings, which may or may not transfer to DL settings (Themes 3 and 4). Because learning takes place at the individual level, the issues that facilitate or hinder the interaction of a learner and technology, e.g. learner control, social needs, must be addressed (Theme 5). At the group level, collaboration adds technology issues, e.g. information richness, synchronicity, to those of group process losses and gains (Theme 6). Finally, evaluating DL learning outcomes requires an examination of both distal and proximal outcomes at both the individual and organization level (Theme 7).

Our list of emerging research themes comprises two types. The first includes specific topics on which research has been conducted, such as individual differences in

DL, the design of hypermedia systems, and computer-mediated collaboration. Although it would have been sufficient for a themes-review paper to limit discussion to easily identifiable topics, we chose, second, to extend our analysis so that we could also present issues that are associated with the fundamental theoretical approach taken by researchers who study DL processes and outcomes. For that reason, we chose to include such themes as a consideration of the differences among the learning models from which instructional designers extract guiding principles, an overview of the issues that must be considered in evaluating both the proximal and distal outcomes of a DL program, and the identification of important, but under-researched, topics.

The subject of DL is the overarching umbrella that unites these varied themes. Some of the themes are interrelated, for example, learners' individual differences will interact with the way they respond to hypermedia systems as well as affect the degree to which they will participate in online collaboration activities. We present other themes that serve as the basis for discussions of future topics, e.g. instructional designers hold implicit beliefs about learning which influence the instructor's role, the amount of social interaction allowed, and the types of projects selected for group collaboration. Broadly, these themes are topics that researchers have investigated, topics that researchers should investigate, or topics that must be considered as part of the fundamental approach to conducting research on DL programs. To implement successful distance training programs, practitioners need to be aware of the areas in which research has, or has not, produced empirical research data that can guide the development of DL programs.

We offer these themes – in the form of questions – as 'food for thought'. That is, we suggest that every theme should compel HR practitioners and those interested in training in organizations to think critically about the issues raised and how they affect the way in which distance training is designed and delivered.

Theme 1: So What Is Distance Learning Anyway?

Distance learning is a broad term that encompasses both distance education (a term commonly used in academia) and distance training (a term commonly used in industry). One can define DL as learning that is media based, remote, or asynchronous and supported by some instructional system (Bourdeau and Bates 1997).

Perhaps because of its rapid growth, DL is a fragmented domain consisting of many relatively new technologies. This disjointed condition is reflected in the lack of standardized terminology to describe DL. The words distributed, distance, online, Internet, or Web-based are often used interchangeably to describe training, education, learning, or instruction. Other terms that also appear are correspondence study, home study, independent study, and external study (Spooner *et al.* 1999). Interactive learning can be described as either synchronous, i.e. real-time communication, or asynchronous, i.e. delayed communication. In addition, the terms e-learning and cyberlearning are appearing with increasing frequency in the literature. Not only are multiple names used, but the same term sometimes describes different technology contexts. For example, researchers describe simulator-based instruction as 'virtual learning' but, to HR practitioners, 'virtual learning' means learning via the Internet.

Sometimes distinctions are made between similar terms that are otherwise used interchangeably, e.g. the terms distance and distributed learning. For example, Freitas *et al.* (1998) point out that ''the use of computers in DL is more commonly referred to as distributed learning'', while DL can involve the ''use of multimedia, teleconferencing, videotaped lectures, and/or computers'' (p. 367). In another interpretation, DL is defined as a broad term that refers to delivering a

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curriculum to learners who are not physically present on campus, while distributed learning connotes ways of facilitating the interaction among those distant learners (Barley 1999). In industry, distributed training has been defined as "training that is generally managed from a central control site and is provided to individuals or teams who are located at one or more remote sites" (Dwyer *et al.* 1997, 137).

To some degree, the interchangeability of terms reflects the variety of technologies that support DL (Benson 1994). It may helpful to think of DL technology as points on a technology continuum. The continuum ranges from simple, low-technology/no-technology (e.g. correspondence by mail) to highly complex technology (e.g. Internet-based synchronous groupware). Instruction can be delivered either synchronously (real-time mode) or asynchronously (delayed mode). The media itself can be one or a combination of the following, which are listed in no particular order of complexity: radio broadcasts, pre-recorded or live interactive television (ITV) broadcasts, compressed video, two-way audio/one-way video vs one-way audio/one-way video vs two-way audio/two-way video, videotapes, videodisc, CD-ROM, satellite transmission, open air broadcasts, cable, computer, email, on-line conferences, listservs or bulletin boards (e.g. Johnson 1999; Khan 1997; Petracchi 2000; Spooner *et al.* 1999).

In sum, those involved in DL need to be more precise in the terminology they use. Without a common frame of reference, communication between and among researchers and HR practitioners will continue to suffer. A very real risk is that research findings will be misinterpreted because of confusion due to ambiguous language. As such, if HR practitioners were to implement system-wide changes to their instructional design program based on inaccurate or imprecise information, the goals of the training program would not necessarily be met.

Theme 2: Why Do We Care About Distance Learning?

