End-User Learning Through Application Play

France Belanger

Craig Van Slyke

As today's knowledge workers tend to have less clearly defined outputs, many organizations are concerned with employees' non-work use of technologies during office hours. In addition, as organizations strive to increase the job efficiency of new hires, managers must collapse overall training time while providing constant on-the-job training. This manuscript argues that individuals' play with computer applications can be considered a form of self-directed, experiential learning. Drawing from information systems research and individual learning theories, an emerging framework for research on the role of application and technology play in individual learning is proposed. The framework suggests that self-directed experience and application of technology to work-related tasks is a moderator of the relationship between self-directed experience and individual learning. The manuscript presents two real life examples to illustrate the inter-relationships of the constructs in the framework. Research recommendations and guidelines for practitioners are then presented.

"The most powerful learning comes from direct experience."

(Peter Senge, The Fifth Discipline, 1990, p. 23)

In today's organizations, many individuals such as professionals and managers are considered knowledge workers who tend to have less clearly defined outputs (as compared to production or clerical workers). This is a problem for managers trying to monitor and measure employee performance and productivity. This age-old concern of organizations was originally reflected in Frederic Taylor's warning to management at the beginning of the industrial age that employees would often be very creative at looking busy instead of doing their actual work. Today's organizations are also concerned that many employees spend some of their office time doing non-work-related activities. Recently, the increasing presence of personal workstations has led management to consider the problem of computer game playing. Another recent concern stems from employees having access to outside information, both business and non-business related, via the Internet and the Web. Studies reveal that workers using the Internet for their job spend an average of 90 minutes per day on sites unrelated to their firm's business, and executives are concerned about the resulting loss of productivity (Stuller, 1997).

It can be argued, however, that providing employees with additional applications or even Internet access may not necessarily lead to shirking or wasting of valuable office time. On the contrary, self-controlled play with computer applications may lead to individual learning, and in turn this knowledge gained can be shared with colleagues resulting in an improvement in overall organizational effectiveness.

Several organizational issues can arise when an organization provides increased access to computer applications, such as conferencing software or Web browsers, to a large number of employees. These include security, computer costs, and illegal

France Belanger is Assistant Professor, Pamplin College of Business, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Craig Van Slyke is Assistant Professor, College of Business Administration, Ohio University, Athens, Ohio.

The authors wish to acknowledge the helpful comments of Dr. Reza Barkhi, Dr. Devi Gnyawali, and Dr. Steve Sheetz on an earlier version of this document.

software copying, to name a few. Among these issues is whether employees use the applications for non-work-related activities during work hours, thereby wasting considerable time, time that could be spent adding value to the organization through their work efforts.

This is not the first time that issues of using technology for non-work-related purposes have worried employers. For example, with the advent of personal computers on everyone's desk came the proliferation of illegally copied computer games. Other examples of new technology being used for non-work purposes include the introduction of facsimile machines and electronic mail. Implementation of faxes saw an enormous level of exchange of office jokes or cartoons during office hours. With e-mail, employees spent time writing to each other asking about lunch, "chatting" about the weekend, or comparing notes about the latest game (Frazee, 1996).

Researchers have proposed a number of concepts to describe the phenomenon of employees performing non-work-related activities during work hours. Kidwell and Bennett (1993) compared and integrated the concepts of social loafing, free riding, and shirking on the basis of a common factor named *propensity to withhold efforts (PWE).* Social loafing and free riding typically occur in the context of a group with a collective goal or task to achieve. Shirking is a concept representing the capacity of individuals to find ways to withhold efforts. Reasons that lead an individual to shirk include lack of proper monitoring, self-interested behavior, or opportunism (Alchian & Demsetz, 1972; Jones, 1984).

