Int. J. Human-Computer Studies (2000) **52,** 991–1005
doi:10.1006/ijhc.1999.0367
Available online at http://www.idealibrary.com on IDEAL®

Creating an effective training environment for enhancing telework

VISAWANATH VENKATESH

The Robert H. Smith School of Business, University of Maryland, College Park, MD 20742, USA. e-mail: vvenkate@rhsmith.umd.edu

CHERI SPEIER
Eli Broad College of Business, Michigan State University, N215 North Business Complex, East Lansing, MI 48823, USA. e-mail: cspeier@pilot.msu.edu

(Received 29 January 1999 and accepted in revised form 22 December 1999)

There is a growing need for research examining the effective implementation and management of teleworking as it is increasingly being used as an organizational work structure. The enhanced functionality of many information technologies facilitates the completion of work across geographically dispersed teleworkers while simultaneously providing a vehicle to overcome social isolation that has been viewed as an inhibitor of teleworker effectiveness. This research assesses two training methods that can be used to help teleworkers develop skill sets for using these technologies. The results suggest that using a game-based training method facilitates the training process by increasing users' intrinsic motivation resulting in increased intention to use the technology. This can be particularly important in enhancing the effective completion of team and individual telework while at the same time providing a mechanism to minimize teleworkers social isolation.

KEYWORDS: game-based training; intrinsic motivation; telework.

1. Introduction

Since the 1970s researchers have been examining the phenomena of telework (e.g. telecommuting, satellite offices, remote work, mobile workers, etc.) (Martin & Norman, 1970). Recent advances in information technology have facilitated the growth of telework as an organizational work structure with significant increases in the number of teleworkers occurring in the last decade (Apgar, 1998; Hill, Miller, Weiner & Colihan, 1998). Technological support for telework has evolved from remote access of limited corporate-based information to email to technology-mediated meetings to today's telework environment that can consist of complete access to corporate files on remote machines and multipoint conferencing. Furthermore, emerging technologies support synchronous and asynchronous remote communication for both individual and team/project activities facilitating communication and cooperation (Hightower, Sayeed, Warkentin & Mchaney, 1998). Thus, today's technologies are creating opportunities for employees and organizations to effectively span geographical boundaries.

1071-5819/00/060991 + 15 $35.00/0

Effective technology training for teleworkers has been identified as one of the critical factors underlying telework success (Kinsman, 1987; Webster & Martocchio, 1995; Raghuram, 1996; Donaldson & Weiss, 1988). A growing body of literature assessing effective methods for training users to use various technologies has evolved (e.g. Olfman & Bostrom, 1991; Webster & Martocchio, 1993; Olfman & Mandviwalla, 1994; Compeau & Higgins, 1995). Although these methods vary, they share a belief that users must be motivated to use a technology resulting in the perspective that perceptions regarding a technology drive that behavior (e.g. use of a technology) (Davis, Bagozzi & Washaw, 1989, 1992). This research proposes an innovative method to address the challenges associated with both minimizing the negative influence of social isolation and increasing the effective training of telework technologies. Thus, the current research proposes a new training method to enhance users' perceptions of emerging telework technologies. Specifically, a field experiment was conducted to assess the effectiveness of a game-based training method that allows users to first interact with each other in a non-work-oriented (game-oriented) setting that will help them feel more comfortable with one another and the new technology. Users' reactions to the technology following such a game-based training were compared to the reactions of their counterparts who underwent traditional lecture/hands-on training.

2. Teleworking

The corporate use of teleworking (e.g. work or parts of work that occur away from a corporate location, often in an employee's home (Korte & Wynee, 1996) has increased significantly as companies have gravitated to flatter organizational hierarchies, increased emphasis on global organizations, and a constant eye toward reducing overhead (Johnson, 1997). Estimates of the number of teleworkers vary; however, eight million Americans worked from their homes in 1993 (Bredin, 1996) and in 1997 the number of US based teleworkers was estimated to be somewhere between 11.1 million (Hill *et al*., 1998) and as many as 40 million (Apgar, 1998). Future forecasts project that telework will involve 10–15% of the workforce in many developed countries (Korte & Wynee, 1996) and 90 million people worldwide by 2030 (Wilkes, Frolick & Urwiter, 1994).

Although these teleworking forecasts paint a very optimistic picture, many prior prognostications were clearly off base as evidenced by Mullner's (1985) estimate that 40% of US employees would be teleworking by 2000. Therefore, it appears that there is a growing reliance on teleworking; however, this growth has not occurred as quickly or penetrated organizations as deeply as anticipated (Korte & Wynee, 1996; Pliskin, 1998), suggesting that there are some potential inhibitors to this work structure.