HR practitioners should be interested in optimizing DL for a number of economic and social reasons. For example, in today's economy, organizations depend on a workforce that is prepared to respond quickly as technology changes and new business opportunities arise (Benson 1994). In fact, the economic success of many businesses will depend on how well workers' skills support the organization's strategic plan and well-planned employee learning programs can provide a competitive advantage to organizations (Fulmer 1997). Furthermore, employee career development is a key business issue because organizations need to build the competencies and skills that meet the strategic needs of the company (Fulmer 1997). HR departments are responsible for maintaining a well-trained, flexible workforce to meet organizational goals. DL may provide the means by which HR practitioners can provide employees with training tailored to the immediate needs of the organization (Benson 1994).

Industry has already invested heavily in DL systems and technology. Ricketts *et al.* (2000) pointed out that 'Internet and information technology outside the classroom is ubiquitous and transcends socioeconomic status. More and more, this is how business is done' (p. 134). In 1999, Web-based training made up only 2% of the training market (Moran 2000), but that 2% of the market represented $1.14 billion of the $63 billion spent on training in 1999. If you consider that Web-based training does not include all aspects of distance training, e.g. satellite and TV transmission, you realize that the true investment in DL is even larger than the figure reported by Moran (2000). Furthermore, not only is DL's current share of the market sizeable, but that share is expected to increase rapidly with the Internet-based learning market projected to grow to $46 billion by 2005 (Peterson *et al.* 1999).

Another reason for caring about DL is the changed role of workers in the economy (Benson 1994). Workers today cannot rely on lifelong employment stability (Paulsson and Sundin 2000). For their own continued employment security, workers must maintain current, transportable work skills. To do so, workers must regularly update their skill inventory through training and education. For workers, DL offers a convenient and flexible delivery option that can accommodate their work and family lives (Johnson 1999). For example, DL offers individuals access to courses that might not be available locally, allows them to avoid commuting, offers them the comfort and convenience of studying at home, and gives full-time workers with family responsibilities the ability to accommodate work and personal schedules (Webster and Hackley 1997; Witt and Wheeless 1999). In addition, DL can be the means of providing instruction to populations, such as the handicapped, the homebound, or non-native speakers, that might otherwise not have access to learning (Johnson 1999; Ricketts *et al.* 2000). Students perceive that DL offers them experience with technology, access to outside experts, and interaction with students outside their own university (Webster and Hackley 1997). By becoming familiar with technologies currently used in industry, learners acquire skills valued by industry (Webster and Hackley 1997). HR practitioners need to care about any technology that facilitates the maintenance of a well-trained workforce.

In spite of the importance of DL to the business goals of organizations, research conducted on adult work populations is very limited. Instead, research on DL is conducted primarily in educational settings. Arguably, there are differences among the learning requirements of adolescents, young adults, and working adults, which may lead one to question the applicability of research findings to industrial settings. For the most part, education and industry both use the same DL technology. However, workplace learners are also supported by technological applications such as electronic performance support systems (EPPS), computer-supported collaborative learning (CSCL) systems, and group decision support systems (GDSS) (e.g. Benbunan-Fich and Hiltz 1999; Stefanov *et al.* 1998). In addition, workplace training differs from traditional education in many important respects: differing learner needs; different technology support; and workplace constraints (see Paulsson and Sundin 2000; Stefanov *et al.* 1998). Indeed, as industry has come to realize how it can benefit from having employees engaged in lifelong learning (Benson 1994), the focus of training has shifted from delivery of a very specific set of skills to the provision of a broader educational system aimed at supporting an organization's strategic goals (Eamon 1999; Farber 1998; Fulmer 1997; Salas and Cannon-Bowers 2001). Also, workplace training has embraced such work-specific concepts as learning while doing, just-in-time learning, and just-in-place learning (e.g. refresher training) (see Benson 1994; Stefanov *et al.* 1998). Each of these approaches to learning has its own unique set of requirements.

In sum, many, if not all, organizations may be able to benefit from DL. An ongoing issue for HR practitioners should be to ensure the optimization of whatever DL they employ. For that reason, HR practitioners must not remain unaware of, or uninterested in, the fact that comparatively little research is being done in proportion to the money being spent on DL.

Theme 3: What Theories Are Guiding the Design of DL Systems?

As Kurt Lewin pointed out some fifty years ago, ''There is nothing so practical as a good theory.'' Theories are useful because they set forth predictions about expected behaviors that will occur if the principles and guidelines of the theories are followed (Campbell 1990). In other words, those who follow sound, research-based theories can maximize their outcomes. Currently, there is no theory or model that predicts learning in a distance

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environment. Indeed, some argue that, because current educational models may be inappropriate or inadequate, attempts to utilize such models will not generate competence in a knowledge society (Harasim *et al.* 1995). As such, researchers are calling for an appropriate learning model that takes into account the unique requirements of instruction delivered via distance technology (Webster and Hackley 1997).