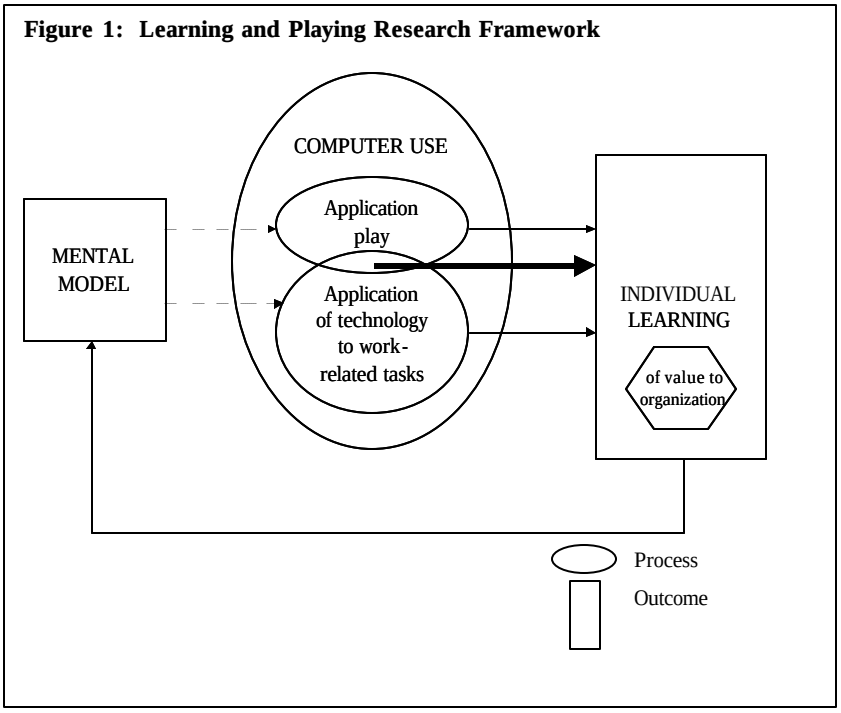
Management's arsenal of mechanisms to control the non-work use of technologies typically includes combinations of policies and monitoring tools. For example, managers may employ tools to alert them if games are found installed on employees' computers. Also, electronic and voice mail have been monitored for many years by organizations wanting to know how employees utilize these resources. While many agree that there is a legitimate reason for employers to monitor e-mail or voice mail use, others claim that there are employee privacy issues to be considered (Daniel, 1995). In the case of the Internet, blocking access seems to be the only way to prevent employees from "wasting" their time. Many companies are offering tools to organizations to control employees' Web access. For example, one California company offers employers a database of 26 Web sites that management can decide to block from employees' view (Fox, 1996).

Research Framework and Learning Examples

It can be argued that employees' play with computers can have positive impacts on their learning since moderate levels of play can be a form of self-directed experiential learning, which has been demonstrated to lead to individual learning. Figure 1 presents a proposed research framework that shows how play can lead to learning for knowledge workers.

The framework suggests that drawing from their existing mental models, individuals who engage in application play or apply technology to work-related tasks will experience some learning. However, the framework also suggests that when

Figure 1: Learning and Playing Research Framework



application play is combined with application of technology to work-related tasks, more learning is likely to occur. Some of the learning individuals experience can be of value to organizations if, for example, they can apply it to increase their knowledge of their industry. In the proposed framework, some components are processes while others are products of those processes. For example, a new, more accurate mental model would be a product or outcome of individual learning. A mental model can be thought of as a cognitive structure that humans construct in order to understand how a system works (Johnson-Laird, 1983).

Playing and Learning Examples

The following two situations illustrate how information gathered through play coupled with activities that transferred the knowledge to a work domain resulted in work-related knowledge. This in turn led to efficiencies in completing work tasks as proposed by the framework. The first situation occurred in an office environment, while the second was in a classroom setting.