From an organizational perspective, benefits of telework include reduced costs (e.g. office space), decreased employee absenteeism and turnover, increased employee morale and productivity, and the ability to access a broader pool of employees as the geographic tie to an "office" are diminished (Wilkes *et al*., 1994; Johnson, 1997; Donaldson & Weiss, 1998; Hill *et al*., 1998; Watson Fritz, Narasimhan & Rhee, 1998). Employees cite benefits of reduced stress (e.g. no commute or interruptions), greater flexibility in balancing their family and work lives, and greater job satisfaction (Johnson, 1997; Wilkes *et al*., 1994). The environment is also benefited by increased telework as there are fewer workers

commuting to and from work reducing the amount of air pollution in major metropolitan areas (Mitchell, 1996; Wilkes *et al*., 1994).

A number of disadvantages associated with telework have also been identified and may be among the reasons for the slower than anticipated penetration of teleworking within the workforce. These disadvantages include reduced supervisor control, inhibited use of work teams, additional information technology and telecommunication costs, and decreased timeliness of work completion (Johnson, 1997; Wilkes *et al*., 1994). However, the most significant disadvantage of telework is believed to be the social isolation that is often experienced by teleworkers no longer interacting with co-workers in their organizational environment (Kinsman, 1987; Kugelmass, 1995; Korte & Wynee, 1996; Watson Fritz *et al*., 1998).

Although face-to-face interaction with colleagues is difficult to completely emulate, recent advances in groupware technologies have enhanced employees' ability to stay connected for both work and social exchange (Li, 1998; Watson Fritz *et al*., 1998). These emerging technologies support synchronous and asynchronous remote communication, often involve electronic discussion databases, and provide sophisticated information-sharing capability (Watson Fritz *et al*., 1998). In addition to team and task support, these technologies can play a significant role in minimizing the geographical distance and social isolation felt by many teleworkers (Li, 1998; Rangecroft, 1998). Thus, these technologies have the ability to significantly transform the way organizations' conduct business, span geographical boundaries, and at the same time potentially overcome the most significant inhibitor (e.g. social isolation) to the success of teleworking. However, to enable teleworkers to successfully overcome these barriers, formal and extensive training on both the teleworking technology and team communications are necessary (Kinsman, 1987; Wilkes *et al*., 1994; Webster & Marotocchio, 1995; Goedon, 1997; Apgar, 1998; Davenport & Pearlson, 1998; Donaldson & Weiss, 1998).

3. Training and motivation to use technology

Even though computer technology has become pervasive in today's workplace, there is growing evidence of unrealized or less than expected productivity gains due to poor user technology acceptance (Keil, 1995; Johnson, 1997). Employee computer training has been identified as a necessary and essential component of individual and organizational computing success to counteract existing acceptance problems (White & Christy, 1987; Tannenbaum, 1990). Recent estimates indicate the organizations spend as much as $20B each year on computer-related training (Industry Report, 1996); however, only 10% of all training leads to change in employees' behavior (Georgenson, 1982). Hence, it appears that in general, more effective training methods are necessary (e.g. Facteau, Dobbins, Russell, Ladd & Kudisch, 1995) and this is likely to be particularly true in a telework environment where workers may have little or no access to a corporate training environment and have to rely on remote training (Kinsman, 1987; Kugelmass, 1995; Whalen & Wright, 1998).

Motivation has been identified as a key determinant of behavior in general (Deci & Ryan, 1987), work-related behavior (George & Brief, 1996) and specifically, there is evidence that it is the primary determinant of an individual's intention to use computer technology and actual computer use (Davis *et al*., 1992; Venkatesh & Speier, 1999). Two

broad classes of motivation—intrinsic and extrinsic—have been defined an examined across a variety of contexts and studies (Deci & Ryan, 1985, 1987; Davis *et al*., 1992; Venkatesh & Speier, 1999); see Vallerand (1997) for a review. Intrinsic motivation (IM) corresponds to the pleasure and inherent satisfaction derived from a specific activity (Deci, 1975; Vallerand, 1997), while extrinsic motivation (EM) focuses on the goal-driven reasons (e.g. rewards) earned when performing a behaviour (Deci & Ryan, 1985). Together, intrinsic and extrinsic motivation influence an individual's intention regarding an activity as well as his/her actual behaviour (Deci, 1975; Davis *et al*., 1992; Venkatesh & Speier, 1999).

Prior research has investigated the manner in which game-based training has influenced users' intentions regarding a technology by taking a technology acceptance perspective (e.g. How easy is the technology to use? How useful is the technology?) (Venkatesh, 1999). The current study extends this prior work by taking a motivational focus and examines explicitly how intrinsic motivation can be leveraged during game-based training to create favorable user acceptance of teleworking technologies. Increased intrinsic motivation has been associated with an individual's willingness to spend more time on a task, lowers levels of anxiety, creates a positive mood, and results in greater learning (e.g. Csikszentmihalyi 1995) and leads to sustained future behavior (Vallerand & Bissonnette, 1992). Thus, creating a training method that can influence the role of intrinsic motivation during the training process and measuring the corresponding influence is critical to our understanding of improving training effectiveness.