Until a theory of DL is developed, instructional designers must rely on general theories of learning. When instructional designers create an instructional program, they are guided consciously or unconsciously by their beliefs about how learners learn, i.e. implicit or explicit theories of learning. Because each theory forecasts different outcomes, instructional designers should intentionally choose the learning model that will best lead to the desired outcomes. The chosen model must be appropriate for the type of content to be learned, the previous knowledge of the learners, the setting in which the knowledge will be applied, and the desired learning outcomes. HR practitioners should be aware of the different sets of assumptions that can underlie the instructional programs being created and delivered via DL.

In this section, we briefly describe four major learning models and identify specific instructional design principles associated with each (see Leidner and Jarvenpaa 1995). Those design principles are manifested in DL in the ways in which the role of the instructor is defined, the degree of learner control, attention to the social needs of learners, and learning through collaborative activities.

In general, there are two types of learning models typically followed: behavioral and cognitive (see Federico 1999; Leidner and Jarvenpaa 1995). Broadly speaking, the behavioral model is lesson based; the cognitive model is learner based (Stefanov *et al.* 1998). The cognitive model has two main branches: the collaborativist and the cognitive information processing models (Leidner and Jarvenpaa 1995; Liaw 2001). We turn next to a discussion of each.

Behavioral or Objectivist Model

The behavioral model, also known as the objectivist model, assumes that knowledge is objective with mutually agreed definitions and interpretations (Leidner and Jarvenpaa 1995). Traditional classroom training fits with the tenets of behaviorist learning. Principles of learning associated with the model include the following: instructors control the content and the pace of learning (usually via lecture); learners are passive because they only accept and do not interpret instructional material; and learner differences are not important because all learners use the same processes to understand the material (Leidner and Jarvenpaa 1995). Furthermore, learning is said to occur in isolation (Salomon and Almog 1998). Given the rigid environment this engenders, it may be appropriately applied when facts or procedures are being taught (Leidner and Jarvenpaa 1995).

Cognitive or Constructivist Model

The cognitive model, also known as the constructivist model, assumes that individuals learn better when they create knowledge by actively constructing a representation of the material being taught (Jonassen 1996). Each learner's unique experiences influence the way in which he or she understands and assigns meaning to the material (Jonassen 1996). Learning is based on associations between different elements of knowledge, so the degree to which learners can connect disparate pieces of information will affect their learning (Salomon and Almog 1998).

In contrast to the traditional model, the cognitive or constructivist model of learning de-emphasizes the role of the instructor, and stresses the role of the learner (Jonassen 1996), with a corresponding increase in the importance of individual differences (Federico 1999). To be successful, learners must take

responsibility for learning (Salomon and Almog 1998) and must control the pace of their own learning (Leidner and Jarvenpaa 1995). The instructor's role is that of a facilitator: setting the stage, posing challenges, facilitating the discussion, and providing tools that support learners as they construct their own knowledge (Salomon and Almog 1998). This model of learning is most effective in situations in which learners are required to construct new meaning, for example, in higher-order learning.

Cognitive Information Processing Model and Collaborative Model

The cognitive or constructivist learning model can be further divided into the cognitive information processing model and the collaborativist model. The cognitive information processing model postulates that the pace of learning depends on the frequency and intensity with which a learner processes information (Leidner and Jarvenpaa 1995). A major assumption is that learners have different preferred learning styles and should be able to choose instruction based on their learning style. A learner's mental model reflects his or her existing knowledge on the subject, i.e. more instructional support is required for novices (Leidner and Jarvenpaa 1995).

The collaborative learning model is also known as the cooperative learning model because it assumes that learning is a social process (Jonassen 1996). The learner's mental models are improved through discussion and shared understanding with others (English and Yazdani 1999; Leidner and Jarvenpaa 1995). The instructor must promote knowledge sharing, and feedback from both the instructor and peers is critical to an individual's learning (Leidner and Jarvenpaa 1995). This learning model is most appropriate when the instructional goal is to develop higher-order skills such as problem-solving and reasoning skills (Liaw 2001), critical thinking, and creativity, particularly when the setting is cooperative, not competitive (Flynn 1992; Shlechter 1990), and when the knowledge to be acquired is difficult and complex (Jehng and Chan 1998).

Conclusions

In this section, we presented the theories of learning that researchers most often referenced. We agree with researchers who say that there is no one best model of learning (see Leidner and Jarvenpaa 1995). Instead, instructional designers must determine the type of knowledge to be imparted, i.e. factual, procedural, or higher-order thinking, which will in turn suggest an appropriate learning model and its related guidelines. For example, novices need a basic amount of information to know what information is needed to solve a problem, and in that case, the traditional model would be more appropriate than the constructivist model (Eamon 1999). The implication for HR practitioners is clear: for instructional strategies to be optimally effective, trainers and instructional designers must integrate learning models with instructional design practices.

Theme 4: Is It the Technology or the Instructional Design that Matters?