Electronic Mail Example. Electronic mail (e-mail) was installed on the local-area-network (LAN) of an organization. The initial e-mail software used a simple interface and was limited to intra-firm communication (no Internet mail was made available). Employees received informal, rudimentary training on how to send and read messages. Early e-mail activity could clearly be classified as application play. Typical messages included topics such as jokes and thoughts of the day, pizza for lunch, happy hour location, and similar non-work topics. Even organizational leaders engaged in this play. In fact, the owner was notorious for sending playful messages to the entire staff on Friday afternoons. After a short period, a new policy was implemented that required sales representatives to request engineering services via e-mail—verbal requests were no longer honored. This led to a transfer of the newly formed mental model of e-mail communications, thus modifying existing mental models of organizational communication. In other words, the knowledge of e-mail communications gained through play was effectively transferred to work-related tasks. This knowledge transfer, coupled with the newness of the technology diminishing, led to the practice of communicating via e-mail becoming embedded in the organization's culture—a tradition that now extends to extra-organizational communications (via Internet mail). Today large portions of internal and external communications occur through electronic mail.

The above scenario illustrates the sequence where play can lead to learning. First, the technology was adopted and implemented and employees were taught the basics of how to use the technology. A period followed in which application play was not only tolerated, but was encouraged, which led to individual members learning to use the technology to communicate. This learning was experiential in nature, and resulted in some organizational members exploring the software and discovering abilities that were not included in the initial training (e.g., attaching files, and addressing a message to multiple recipients). Transfer of the learning to organizationally significant activities was accomplished by implementing and enforcing the requirement of requesting engineer time via e-mail. This transfer is a critical component of how play can lead to learning. Without this transfer, the learning does not extend from the individual to organizational tasks. This new knowledge then could be considered part of the organization's knowledge base, and was in fact extended to new organizational knowledge (communicating outside the organization via e-mail) when Internet mail capabilities were included.

Notes Example. Another example of how application play has been used to help end users gain knowledge of an application comes from a classroom setting. One of the authors recently taught a College of Business (COB) core MIS class, which is required for all COB students. One of the goals of the class was to give students exposure to a collaborative information technology, Lotus Notes Discussion Database. At the beginning of the term, the instructor posted a number of provocative, and/or controversial topics for discussion. These topics were chosen for their potential to generate discussion, rather than for being directly related to specific course topics—their purpose was to entice students to use the technology to join in the

discussion, not to reinforce detailed course material.

One "playful" topic was a news item regarding new technologies targeted at replacing traditional printed books. The students, as expected, had strong opinions on how well they thought this would work, and they expressed these. From a class with 35 students, there were 33 responses to this topic. Over the course of the semester, the instructor continued to post provocative and directly course-related topics. By the end of the term, the students in the class used the Discussion Database as a matter of routine—they had not only learned the technology, but had also made its use routine. In addition, they learned how to use the technology well enough that in end-of-term feedback no students mentioned any difficulty in using the Discussion Database technology.

Many researchers and practitioners involved with information technology today may have experienced or heard of similar situations. For example, Sproull and Kiesler (1991) discuss at length how the introduction of electronic mail impacted organizations, separating first level effects (faster communications) and second level effects (more contacts between individuals overall). The basic idea is that individuals in organizations have learned not only to use the technology, but also other relevant content by playing with information technology and applying it to work-related tasks.