4. Effect of training on motivation

Several methods of technology training emphasizing the communication of conceptual and procedural knowledge have been proposed and tested for overall effectiveness (e.g. Eason, 1982; Deci & Ryan, 1985; Gist, Schwoerer & Rosen, 1989; Sansone, Sachau & Weir, 1989; Glaser, 1990; Kalen & Allwood, 1991; Webster & Martocchio, 1995). However, these methods have little or no emphasis on simultaneously increasing intrinsic motivation. Given the importance of intrinsic motivation in the learning process, one mechanism for increasing intrinsic motivation is examined—the use of fantasy. Fantasy is to be a particularly important aspect of learning as it provides meaning and the mental models necessary to instill intrinsic motivation (e.g. Li, 1998; Parker & Lepper, 1987) and discovery-based learning (Bruner, 1962). An increased emphasis on fantasy leads to higher levels of enjoyment, more sophisticated integration of material, and enhanced interest in gathering additional information (Starbuck & Webster, 1991).

One method of embedding fantasy into training is by incorporating game-play into a given training scenario. More specifically, games that employ Multi-User Dungeons (MUDs) create explicitly a fantasy role-play based on the popular fantasy role-playing game "Dungeons and Dragons". MUDs offer exciting possibilities for distance training as trainees could assume different roles or personalities relevant for the training topic offered (Whalen & Wright, 1998). By creating a fantasy environment to explore the boundaries of a technology, game-based training can instill an enhanced state of playfulness among users (Webster & Martocchio, 1992), thus making the training program more intrinsically motivating yet maintaining meaningful content. Playfulness,

a construct very similar to intrinsic motivation (Unger & Kernan, 1983) has been shown to create more favorable outcomes (Sandelands, 1988; Starbuck & Webster, 1991; Webster & Martocchio, 1993). This is in contrast to the more typical training method emphasizing knowledge transfer only. Therefore:

*H*1: *Users participating in game-based training will have higher intrinsic motivation than those participating in traditional training.*

A user's extrinsic motivation to use a technology is an outcome belief (Bandura, 1977) typically based on his/her perception of value associated with using the technology. For example, the degree to which the use of a given technology facilitates the completion of work resulting in compensation, promotion, etc. There is evidence to suggest that an individual's understanding of extrinsic factors influencing technology acceptance would be dependent on the task/technology fit (Venkatesh & Davis, 2000) and therefore, can be expected to be independent of the training method. Similarly, training has not been found to influence perceived usefulness (Venkatesh, 1999; Venkatesh & Davis, 1996, 2000), which is also conceived as an outcome-belief. We expect a comparable relationship between training and extrinsic motivation given prior research demonstrating the similarity between extrinsic motivation and perceived usefulness (Davis *et al*., 1992). Therefore

*H*2: *Extrinsic motivation will be equivalent between users in both game-based and traditional training.*

There is strong empirical support for the relationship between intrinsic/extrinsic motivation and intention to perform an activity (e.g. use a technology) (Kruglanski, Friedman & Zeevi, 1971; Davis *et al*., 1992; Vallerand, Fortier & Guay, 1997; Venkatesh & Speier, 1999) and actual behavior (Deci & Ryan, 1985; Vallerand *et al*., 1997; Vallerand & Bissonnette, 1992). However, the nature of the relationship varies, depending on the motivational forces specific to the behavior at hand. For example, Deci (1971, 1975) indicated an interactive effect between extrinsic and intrinsic motivation on intention where introducing or increasing extrinsic motivation decreases intrinsic motivation for tasks that were originally purely motivated from an intrinsic perspective. However, for behaviors that were not purely intrinsic in the first place, extrinsic and intrinsic motivations play an additive role in explaining intentions and behavior (Calder & Staw, 1975; Mossholder, 1980; Hirst, 1988).

In prior technology adoption and usage research, there is evidence supporting the role of extrinsic/instrumental outcomes as determinants of usage intentions and behavior (e.g. Davis *et al*., 1989). The role of motivation, both extrinsic and intrinsic, as determinants of usage of computers in the workplace as additive forces on intention has been theoretically justified and empirically demonstrated (Davis *et al*., 1992). The earlier hypotheses suggested that game-based training will have a stronger influence on intrinsic motivation while there will be no difference between game-based and traditional training with respect to extrinsic motivation. Given the additive role of extrinsic and intrinsic motivation for workplace computing, it follows that intention should be more strongly

influenced by game-based training. Therefore:

*H*3: *Users participating in game-based training will have higher intentions to use the technology than those participating in traditional training.*

5. Effects of training on relationships

Past examination of training where knowledge transfer was emphasized demonstrates that users' expectations regarding outcomes (i.e. extrinsic motivation) exert the strongest influence on intention to use the technology (Davis *et al*., 1989, 1992). Intrinsic motivation plays a lesser role as a determinant when only knowledge transfer occurs. With game-based training, users should experience an interaction that goes beyond the technical training and reframes (Tversky & Kahneman, 1982) the training experience to positively influence intrinsic motivation as stated in H1. In addition, this reframing of the training environment has the potential to influence the relationship between intrinsic motivation and behavioral intention.