Another major theme that emerged from our literature review was researcher interest in determining the best instructional design practices for DL. The research emphasis on design suggests that instructional design is far more important than the technology through which the instruction is delivered. According to Lawless and Brown (1997), ''Technology is not efficient learning in and of itself, but merely provides a forum for effective learning'' (p. 127). As Ricketts *et al.* (2000) pointed out, no course ''will automatically become better merely by being made electronic'' (p. 135). Recognizing that general instructional design models suitable for delivering classroom training must be expanded to incorporate elements unique to

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DL, researchers are calling for theory-based research to uncover appropriate principles and guidelines (Salas and Cannon-Bowers 2001). Researchers have investigated various instructional design issues, including the role of the instructor, and, in this section, we discuss the implications of each issue for learning outcomes.

Role of the Instructor

A number of researchers are interested in the role of the instructor in DL. Ricketts *et al.* (2000) believe that instructional designers and instructors are still needed to determine course content as well as to drive the course. Other researchers think that technology should provide support tools to supplement learning, but not necessarily to replace instructors, whose role of guiding discussions is so important to constructivist thinking (Anderson and Jackson 2000). Indeed, some conclude that the ''most important influence on involvement and participation was teaching style'', defined as the degree to which the instructor encouraged learner interaction (Webster and Hackley 1997, 1303).

Interface Design

Researchers are investigating how to design user-friendly interfaces between the learner and DL technology. For example, Anderson and Jackson (2000) recommend using an integrated user interface, in which all computer support tools are seamlessly joined, to avoid confusing the learner and to minimize system instability, i.e. if too many applications are combined, system crashes may occur. Note that the term 'user interface' also describes the organization of information and the interface through which learners access the information, such as in a hypermedia system (e.g. Liaw 2001). User interfaces are especially important for distance learners, who have no teacher present to answer questions or clarify information (Lohr 2000).

Hypermedia has also been the subject of a great deal of research attention (Liaw 2001; Parlangeli *et al.* 1999; Salomon and Almog 1998). Federico (1999) defines hypermedia as 'an umbrella term, referring to any sort of computer-stored information, which is related and retrieved via links' (p. 662). Hypermedia navigation refers to how a learner moves between information items. According to Parlangeli *et al.* (1999), learners in a hypermedia system have to ''deal with a double learning process: on the one hand ... to learn how to interact with the system, on the other hand ... to acquire new and likely difficult concepts'' (p. 38). An effective interface enables the learner to focus on learning the instructional content rather than on learning how to access the content (Lohr 2000).

A number of issues have been raised regarding the use and sometimes misuse of hypermedia. Before choosing hypermedia as the presentation medium, instructional designers must consider the learner's level of knowledge. For example, novices may experience a greater cognitive load while using a hypermedia system, making it less than the ideal medium for learning (Federico 1999). Another concern about hypermedia is that its visual appeal may lure learners into superficial exploratory behavior (Salomon and Almog 1998). To address such problems, a number of disciplines offer guidelines for effective interface design (e.g. human factors, graphic arts, and instructional design), and designers are encouraged to evaluate the usability of the design using the criteria of effectiveness, efficiency, and appeal (Lohr 2000).

Learner-centered Instruction

Specific design principles have also been proposed for learner-centered instruction (Stefanov *et al.* 1998). The learner-centered model says that ''learners construct their own knowledge while solving real business problems and transferring their knowledge to other learners ...'' (Stefanov *et al.* 1998, 83).

Stefanov and his colleagues believe that learners will be more motivated and self-directed and will search for personal efficiency if the instructional strategy is based on learner-centered principles.

Team Training

Because teams as well as individuals are involved in DL, instructional design must also incorporate team training. A large literature in team training has enumerated, not only the knowledge, skill, and attitude competencies possessed by high-performing teams (Cannon-Bowers *et al.* 1995; Salas and Cannon-Bowers 2000), but also principles for promoting teamwork, eliciting feedback in team settings, and evaluating team training have been developed (see Swezey and Salas 1992). Nonetheless, it remains to be seen whether principles and guidelines developed for training teams using traditionally derived methods will be effectively applied in distributed environments.

Conclusions

In sum, technology is only a vehicle for conveying instruction to learners and much of the success of any instructional effort will depend on the quality of the instructional principles that underlie its design. Appropriate design standards must be applied to technology interfaces in DL to ensure that learners' attention is on the material they are supposed to be learning. HR practitioners must be familiar with the principles of instructional design and apply them systematically to instructional design efforts.

Theme 5: Are Learners Really in Control?

Given that the role of the learner is central to the instructional effort, we were not surprised to find that learner-related topics emerged as a major theme in the DL research. Under the general theme of learner characteristics, we will discuss three sub-themes: defining learner control, specific learner characteristics that affect learning outcomes, and learners' need for social interaction.

How Much Control Do Learners Really Have?

The term 'learner control' is ubiquitous in the literature (see Federico 1999; Lawless and Brown 1997; Liaw 2001). Learner control refers to giving learners the opportunity to control the pace and sequencing of their learning in a hypermedia environment. As previously discussed, many learning models are based on the notion of learners having control over their instructional process. However, we suggest that the term learner control is misleading within the context of DL because, strictly speaking, learners are only in limited control. For example, learners can control the pace, sequencing, and breadth/depth of the information they choose to review, but it is the instructional designers who determine the actual content. In this case, content includes the type, number, and quality of graphics; the presence or absence of sound, audio, animation, film, files; the structure/outline; and the difficulty level of the text.