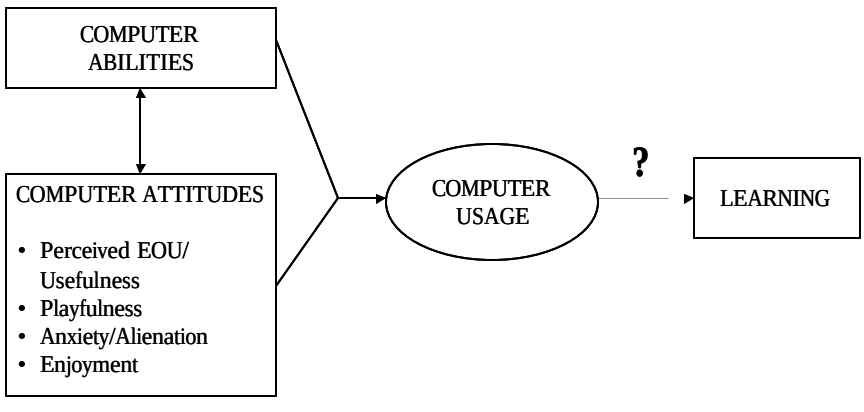
Theoretical Background

Antecedents to Computer Use

Most employees nowadays use computers to perform some of their tasks in organizations. This discussion focuses more particularly on computer usage that is in the form of application play, not on its antecedents. It is important, however, to distinguish application play from some of these antecedent variables. Several researchers have investigated issues of resistance to change, technology phobia, and other factors that may prevent the optimum use of computers by employees. In particular, computer abilities (knowledge and skills), as well as computer attitudes, have been proposed and studied with respect to their effects on computer usage. Figure 2 presents some of these factors. Computer abilities are often measured as actual skills or knowledge evaluations of individuals. Computer attitudes, on the other hand, are measured by a variety of factors, some of which include perceived ease of use (EOU) and usefulness (scale available from Davis et al., 1992), playfulness (7 item scale available from Webster and Martocchio, 1992), computer anxiety or alienation (14 item scale), and computer enjoyment (scale available from Atkinson and Kydd, 1997).

Several of the antecedent factors discussed above are said to lead to more learning, but most of the studies have looked at one type of learning only: computer training (and most often with undergraduate or MBA students). For example, in a study of playfulness and learning, Perry and Ballou (1997) suggest that when interactions with tasks are playful, "people engage in exploratory behaviors, spend more time and effort on task performance, enjoy what they are doing more, and learn more effectively" (p. 96). The computer attitude factors reflect either individual characteristics of learners or characteristics of the technology. The focus of this discussion is on behaviors (application play), and their effects on learning. Possibly, application play could be a mediating variable between computer attitudes and

Figure 2: Antecedents of Computer Usage



the outcome of greater learning, as reflected by the dotted arrow with a question mark on Figure 2.

Playfulness, Application Play and Work-Related Tasks

A particular factor that warrants further discussion is computer playfulness, which has been positively associated with individual learning (Webster & Martocchio, 1992). While this manuscript may seem to provide the same argument, it should be made clear that application play (further described in the next sub-section) and playfulness are two different concepts. Playfulness can be defined as an individual's "tendency to interact spontaneously, intuitively, and imaginatively with microcomputers" (Webster & Martocchio, 1992). Again, it is an individual characteristic or trait, which has been demonstrated to be stable over time (Yager et al., 1997). Application play, however, is defined as the actual *behavior or action of applying information technology or applications to tasks associated with personal enjoyment or fulfillment*. In addition, as with other computer attitude studies, playfulness research (Atkinson & Kydd, 1997; Perry & Ballou, 1997; Webster & Martocchio, 1992) tends to look at computer training (and learning), but not necessarily at learning content that could be relevant to job-related tasks.

Surfing the Web can be considered one form of application play. There can be several reasons to use the Web for work-related purposes: to provide and get information, to communicate with others, to market or buy products and services (Atkinson & Kydd, 1997). It can also be used for personal pleasure. The issue for management is to know when employees surf the Web for personal pleasure and when the surfing is for work. There are some key differences between browsing and playing computer games, such as the potential of finding job-relevant information and the fact that browsing includes a communication capability. Similarities include the potential for learning computer skills and reducing computer phobia, and the ability to promote individuals' interest in the information through graphical interfaces and multimedia tools.

Learning Theories

The standard model of learning is the objectivist model, in which a reality exists and individuals are taught by experts. However, when looking at other models of learning, such as constructivism or socio-culturalism, learning is promoted by learner centric approaches, in other words by allowing individuals to take control of their own learning environment. For example, several widely referenced learning theories give insight into the link between playing and learning, including andragogy (Knowles, 1984), minimalism (Carroll, 1990; Van der Meij & Carroll, 1995), experiential learning (Kolb, 1984; Rogers, 1969), and action learning (Revans, 1980). Other theories of learning include cognitive information processing and cooperative learning models. Although these theories vary in their details, in general they share two common threads--the value of experimental learning, and the importance of making learning meaningful to the learner. In addition to active learning and experimentation, learning is more effective when there is cooperation and teamwork, and when learning is through problem solving (Alavi, 1994).