Cognitive evaluation theory provides guidance in understanding the influence of intrinsic motivation on behavioral intention (Deci, 1975). Cognitive evaluation theory emphasizes the role that one's locus of causality exerts in explaining performance. A user can assess cognitively whether his/her locus of causality is internal or external. Locus of causality is internal when performance/behavior is driven by a user's internal reward structure (e.g. intrinsic motivation). Alternatively, locus of causality is external when performance/behavior is driven by a reward structure external to the user. Whereas most training emphasizes knowledge transfer, the perceived value of the training is associated with the capabilities of the technology and the resulting manner in which the technology can positively affect one's efficiency/effectiveness (e.g. outcome expectation). Given the dual emphasis on fantasy and outcome values, game-based training has the potential to shift the locus of causality towards an internal cognition. This shift likely leads to greater emphasis being placed on the gratification and rewards engendered intrinsically. Therefore:

*H*4: *The influence of intrinsic motivation on behavioral intention to use* (*IM-BI*) *will be higher among users in game-based training than users in traditional training.*

As discussed earlier, extrinsic motivation will likely exert a strong influence behavioral intention across training methods. It is also expected that the relationship between extrinsic motivation and intention will be comparable across training methods as extrinsic motivation is established as a match between the technology capabilities and job tasks (Davis *et al*., 1992; Venkatesh, 1999; Venkatesh & Davis, 2000). Neither training method has an inherent advantage nor disadvantage in establishing the degree to which there is a task/technology match. Therefore:

*H*5: *There will be no difference in the extrinsic motivation to behavioral intention* (*EM-BI*) *relationship across game-based and traditional training.*

Finally, the additive effects of intrinsic and extrinsic motivation have been discussed (Calder & Staw, 1975; Hirst, 1988; Mossholder 1980). While the relationship between

extrinsic motivation and intention is expected to be the same across training methods, the intrinsic motivation to intention relationship is expected to be stronger when game-based training is employed. Given the additive nature of these effects, the additive impact of intrinsic and extrinsic motivation on behavioral intention will be higher for game-based training than traditional training methods. Therefore:

*H*6: *The variance in behavioral intention explained by intrinsic and extrinsic motivation will be higher for users participating in game-based training—compared to users participating in traditional training.*

6. Method

A field experiment was conducted among business professionals to study the effect of game-based training on users' perceptions and learning.

6.1. SUBJECTS

Letters addressed directly to the individual were sent to 320 business professionals in a major midwest metropolitan area in USA. This letter announced a full day (about 8 h) of free training on the Virtual Workplace System.† Eighty-two individuals agreed to participate and 69 individuals actually attended. The participants were, for the most part, familiar with electronic mail and telework (although only 1 participant had telework experience), while only two subjects were familiar with MUDs and Dungeons and Dragons. The average age of the participants was 41 years with just over 7 years of work experience and 55% of the participants were male.

6.2. SYSTEM

The technology evaluated in this study the Virtual Workplace System, an Internet-based application facilitating real-time interactions between teleworkers who are not co-located. This environment generalizes to knowledge workers who actively use a computer in their work and participate in and create deliverables for project/team interactions where team members are not physically proximate. The system has the ability to share information (using electronic mail, file transfer utilities, etc.) and allow users to participate in meetings while also supporting basic word processing and file management functions.

6.3. PROCEDURE

Participants were randomly assigned to one of the two different training interventions designed to familiarize them to the Virtual Workplace System. Developers of the Virtual Workplace System, not the researchers, conducted training with two trainers involved in each of the two sessions. Both the game-based (35 participants) and traditional (34 participants) training interventions were comprised of three 2-h sessions, with 30-min breaks between sessions, conducted on the same day. After the last 2-h session, subjects

† This system was built as part of this research stream. Technical details are available on request.

completed a 45-min knowledge test at the end of the training. The total hands-on experience in both interventions was equivalent (4 h). Participants in each intervention were co-located although the only communication they had with one another was through the Virtual Workplace System during training, simulating long-distance communication.

In order to ensure equivalence between the 2 h of game play in the game-based training and the first 2 h of hands-on use in traditional training, the activities in which subjects were involved were made as similar as possible. In the game-based training intervention, the subjects were briefly introduced to the game and navigated through the virtual world of the game, interacted with other users of the game (other subjects) and played the game (killing monsters and gathering treasures). During the first 2 h of hands-on use during traditional training, subjects navigated through the virtual workspace and interacted with others on the system. During the second 2 h of hands-on use in both interventions, the activities were job-oriented. Thus, the key difference across interventions was the game context in the game-based training intervention.