Indeed, one could argue that learners have the same control that they have always had with textbooks. For example, they can choose whether to read chapters in order or to select reading material randomly. Depending on their inclination, they can decide whether to read material carefully or only to skim it. Learners have always had the option of looking up words in the glossary or searching the index for more information about a subject. And learners can always find other books on the topic.

Of course, in a multimedia or hypermedia environment, the sequencing available to a learner is faster and more elaborate. In addition, hypermedia allows (to the degree instructional designers programmed it) the learner to repeat lessons and tests, and to decide when enough knowledge has been acquired. In fact, hypermedia allows five

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levels of learner control: browsing, searching, connecting, collecting, and generating (Lawless and Brown 1997). Essentially, the learner can decide how much more knowledge on a topic he or she needs and proceed accordingly. As a cautionary note, we should like to point out that this approach is most effective for learners who have some knowledge of a subject (Lawless and Brown 1997), because novices don't know what it is they don't know.

What About Learner Characteristics?

Regarding the interaction between learners and technology, Russell (1997) states that ''students are not alike. Individual differences in learning styles dictate that technology will facilitate learning for some, but will probably inhibit learning for others, while the remainder experience no significant difference'' (p. 44). A growing body of research shows that individual differences do predict learning outcomes in DL (e.g. Clawson and Choate 1999). If no one instructional strategy is best for all learners, then the solution may be to employ adaptive instruction (Federico 1999). Adapting instructional procedures to individual differences will result in more efficient learning, and research is needed to identify the specific cognitive characteristics important for learner control as well as the learners for whom the benefits of a dynamic instructional environment will be the greatest (Federico 1999).

The theories of learning discussed earlier imply that learners must possess certain characteristics to learn successfully in a DL environment. For example, according to the constructivist model, learners must be motivated to control their own learning, and they must exercise self-regulatory skills that will keep them focused on learning (Salomon and Almog 1998). Other important differences are skill in self-regulation, such as self-discipline (especially for routine tasks) and related metacognitive skills such as self-monitoring and the ability to learn mindfully (Salomon and Almog 1998). Researchers have tried to determine which individual difference variables (learner characteristics) affect learning outcomes. For example, Lawless and Brown (1997) suggested that important learner characteristics include prior knowledge, present interest, self-efficacy, and external constraints, e.g. instructional design, learner control, and control extent. Salas and Cannon-Bowers (2001) point out that, while high cognitive ability learners will adjust well to DL environments, research is still needed to show practitioners how to optimize training for low cognitive ability individuals.

Goal orientation, the ''mental framework used by individuals to interpret and behave in learning- or achievement-oriented activities'' (Salas and Cannon-Bowers 2001, 479) similarly benefits training attempts. Mastery orientation, a form of goal-orientation emphasizing comprehension over performance has been linked to knowledge acquisition (Fisher and Ford 1998). Finally, a learner's motivational level can predict learning outcomes, but not every learner is self-motivated and comfortable with an electronic environment (Ricketts *et al.* 2000). Also, as mentioned, successful learners must be able to exercise metacognitive self-monitoring and self-discipline (Salomon and Almog 1998). Instructors need to ''guide or coach students who don't have sufficient cognitive and metacognitive characteristics' to monitor and control their own performance . . .'' (Federico 1999, 666).

Researchers have been investigating the importance of metacognition to learner outcomes in DL environments (see Schmidt and Ford 2001). For example, Schmidt and Ford (2001) found that individuals with strong metacognitive skills benefited the most in learner control environments. Because these individuals knew how to monitor and regulate their learning, they could make better decisions about where to direct their attention. Other studies have found inconclusive results (Brown 1999; Toney and Ford 2001). More research needs to be done in this area.

Clearly, a learner's individual characteristics can affect learning outcomes. However, not all learning occurs in solitude. According to many of the theories of learning, individuals can improve their learning if they discuss knowledge with others. In the following section, we will discuss how learner collaboration affects learning outcomes.

What About Social Needs of Learners?

Another theme that received consistent attention from researchers is consideration of the degree to which a learner needs social contact during the instructional process. Researchers want to know whether the learning experience is enhanced when learners perceive a spirit of community, in which trust, cohesion, liking, and attraction are established and nurtured. Do learner needs for social interaction affect how much learning occurs and how satisfied learners are with their learning experience? And if social needs are important, researchers want to know the circumstances under which it is appropriate for individuals to learn on their own and when it is better for them to learn as part of a group.

If social interaction does matter to learners, HR practitioners need to know the consequences of not fostering it. Will learners feel less satisfied with a course, experience lower motivation to learn, and be less willing to take another class? In organizations, will trainees feel less loyalty to the company and be less committed to its goals? Or will learners look elsewhere, e.g. to on-the-job interactions or after-work activities, to have their social needs met?

Although some research suggests that learners may be willing to forego social interaction in exchange for the convenience of DL (Witt and Wheeless 1999), it is not clear if that finding will apply to the organizational setting. Moreover, organizations that employ teleworkers or that rely on project teams whose members are geographically dispersed experience greater constraints on their ability to provide compensatory social experiences.