These commonalties are the key to understanding the learning value of application play. Only models and theories relevant to this issue are presented below. Readers interested in other models of learning can refer to one of the several reviews of learning theories in information system research (for example, Leidner and Jarvenpaa, 1995).

- *Experiential Learning.* One learning theory that points to the value of experimentation and meaningfulness, is experiential learning theory. Experiential learning (Rogers, 1969) refers to knowledge that is applied, and that addresses the needs and wants of the learner, such as knowledge gained through application play. Experiential learning is particularly applicable to application play. The theory proposes that learning is facilitated when the learner is completely involved in and has control over the nature and direction of the learning experience, and when learning is primarily based on problem solving. Application play can meet both of these criteria. When playing with an

application the learner is participating fully, and is fully involved in directing and controlling the learning experience. Another learning theory that postulates the importance of active experimentation in the learning experience is Kolb's (1984) model of learning. According to this model, learning is defined as a recurring cycle consisting of four stages: concrete experience, reflective observation, formation of abstract concepts, and testing through active experimentation. These stages can be related to application play. Through play with an application such as data conferencing (for example using chat and whiteboard facilities) the learner gains concrete experience, and later can engage in active experimentation into the capabilities of the application (such as using audio and video features).

- *Andragogy*. Andragogy (Knowles, 1984), or adult learning, posits that adults are generally self-directed. This leads to several assumptions about the design of adult learning experiences that are applicable here. According to Knowles, adult learning is facilitated when adults 1) learn experientially, 2) use a self-directed, problem-solving approach to learning, and 3) learn topics of immediate value. These propositions can help explain why application play may lead to learning. For example, when browsing the Web, a learner is generally applying the browser to solve some problem, even though that problem may be trivial in the organization's view. Further, often the user searches the Web to discover information that is of immediate value. For example, the user may navigate to an airline's Web site to find flight schedule information. This information has value to the user as evidenced by the fact that s/he took the time to search for it. Interestingly, at a second level, learning of value to the organization may also have occurred. In order to find out the site's content, the user must learn how to use the browser to locate and navigate to that site. This may include learning the mechanics of the browser as well as the peculiarities of using search engines—learning that may indeed be valuable to the organization. In addition, once the technology has been learned, further browsing may lead to obtaining new information that can be assimilated and applied to obtain more accurate mental models of that particular domain. For example, an employee needing to acquire new products for his or her organization may find useful comparative data on the Internet.
- *Minimalism*. Minimalism (Carroll, 1990; Van der Meij & Carroll, 1995) provides a learning framework that is particularly applicable to training end users. The basic idea of minimalism is that instructional materials should be unobtrusive and should facilitate self-directed activities. Application play of the Web browsing nature forces the user to explore their environment through the use of hypertext. Hypertext or hypermedia can be defined as non-sequential media where series of inter-linked pages allow users to explore the content on their own, using their own mental model of the structure of the information. Hypertext can directly impact learning by forcing users to explore content on their own, using lateral, random, vertical, linear, and structured access approaches. Conversely, some researchers ague that browsers by themselves are not sufficient to provide "suitable, engaging environments in which learning may occur" (Hutchings et al., 1995) because the freedom offered to learners as they browse is unstructured and the information is fragmented.
- *Constructivism*. The concept of mental models may help to illustrate the role that meaningfulness and experience play in learning. Constructivism (Tobin & Tippins, 1993) contends that learning is a process of building knowledge by using what is known to find sense in experiences. New information gathered through experiences are integrated with existing mental models resulting in expanded, more complex mental models. This may lead to better learning when individuals "are forced to discover things themselves rather than when they are told, or instructed" (Leidner & Jarvenpaa, 1995, p. 267). Constructivism has application to the learning