The traditional training intervention was designed to have a concept-first training focusing on the concepts, features, and procedures of the system. Extensive handouts, both on the concepts and procedures of the system, were used to aid the subjects' learning process. Therefore, the traditional training intervention closely mirrored an executive training program on a new software product.

The game-based training intervention employed a game (i.e. MUD) to help users develop an understanding of system features and functionality. MUD is a multi-user game on the Internet that is based on the popular fantasy role-playing game "Dungeons and Dragons". MUDs are based on the metaphor of physical space (Venkatesh, 1999) described in a text-based virtual space (i.e. the real world, buildings and offices are described in the form of test as one would see it in reality). Every person (player of the game) creates her/his own character. A character is the representation of the user in the virtual world. Such user-created characters serve as a front for users to interact in the virtual world. It includes a name, gender and even a description. MUDs employ different-place, same-time online interaction similar to communication among users who telework.

The game-based training environment enabled trainers to underscore the idea that any action types in the Virtual Workplace System would result in some type of effect. These actions and effects were dispalyed textually on the screen of the teleworker's monitor. Therefore, to slay a dragon, the teleworker would determine the appropriate command structure, type it into the system, and the system would then inform the teleworker of the response of his/her command. Similarly, searching for treasure provided the teleworker with a fantasy to fulfil while at the same time developing his/her procedural knowledge of searching for files or co-workers.

7. Measurement

All subjects completed a questionnaire prior to and following training. Prior to training, computer experience, and pre-experimental measurements of computer self-efficacy (Compeau & Higgins, 1995) and microcomputer playfulness (Webster & Martocchio, 1992) were collected. After training, subjects filled out a questionnaire measuring the

different constructs using scales that were previously developed and validated—three items were used to measure intrinsic motivation (Davis *et al*., 1992; Venkatesh & Speier, 1999), four items were used to measure extrinsic motivation (Davis *et al*., 1989, 1992; Davis & Venkatesh, 1996; Ventakesh & Davis, 1996, 2000; Venkatesh & Speier, 1999; Venkatesh & Morris, 2000), and two items were used to measure behavioral intention to use (Davis *et al*., 1989, 1992; Davis & Venkatesh, 1996; Ventakesh & Davis, 1996, 2000; Venkatesh & Speier, 1999; Venkatesh *et al*., 2000). The appendix lists the scales used to test the hypotheses.

8. Results

Cronbach alpha estimates for intrinsic motivation (IM), extrinsic motivation (EM), and behavioral intention to use the technology (BI) were all over 0.90 demonstrating high reliability. Factor analysis was used to support convergent and discriminant validity and results indicated all construct cross-loading were less than 0.20. The results of the manipulation check (knowledge test scores) demonstrates that the knowledge transfer was equivalent across treatments [game-based ($M = 86.8$; S.D. $= 7.1$) and the traditional training ($M = 87.9$; S.D. $= 6.8$)] as expected. Similarly, the subjects were equivalent across both groups in terms of computer experience, computer self-efficacy, and playfulness.

Means and standard deviations of the constructs investigated are presented in Table 1. Individuals participating in the game-based training method had higher levels of IM compared to those in the traditional training method, thus supporting H1. Also, as expected, EM was not significantly different across training methods (H2). The higher level of IM among game-based training participants was reflected in a higher level of intention to use the new technology, thus confirming H3. The differences in IM and BI were confirmed by an ANOVA, followed by the Tukey test ($p < 0.05$).

Regression analyses were performed to examine the extent to which IM and EM were weighted by individuals in forming their intention to use the new system. Table 2 presents a comparison of the effect of the different training interventions on the relationship between IM and BI, and EM and BI. Individuals in the game-based training placed a greater emphasis on IM compared to individuals in the traditional training method (H4), while the emphasis on EM was comparable across training methods (H5). As expected, importantly, this resulted in a higher proportion of variance being explained among those in the game-based training (H6). A path analysis of the data pooled across training methods and including a dummy variable TRAINING (0 = Game-based training; 1 = Traditional training) confirmed the pattern of results—TRAINING was a significant moderator of the IM–BI relationship ($p < 0.05$), but not a significant moderator of the EM–BI relationship. In order to help better understand the practical significance of the results, Table 2 presents the results from the independent samples (two different training groups).

From the standpoint of the data analysis, a note of caution regarding the null hypotheses H2 and H5 is worth mentioning. The results and the associated interpretation of support for H2 and H5 are constrained by the fact that a power analysis revealed a high likelihood of Type II error—there was greater than 50% chance that a large effect size would not have been detected. While type II errors typically pose a serious threat to

TABLE 1
Effect of training method on intrinsic motivation, extrinsic motivation and intention

	Intrinsic motivation	Extrinsic motivation	Intention
Traditional training	4.1 (0.9)	5.1 (0.7)	5.1 (0.9)
Game-based training	6.1 (0.6)	5.3 (0.9)	6.0 (0.6)
Significance of difference	***		*

* $p < 0.05$.
*** $p < 0.001$.