The degree of social interaction possible in DL environments can be thought of as points located on a continuum. Learners working independently (e.g. using text-based materials, videotapes, television broadcasts) are on the low end of the continuum; learners using asynchronous technology (e.g. e-mail, listservs, bulletin boards) are somewhere farther along the scale because they can offer and receive delayed written social support; learners using synchronous technology (e.g. chat rooms, groupware) can experience immediate feedback to their social overtures; and finally, learners who are enrolled in a class delivered via ITV or videoconferencing can respond to the usual verbal and non-verbal cues of face-to-face communication, although communication subtleties may be lost due to transmission quality. Research showed that communication cues, e.g. feedback and non-verbal cues such as eye contact, can affect learning outcomes (Webster and Hackley 1997). Even in a face-to-face condition, however, learners may find it difficult to receive individualized attention from instructors, e.g. if the class size is large.

What role do instructors play in facilitating perceptions of social interaction in the learners? Instructor behavior can lead learners to believe that the instructor and other learners are interested in the learner as a person (Freitas *et al.* 1998; Witt and Wheeless 1999). One option is to train instructors of DL classes to engage in ice-breaking activities, e.g. requiring learners to post on the class listserv their reasons for taking the course (Ricketts *et al.* 2000).

In sum, in learner-centered instruction, characteristics of the learner will interact with DL technology to influence learning outcomes. Although some characteristics, e.g. metacognition, motivation, and self-efficacy, appear to be important in all DL environments, not enough research has been conducted yet to identify the learner characteristics that are important in specific DL environments. In addition, the social needs of learners cannot be disregarded if learning

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objectives are to be met fully. Furthermore, even if learners who feel socially isolated successfully complete training programs, the long-term implications for the organization are unknown, e.g. turnover or sub-standard long-term performance.

Theme 6: What Facilitates Collaboration in DL?

Another consistent theme that emerged from our literature search is the subject of online collaborative learning. Collaborative learning 'involves small groups of students working together to actively solve assignments' (Ocker and Yaverbaum 1999, 427). Collaborative assignments can include decision making, problem-solving, report production, or experimental projects. The topic has obvious consequences for organizations, in which virtual teams are being tasked with product research and development, software development, and other forms of problem-solving activities.

The collaborativist model of learning has been heavily influenced by Vygotsky (1978), who proposed that learners have a zone of proximal development, which is the difference between what they can learn on their own and what they can learn by working together with others who are more capable (Warschauer 1997). When learners work together collaboratively, they not only learn themselves, but they are also contributing to the development of the other group members. For example, one study found that learners who attended a pilot computer-mediated tutoring session reported that the most useful aspect of the tutoring session was the discussion with and support from other learners (Weller 2000).

The benefits of online collaboration are extensive. Individuals who work alone do not have social support or group feedback, and so they may feel may feel anxious and uncertain, which would reduce their performance (Benbunan-Fich and Hiltz 1999). According to students who enrolled in online graduate courses in education, the following benefits were perceived: ''increased interaction, quantity and intensity; better access to group knowledge and support; more democratic environment; convenience of access; increased motivation'' (English and Yazdani 1999, 5). Warschauer (1997) points out that online interaction can be more frequent because long-distance exchanges are faster, cheaper, easier, and more natural. Warschauer (1997) also believes that greater equality of participation occurs because computer-mediated communication (CMC)

> (a) reduces social context clues related to race, gender, handicap, accent, and status (Sproull and Kiesler 1991); (b) reduces nonverbal cues, such as frowning and hesitating, which can intimidate people, especially those with less power and authority (Finholt, Kiesler, and Sproull 1986); and (c) allows individuals to contribute at their own time and pace (Sproull and Kiesler 1991). (p. 473)

Additionally, there has only been a limited amount of research conducted on the effects of diversity in online collaboration (Anakwe *et al.* 1999). Marjanovic (1999) reported that the anonymity of asynchronous collaboration contributes to ideas being measured on their merit and not on the rank of the contributor. Furthermore, the anonymity of the system was favorably viewed by international students, who indicated that they were able to participate as equals in spite of language difficulties, as well as differences in culture and educational background (Marjanovic 1999).

Interpersonal Skills Training

A noticeable gap in the DL literature is the lack of attention being given to training interpersonal skills, which includes the skills that support collaboration (see English and Yazdani 1999). Jonassen (1996) points out, ''You cannot assume that learners necessarily possess the skills needed to collaborate with

other students, . . . They need to learn how to communicate, how to assume leadership, and how to deal with controversy when it arises'' (p. 35). Thus, the research community needs to emphasize interpersonal skills training better, given that industry is increasingly focusing on the development of customer service skills and employee interpersonal skills (see English and Yazdani 1999). According to the American Society for Training and Development's (2001) ASTD State of the Industry Report, 9% of training spending in 1999 went to training in interpersonal communication.