of complex information technologies, such as the Web (Brandt, 1997). The Web's complexity stems from its rather abstract structural organization, which may be so abstract that most individuals do not have a clear mental model of the technology. This can be contrasted with e-mail, for example, where individuals had a mental model of sending mail (hence the mail icons used in today's e-mail interfaces), or even databases where individuals could think of a Rolodex. Brandt makes the point that constructivism is particularly applicable when constructing knowledge and solving problems in areas of "conceptual complexity and case-to-case irregularity." By playing with an application in an active, problem-solving manner, the learner is constructing new knowledge, gained from the experiences, about the structure and information content of the related domain. This new knowledge is constructed based on existing mental models of information retrieval and of the domain in question. For example, an individual learner who is trying a new software application will assimilate the knowledge gained into expanded mental models of the application—knowledge that may have value to the organization. By experiencing similarities and differences in the various aspects of an application, and by encountering difficulties, the learner tests and adjusts mental models, resulting in a more accurate and more comprehensive set of mental models. By gradually implementing the use of similar applications into the organization, these expanded mental models can serve as a foundation from which to build new mental models, which are more directly applicable to work-related tasks.

- *Cognitive Information Processing.* The cognitive information processing model also highlights the role of mental models in learning. It suggests that individuals have their own preferred learning styles (Bovy, 1981), and that only information processed by individuals can lead to learning. Individuals' prior knowledge from their mental model of that domain of knowledge is used in processing new information (Leidner & Jarvenpaa, 1995). Therefore, learning occurs when individuals acquire, process and retain information, which can then be used in problem solving situations.

The several learning theories included in this discussion show the importance of meaningful experience and self-direction in adult learning. To summarize, adult learning is facilitated when the learning is 1) experiential, 2) meaningful to the learner, 3) problem-based, and 4) self-directed.

Application play embodies these ideas. The learning is experiential in nature and is meaningful to the user. Generally, the play is also problem-based since the play would typically be directed at gathering information or completing a task. Finally, the learning is self-directed, since the learner is in control of how the play experience progresses.

Mental Models

Active learning and constructivist learning theories suggest that mental models play an important role in individuals' learning process. Mental models can be defined as cognitive representations of elements that make up a domain and the interrelationships between those elements (Ansari & Simon, 1979). As discussed, learning occurs when individuals construct meaning based on information that is processed through their existing mental model (Alavi et al., 1995). Once information has been processed, it is stored in long-term memory. It can then be reconstructed when individuals explore, analyze or manipulate new information. In the case of application play, more accurate mental models can be obtained in one of two ways: either individuals develop a better understanding of the organization of existing knowledge, or they improve their knowledge, either in the form of more knowledge, or more accurate knowledge of a domain.

The examples used in the previous section involve learning skills related to the use of a technology (e-mail) as well as learning content (Notes). When learning to use technology individuals develop a more accurate mental model of how that technology works, but then once they know the technology, less learning is likely to occur. In this case, some can argue that further play would be detrimental to the organization since

only marginal learning may occur every time the user "plays" with the application. However, it can be expected that learning content can improve the accuracy of a mental model even if one has used the application several times. For example, while Web surfing may be beneficial at first to learn computer, Internet, and browser usage skills, further surfing can help improve mental models of content material, such as competitors' products or offerings on the Internet. In a university example, a staff person browsing the Web may find that another university already offers some new "innovative" program planned by their own organization. This type of play, which allows the individual to absorb more information, can be beneficial to organizations. For example, it has been suggested that managers who are flexible (and possibly playful) in their collection of information may come up with better ideas for organizational improvement (Vandenbosch & Higgins, 1996).

Organizational Value of Individual Learning

As the previous section indicates, application play can lead to individual learning. However, this learning is not of value to the organization unless it can be transferred to knowledge that is beneficial to the organization. For example, the knowledge of how to find and gather sports scores on the Web is of no benefit to the organization. If, however, this knowledge is transferred to gathering information on competitors, then the organization benefits. For practitioners, the question is often whether training investments pay off in the long run for their organization through shared knowledge and increased organizational memory.