TABLE 2
Effect of training method on relationships

	Variance explained in intention	IM–BI	EM–BI
Traditional training	0.50	0.27***	0.57***
Game-based training	0.67	0.59***	0.56***

Notes: When the data were pooled across training methods, the IM–BI relationship was moderated by TRAINING (0 = game-based training; 1 = traditional training) ($p < 0.05$).
The EM–BI relationship was not moderated.
***$p < 0.01$.

the validity of the results, this concern is greatly alleviated in this research given the minimal focus on the null hypotheses related to extrinsic motivation (H2 and H4), and the significant emphasis on the directional hypotheses related to intrinsic motivation and the consequent impact on intention (H1, H3 and H5).

9. Discussion

The results support the theory that technology acceptance was higher among teleworkers who underwent a game-based training program compared to teleworkers who were trained using a traditional method. More specifically, teleworkers undergoing game-based training developed higher levels of intrinsic motivation regarding the technology leading to enhanced behavioral intention to use the technology. Teleworkers in the game-based training intervention were also more strongly influenced by intrinsic motivation, as compared to extrinsic motivation, in determining behavioral intention to use. Thus, by departing from the traditional knowledge-focused implementation of training, teleworkers appear to be more favorably disposed toward the technology while performing comparably on a knowledge test. This outcome is particularly salient, as there were no adverse effects on extrinsic motivation or its role as a determinant of behavioral intention to use a technology. Therefore a game-based training method will potentially allow users to scale initial hurdles to acceptance and usage, and also create

higher levels of intrinsic motivation, which is more likely to lead to sustained usage behavior.

9.1. LIMITATIONS

Before addressing implications from this research, it is important to acknowledge possible limitations in our findings—non-respondent bias, generalizability, and power to detect findings (described in prior section). Participants volunteered to participate in this study, likely because they perceived some value in learning about teleworking tools. Therefore, extrinsic motivation was likely to be strong, potentially explaining the non-significant difference in the effect on extrinsic motivation and the role of extrinsic motivation in determining behavioral intention to use. From a generalizability perspective, a single technology and training technique were implemented. It is possible that alternative technologies or different operationalizations of the training methods could result in different findings.

9.2. IMPLICATIONS FOR RESEARCH AND PRACTICE

This research bears key implications for teleworkers and the management of teleworkers. Organizational practitioners may wish to develop and embed game-based training into the existing fabric of teleworker training materials. This type of method can facilitate training and acceptance of important technologies while at the same time facilitating "anytime/anywhere" training, ultimately reducing the cost and enhancing the effectiveness of an overall training program. Perhaps more importantly, prior examinations of distance and teleworkers training have observed the need to simultaneously develop both team and technical skills (Crandall & Wallace, 1998). Focusing on these skills simultaneously can help familiarize teleworkers with effective methods for interacting with colleagues, ultimately resulting in minimizing the social isolation experienced by many teleworkers. Therefore, developing these skills simultaneously allows teleworkers to acquire the technical mastery behind using communication and information technologies while at the same time provides the teleworker with insights in effective ways to communicate in this remote environment.

Further, the findings (i.e. higher levels of intrinsic motivation and increased emphasis on intrinsic motivation) are extremely encouraging from an organizational perspective. Prior research on intrinsic motivation (see Vallerand, 1997 for a review) would suggest that the primary advantages of such a pattern stem from the fact that individuals with higher levels of intrinsic motivation and an internal locus of causality (resulting from increased emphasis on intrinsic motivation) will tend to spend more time and effort on their job and will also be more creative during times of high intrinsic motivation.

This research also has important theoretical implications for work in the area of end-user training. The increased potential for acceptance by directly influencing intrinsic motivation appears to be a meaningful avenue for enhancing the effectiveness of training sessions. Researchers in the area of user training should consider other mechanisms for influencing intrinsic motivation to improve training outcomes, perhaps curiosity and challenge as suggested by Malone (1981*a*, *b*).

Aligning features of a given technology to features of a game-based training environment to enhance the training experience can be accomplished across a broad range of technologies. Typically, games have been seen as detractors from work and productivity since they cause people to waste time. However, results from this research suggest that games can enhance intrinsic motivation, perhaps resulting in lower user perceptions of effort of the task at hand (see Venkatesh, 1999). Also, higher levels of intrinsic motivation may help overcome hurdles to acceptance, adoption and use of a technology. It appears that game-based training not only increased levels of intrinsic motivation but also results in this heightened enjoyment having a greater influence on behavioral intention to use. Given the use of experienced professionals and their corresponding unfamiliarity with telework, these findings are particularly encouraging.‡

Several promising additional directions for future research emerged from the findings of this work. One important direction for future research to focus on is the long-term effects (i.e. whether the favorable user reactions were temporary or whether such reactions were sustainable) of game-based training on motivation, intention, and usage of telework technologies. Another area for future study is the role of game-based training in distance education, which is becoming increasingly popular while continuing to be a great challenge for educators. Finally, the generalizability of these findings should be examined across technologies (individual and organizational), environments (corporate cultures, training over distance to replicate some teleworking environments), users (age, IT sophistication, level in hierarchy) and interactions amongst these factors.