Team Training

In our review of the research literature on distance training, we expected that team training would emerge as a major theme. After all, many organizations now rely on teams to accomplish tasks that were done in the past by individuals (Salas *et al*. 1999). For that reason, HR practitioners should be interested in team training because ''effective teamwork does not occur automatically'' (Salas *et al*. 1999, 137), and a considerable body of research shows how being trained as a team member can lead to improved performance (see Salas and Cannon-Bowers 2001). Furthermore, we expected to find team training emerging as a theme because the volume of research on traditional team training has increased recently. For example, Salas and Cannon-Bowers (2001) discussed research studies that were conducted on the following team-related topics: cross-training (Blickensderfer *et al.* 2000), team leadership training (Tannenbaum *et al*. 1998), team coordination training (Prince and Salas 1993), and team self-correction (Smith-Jentsch *et al.* 1998). In the context of DL, some research has been done on evaluating the performance of teams in DL environments. For example, Dwyer *et al*. (1997) proposed an event-based (learning objectives) approach to measuring team training in a distributed training environment and later validated their team performance instrument (Dwyer *et al*. 1999).

More research has been conducted on the topic of collaboration, i.e. co-operation, than on team training, but findings from collaboration studies do not necessarily apply to teams. According to Noe (1999), team training ''involves coordinating the performance of individuals who work together to achieve a common goal'' (p. 180). Whenever teams are involved, additional factors must be considered, e.g. degree of cohesion, interpersonal attraction, and shared mental models and situational awareness (Salas and Cannon-Bowers 2000). A great deal more research is needed to determine critical team-training factors in a DL environment. Furthermore, the research must be conducted on intact teams, because training an individual team member does not produce the same results as training team members together (Salas *et al*. 1999).

In sum, although many researchers are studying collaborative DL, more research is needed to support industry as it increasingly relies on distributed teams. In particular, team training and interpersonal skills training are neglected research areas.

Theme 7: Evaluation and ROI: Where Is the Evidence that DL Works?

The final major theme that we uncovered in our literature review concerns the evaluation of DL. Why should HR practitioners and researchers care about evaluating the effectiveness of DL? They should care because performance measurement allows learning to be assessed so that performance can be improved or the need for remediation identified (Salas *et al*. 1997). Without evaluation, it is not possible to determine whether training made a difference. Another justification for evaluation is that it can tell us which factors contributed to training effectiveness (Salas *et al*. 1997), and, as a result, these factors can be incorporated into the next round of training. Given that

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evaluation is foundational to the effective implementation of DL, in this final section we discuss a number of questions to address this issue.

Does DL Work?

Although the use of DL is widespread, certain authors argue that basic research still has not proven conclusively that DL is better than or equal to traditional classroom learning (Eamon 1999; Farber 1998). Gilbert (1996) said that ''no form of distance education or . . . technology has yet proved so much more effective and/or less expensive than 'traditional' forms of teaching and learning as to become a complete replacement for them'' (p. 12).

Various researchers have questioned the methodology used in published studies that claim to have demonstrated that DL outcomes equal or exceed those of traditional classroom learners (Merisotis and Phipps 1999; Ricketts *et al*. 2000). The methodological problems include non-random assignment of subjects, lack of control for extraneous variables, failure to report validity and reliability, and reactive effects of learners and instructors (Merisotis and Phipps 1999; Ricketts *et al*. 2000). For example, if individuals who enroll in DL classes differ in important ways from those who enroll in on-campus classes, e.g. motivation, maturity, intelligence, then comparing the two groups may not be meaningful (Ricketts *et al*. 2000). However, in spite of the criticism, comparative studies are still being conducted (Petracchi 2000; Spooner *et al*. 1999).

How Is DL Evaluated?

As late as 1999, Peled asked how academic institutions could ''collect and analyze data in order to determine the effectiveness of the new computer-mediated DL approach . . .'' (p. 413). Some researchers believe that a degree of evaluation overlap should exist between traditional and DL because the two methods share many goals and techniques for assessing learning (Ricketts *et al*. 2000). In most cases, researchers measure learning effectiveness by learner outcomes, learner attitudes toward learning through distance education, and learners' overall satisfaction with DL (Merisotis and Phipps 1999). Other researchers propose that teaching effectiveness should consider characteristics of the learner, the technology (quality, reliability and medium richness, as well as the number of media used), the instructor, and the course (e.g. size of class which affects the amount of attention instructor can give individual learners) (Webster and Hackley 1997).

In organizations, the traditional model used to evaluate training is Kirkpatrick's (1975) four-level model. Evaluations are made of learner reactions (satisfaction, difficulties); learner achievements (problem solutions, specified goals); work behavior (learning transferred to the workplace); and organizational benefits (improved performance) (Benigno and Trentin 2000; Stefanov *et al*. 1998). We suggest that Kirkpatrick's model is insufficient for evaluating the effectiveness of DL, and that the model should be expanded to reflect the multiplicity of factors that influence satisfactory DL outcomes.