In *The Fifth Discipline* (Senge, 1990), the concept of the learning organization reveals the importance of encouraging individual employees to learn more by providing an environment conducive to such learning. One way organizations can provide this learning environment is by encouraging moderate levels of play, when it is felt that this play can be applied immediately, or in a reasonable amount of time, to work-related tasks. Once employees have gained some useful knowledge, they can share their individual interpretations, which may then lead to organizational learning. Organizations learn through their members as information is transmitted "from one organizational member or groups of members to another" (Simon, 1991, p. 125). However, the link between individual and organizational learning is still in need of empirical verification.

Guidelines and Research Recommendations

The previous sections provide a framework and discussion of how individual learning can occur through application play and the application of technology to work-related tasks. An important question, however, is how can organizations make use of these ideas to encourage "play" that will lead to learning of value to organizations.

For practitioners, the information from the previous discussion and the proposed research framework in Figure 1 may be combined, resulting in a series of guidelines to foster individual learning that is of value to the organization. Organizations should consider a number of issues when attempting to take advantage of the learning potential of application play. Allowing employees to play with an application will help them gain knowledge of the application or environment in which the application is used. However, organizations must remain careful that application play does not become excessive since employees still need to perform their work-related tasks in order to add value to the organization. At the same time, it is critical to take some conscious action to link the use of the application to work-related tasks, since this is an important element in transferring the knowledge gained from application play to that which is useful to the organization.

Allowing individuals to approach learning of technology in a playful environment may also decrease their computer "phobia" or inhibition to use certain applications. To become a "learning organization," an organization must provide an environment for continual learning where each individual will strive for personal mastery (Senge, 1990).

Researchers may wish to use the theoretically-based framework of how application play may lead to individual learning as a platform from which to

further explore the role that self-directed experience and application of technology to work-related tasks play in individual learning. For example, it might be interesting to investigate application play in the context of different managerial styles and their effect on outcome measures. In addition, the framework highlights several areas in need of investigation. For example, the following questions could be answered:

- Do individuals who engage in self-directed experience with a technology experience learning?
- Do individuals who apply technology to work-related tasks experience learning?
- Do individuals who engage in self-directed experience with a technology and then apply this to work-related tasks experience more learning than individuals who only engage in self-directed experience or who only apply the technology to work-related tasks?
- Do individuals experiencing individual learning through application play and application of technology to work-related tasks obtain more accurate mental models of the particular domain related to this learning experience?

Concluding Remarks

Various forms of application play as examples of self-directed experience that may lead to individual learning were theoretically explored in this manuscript. This learning results in the individual's mental model of the application being improved as a result of the experiences gained in the application play. Further, it was argued that following the self-directed experience with the use of the application for work-related tasks will further modify existing mental models. This could result in a new mental model of how the application can be applied in the work setting. A research framework was proposed (Figure 1) that illustrated the role of self-directed experience (including application play) in individual learning.

Organizations are devoting considerable resources to training employees in computer applications. The returns from these investments are not clearly established. It is possible that if individuals do not engage in self-directed experiences when using these computer applications, sufficient learning from the organizational perspective may not occur. Conversely, while organizations may be fearful of losses of productivity through employees' application play, there may actually be individual learning that will benefit the organization. Proposing this emerging framework, defining application play, and delineating guidelines and research recommendations represent the first steps towards a more complete understanding of this area.

References

Alchian, A., & Demsetz, H. (1972). Production, information costs, and economic organization. *American Economic Review, 62*(5), 777-795.

Alavi, M. (1994). Computer-mediated collaborative learning: An empirical evaluation. *MIS Quarterly, 18*(2), 159-174.

Alavi, M., Wheeler, B., & Valacich, J. (1995). Using IT to reengineer business education: An exploratory investigation of collaborative telelearning. *MIS Quarterly, 19*(3), 293-311.