We would like to express our sincerest thanks to Professors Gerry DeSanctis (Duke University) and Fred Davis (University of Maryland) for their insightful suggestions during various phases of this research. We would also like to thank Tracy Ann Sykes (University of Maryland) for her editorial work that helped improve the readability of this paper. Last but not least, the comments and guidance of editor, Professor Philip Barker (The University of Teeside), and the three anonymous reviewers significantly enhanced the quality of this paper.

References

APGAR, M. (1998). The alterantive workplace: changing where and how people work. *Harvard Business Review*, **76,** 121–135.

BANDURA, A. (1977). *Social Learning Theory*. Englewood Cliffs, NJ: Prentice-Hall.

BREDIN, A. (1996). *The Virtual Office Survival Handbook*. New York: Wiley.

BRUNER, J. S. (1962). *On Knowing: Essays for the Left Hand*. Cambridge, MA: Harvard University Press.

CALDER, B. J. & STAW, B. M. (1975). Self perception of intrinsic and extrinsic motivation. *Journal of Personality and Social Psychology*, **31,** 599–603.

COMPEAU, D. R. & HIGGINS, C. A. (1995). Computer self-efficacy: development of a measure and initial test. *MIS Quarterly*, **19,** 189–211.

CRANDALL, N. F. & WALLACE, M. J. (1998). *Work and Rewards in the Virtual Workplace: A New Deal for Organizations and Employees*. New York: American Management Association.

CSIKSZENTMIHALYI, M. (1975). *Beyond Boredom and Anxiety*. San Francisco, CA: Jossey-Bass.

‡ This is a particularly interesting finding since the average age of subjects in both studies was over 40. One would not readily expect subjects who are older to find games as appealing as those who are younger (see Morris & Venkatesh, 2000), especially given that they were not familar with Dungeons and Dragons or MUDs. An analysis of the data by dividing it into two groups (under-40 and over-40) revealed no moderating effect for age and the impact it has on the role of the training method.

DAVENPORT, T. H. & PEARLSON, K. (1998). Two cheers for the virtual office. *Sloan Management Review*, **39,** 51–65.
DAVIS, F. D., BAGOZZI, R. P. & WARSHAW, P. R. (1989). User acceptance of computer technology: a comparison of teo theoretical models. *Management Science* **35,** 982–1002.
DAVIS, F. D., BAGOZZI, R. P. & WARSHAW, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology* **22,** 1111–1132.
DAVIS, F. D. & VENKATESH, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: three experiments. *International Journal of Human-Computer Studies*, **45,** 19–45.
DECI, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology*, **18,** 105–115.
DECI, E. L. (1975). *Intrinsic Motivation.* New York: Plenum Press.
DECI, E. L. & RYAN, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Plenum.
DECI, E. L. & RYAN, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology*, **53,** 1024–1037.
DONALDSON, S. I. & WEISS, R. (1998). Health, well-being, and organizational effectiveness in the virtual workplace. In M. IGBARIA & M. TAN, eds. *The Virtual Workplace*, pp. 24–44. Hershey, PA: Idea Group Publishing.
EASON, K. D. (1982). The process of introducing information technology. *Behaviour and Information Technology*, **1,** 197–213.
FACTEAU, J. D., DOBBINS, G. H., RUSSELL, J. E. A., LADD, R. T. & KUDISCH, J. D. (1995). The influence of general perceptions of the training environment on pretaining motivation and perceived training transfer. *Journal of Management*, **21,** 1–25.
GEORGE, J. M. & BRIEF, A. P. (1996). Motivational agendas in the workplace: the effects of feelings on focus of attention and work motivation. *Research in Organizational Behavior*, **18,** 75–109.
GEORGENSON, D. L. (1982). The problem of transfer calls for partnership. *Training and Development Journal*, **30,** 75–78.
GIST, M. E., SCHWOERER, C. & ROSEN, B. (1989). Effects of alternative training methods on self-efficacy and performance in computer software training. *Journal of Applied Psychology*, **74,** 884–891.
GLASER, R. (1990). The reemergence of learning theory within instructional research. *American Psychologist*, **45,** 29–30.
GORDON, G. E. (1997). HR implications of officeless office work. *Employment Relations Today*, **24,** 23–32.
HIGHTOWER, R. T., SAYEED, L., WARKENTIN, M. E. & MCHANEY, R. (1998). Information exchange in virtual work groups. In M. IGBARIA & M. TAN, Eds. *The Virtual Workplace*, pp. 199–216. Hershey, PA: Idea Group Publishing.
HILL, E. J., MILLER, B. C., WEINER, S. P. & COLIHAN, J. (1998). Influences of the virtual office on aspects of work and work/life balance, *Personnel Psychology*, **51,** 667–683.
HIRST, M. K. (1988). Intrinsic motivation as influenced by task interdependence and goal setting. *Joournal of Applied Psychology*, **73,** 96–101.
INDUSTRY REPORT. (1996). *Training*, **33,** 37–79.
JOHNSON, M. (1997). *Teleworking in Brief.* Oxford: Butterworth-Heinemann.
JOHNSTON, D. C. (1997). Computer clogged, IRS seeks to hire outside processors. *New York Times*, A1, A18, 31 January.
KALEN, T. & ALLWOOD, C. M. (1991). A survey of the training of computer users in Swedish companies. *Behaviour and Information Technology*, **10**, 81–90.
KEII, M. (1995). Pulling the plug: software project management and the problem of project escalation. *MIS Quarterly*, **19,** 421–447.
KINSMAN, F. (1987). *The Telecommuters.* Chichester: Wiley.
KORTE, W. B. & WYNEE, R. (1996). *Telework*: *Penetration*, *Potential*, *and Practice in Europe*. Amsterdam: IOS Press.
KRUGLANSKI, A. W., FRIEDMAN, I. & ZEEVI, G. (1971). The effects of extrinsic incentive on some qualitative aspects of task performance. *Journal of Personality*, **39,** 606–617.