To expedite the evaluation of other factors, organizations can make use of technological tools that provide rapid feedback, allowing instructors to make fast changes that will improve teaching strategies. Course management software, such as WebCT, can monitor a learner's online activity, e.g. by tracking the number of times that a learner logged in, posted messages, entered chat rooms, read or downloaded material, etc. (Ricketts *et al*. 2000). Learners leave electronic footprints, i.e. log files, which instructors can analyze to determine how learners navigate and how they learn (Peled and Rashty 1999). Log files reveal not just how often and for how long a learner accessed a site, but the path the learner followed, the files the learner downloaded, links followed to other sites, the postings that were made, the

searches conducted, and at what time of the day the activity occurred.

Are the Right Outcomes Being Measured?

In academia, educators have questioned whether DL classes provide a total educational experience and have cautioned against the widespread acceptance of DL classes as a substitute for classroom learning (Eamon 1999; Farber 1998). Some researchers have argued that grades are not the only, or even the proper, yardstick for measuring the effectiveness of DL (e.g. Benigno and Trentin 2000). For example, Eamon (1999) points out that traditional university education was an effective means of passing on culture through guidance, individual and group interaction, mentoring, acculturation, role modeling, and socialization. Education, he says, is more than just conveying information, and technology can only supplement, not supplant, the instructor's role, which is still critical to the education process.

On a similar note, Farber (1998) questions whether academic performance, e.g. grade-point average and final examination scores, can adequately measure post-secondary education. He proposes three categories by which learning can be evaluated: ''measurable competence'', e.g. academic performance and competency through attainment of specific subject-matter knowledge; ''competence'', which is a broader, less easily measured competence that is rarely measured by assessment instruments; and ''education'', which deals with the more general effect of education on college students. Accordingly, desirable outcomes of the education process are attitudes and values, psychosocial changes, and moral development. Learners experience these effects as a result of their interactions with instructors and peers (Farber 1998).

Although intended to describe the university setting, these arguments have implications for organizational training programs. We suggest that traditional classrooms led by instructors are a powerful medium through which organizations can transmit, not just subject-specific knowledge, but the cultural values and goals that comprise the organization's culture. In addition, classroom settings give employees the chance to meet other employees, possibly form friendships, and establish networks of resource contacts that can be called upon in the future to help facilitate problem-solving.

What's the Return on Investment?

Although researchers can identify various benefits and costs associated with DL (Eamon 1999; Ricketts *et al*. 2000), only HR practitioners have access to organization-specific information, e.g. corporate financial information, that is needed to conduct thorough cost–benefit analyses. Every organization must consider its unique circumstances when evaluating whether an investment in distant learning is appropriate. To be maximally efficient for an organization's needs, the organization's training program should directly reflect the organization's goals and strategic objectives (Martocchio and Baldwin 1997; Wilson 2000).

Moreover, Salas *et al*. (1999) caution HR practitioners to resist the urge to become caught up in the ''faddish'' aspects of DL. Russell (1997) addressed the ''faddism'' issue when he asked ''Why do professional educators embrace high-cost technologies when low-cost technologies work as well?'' (p. 46). He argued that individual differences in learning styles would determine whether technology was an effective vehicle for learning delivery.

We propose that an effective DL program must take into account the fit between the learners, the learning objectives, and the nature of the task to be learned. We further suggest that every technology has advantages and disadvantages, which need to be considered by trainers and instructional designers. We caution HR practitioners to

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remember that the social aspect of training and education cannot be ignored. Furthermore, when the tradeoffs between the benefits and costs of alternate systems are being evaluated, the analysis should not necessarily be limited to short-term, purely financial outcomes.

So What About the Science of Distance Learning?

In sum, we find that industry is continuing to increase spending on DL, despite the fact that researchers cannot yet tell HR practitioners why, when, or for whom DL works the best (Themes 1 and 2). Nonetheless, the data do suggest that effective instructional design of DL can increase training effectiveness (Themes 3 and 4). Given this, HR practitioners need to think about what learning actually is in terms of the learner, both as a whole person (Theme 5), and as a member of a collaborative or cooperative team (Theme 6). Finally, return-on-investment calculations should balance immediate organizational benefits with longer-term organizational costs (Theme 7).

Despite the lack of empirical support, it is likely that the principles and guidelines that promote effective learning will also apply to DL. However, the technology-specific opportunities and constraints of DL pose additional requirements for the trainer and instructional designer. Once again, we emphasize that more research is needed to discover the factors involved in successful DL programs.

We must not forget that training occurs at the individual level. As we discussed earlier, training is about learning, and learning is about changes in an individual's cognitive and behavioral repertoire (Kraiger *et al.* 1993). More research is needed to inform us about the internal cognitive processes through which individuals learn and how those processes interact with distance delivery of instruction.

DL is about delivering instruction; and the most advanced technology is not always the best solution. As Lawless and Brown (1997) said ''Technology is not effective learning in and of itself, but merely provides a forum for effective learning'' (p. 128). Furthermore, DL in education is not equivalent to DL in work organizations. The environment, demands, and outcomes are different, and the difference must be taken into account when transporting research findings to workplace applications. More research is needed in work settings so that the interaction of workplace conditions and DL can be examined at first-hand.

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Notes

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