Ansari, Y., & Simon, H. (1979). The theory of learning by doing. *Psychological Review, 86*(2), 124-140.

Atkinson, M., & Kydd, C. (1997). Individual characteristics associated with World Wide Web use: An empirical study of playfulness and motivation. *Database for Advances in Information Systems, 28*(2), 53-62.

Bovy, R. (1981). Successful instructional methods: A cognitive information processing approach. *Educational Computing and Technology Journal, 29*(4), 203-217.

Brandt, D. (1997). Constructivism: Teaching for understanding of the Internet. *Communications of the ACM*, 40(10), 112-117.

Carroll, J. (1990). *The Nurnberg funnel*. Cambridge, MA: MIT Press.

Daniel, T. (1995). Electronic and voice mail monitoring of employees: A practical approach. *Employment Relations Today, 22*(2), 1-10.

Davis, F., Bagozzi, R., & Warshaw, P. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology, 22*(14), 1111-1132.

Fox, R. (1996). News track. *Communications of the ACM, 39*(11), 10.

Frazee, V. (1996). Is e-mail doing more harm than good? *Personnel Journal*, *75*(5), 23.

Hutchings, G., Hall, W., & White, S. (1995). Resource-based learning using an open hypermedia system. In E. Percival, R. Land, & D. Edgar-Nevell (Eds.). *Computer assisted and open access education* (pp. 160-165). London: Kogan Page Ltd.

Johnson-Laird, P. (1983). *Mental models: Toward a cognitive science of language, inference, and consciousness*. Cambridge, MA: Cambridge University Press.

Jones, G. (1984). Task visibility, free riding, and shirking: Explaining the effect of structure and technology on employee behavior. *Academy of Management Review, 9*(4), 684-695.

Kidwell, R. Jr., & Bennett, N. (1993). Employee propensity to withhold effort: A conceptual model to intersect three avenues of research. *Academy of Management Review, 18*(3), 429-456.

Knowles, M. (1984). *The Adult learner: A neglected species* (3rd ed.). Houston: Gulf Publishing.

Kolb, D. A. (1984). *Experiential learning*. Englewood Cliffs, NJ: Prentice Hall.

Leidner, D. E., & Jarvenpaa, S. L. (1995). The use of information technology to enhance management school education: A theoretical view. *MIS Quarterly, 19*(3), 265-291.

Perry, E., & Ballou, D., (1997). The role of work, play and fun in microcomputer software training. *Database for Advances in Information Systems, 28*(2), 93-112.

Revans, R. (1980). *Action learning*. London: Blong & Briggs.

Rogers, C. (1969). *Freedom to learn.* Columbus, OH: Merrill.

Senge, P. (1990). *The fifth discipline*. London: Century Business.

Simon, H. (1991). Bounded rationality and organizational learning. *Organization Science, 2*(1), 125-134.

Sproull, L., & Kiesler, S. (1991). *Connections: New ways of working in the networked organization.* Cambridge, MA: MIT Press.

Stuller, J. (1997). Games workers play. *Across the Board, 34*(7), 16-22.

Tobin, K., & Tippins, D. (1993). Constructivism as a referent for teaching and learning. In K. Tobin (Ed.). *The practice of constructivism in science education* (pp. 3-21). Washington, DC: AAAS Press.

Vandenbosch, B., & Higgins, C. (1996). Information acquisition and mental models: An investigation into the relationship between behavior and learning. *Information Systems Research, 7*(2), 198-115.

Van der Meij, H., & Carroll, J. (1995). Principles and heuristics for designing minimalist instruction. *Technical Communications, 42*(2), 243-261.

Webster, J., & Martocchio, J. (1992). Microcomputer playfulness: Development of a measure with workplace implications. *MIS Quarterly, 16*(2), 201-226.

Yager, S., Kappelman, L., Maples, G., & Prubutok, V. (1997). Microcomputer playfulness: Stable or dynamic trait? *Database for Advances in Information Systems, 28*(2), 43-52.