KUGELMASS, J. (1995). *Telecommuting: A manager's Guide to Flexible Work Arrangements*. New York: Lexington Books.

LI, F. (1998). Team-telework and the new geographical flexibility for information workers. In M. IGBARIA & M. TAN, Eds. *The Virtual Workplace*, pp. 301–318. Hershey, PA: Idea Group Publishing.

MALONE, T. W. (1981*a*). What makes computer games fun? *Byte*, **6,** 258–277.

MALONE, T. W. (1981*b*). Toward a theory of intrinsically motivating instruction. *Cognitive Sciences*, **4,** 333–369.

MARTIN, J. &. NORMAN, A. R. (1970). *The Computerized Society: An Appraisal of the Impact of Computers on Society in the Next Fifteen Years*. Englewood Cliffs, NJ: Prentice-Hall.

MITCHELL, W. J. (1996). *City of Bits: Space, Place and the Infobahn*. Cambridge, MA: MIT Press.

MOSSHOLDER, K. W. (1980). Effect of externally mediated goal setting on intrinsic motivation: a laboratory experiment. *Journal of Applied Psychology*, **65,** 202–210.

MULLNER, W. (1985). Risiken und Rechtsfragen der Teleabeit. In H. R. HANSEN, Ed. *Gi/OCG/OGI-Jahrestagung, Informatik Fachberichte*, pp. 970–977. Berlin: Springer-Verlag.

OLFMAN, L. & BOSTROM, R. P. (1991). End-user software training: an experimental comparison of methods to enhance motivation. *Journal of Information Systems*, **1,** 249–266.

OLFMAN, L. & MANDVIWALLA, M. (1994). Conceptual versus procedural software training for graphical user interface: A longitudinal field experiment. *MIS Quarterly* **18,** 405–426.

PARKER, L. E. & LEPPER, M. R. (1987). Effects of fantasy contexts on children's learning and motivation: making learning more fun. *Journal of Personality and Social Psychology*, **62,** 625–634.

PLISKIN, N. (1998). Explaining the paradox of telecommuting. *Business Horizons*, **41,** 73–78.

RAGHURAM, S. (1996). Knowledge creation in the telework context. *International Journal of Technology Management*, **11,** 859–871.

RANGECROFT, M. (1998). Interpersonal communication in distance education. *Journal of Education for Teaching*, **24,** 75–76.

SANDELANDS, L. E. (1988). Effects of work and play signals on task evaluation. *Journal of Applied Social Psychology*, **18,** 1032–1048

SANSONE, C., SACHAU, D. A. & WEIR, C. (1989). Effects of instruction in intrinsic interest: the importance of context. *Journal of Personality and Social Psychology*, **57,** 819–829.

STARBUCK, W. & WEBSTER, J. (1991). When is play productive? *Accounting, Management and Information Technology*, **1,** 71–90.

TANNENBAUM, S. I. (1990). Human resource information systems: user group implications. *Journal of Systems Management*, **41,** 27–32.

TVERSKY, A. & KAHNEMAN, D. (1982). Judgment under uncertainty: Heuristics and biases, In: D. KAHNEMAN, P. SLOVIC & A. TVERSKY, Eds. *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge, UK: Cambridge University Press, Cambridge.

UNGER, L. S. & KERNAN, J. B. (1983). On the meaning of leisure: an investigation of some determinants of the subjective experience. *Journal of Consumer Research*, **9,** 381–392.

VALLERAND, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. *Advances in Experimental Social Psychology*, **29,** 271–360.

VALLERAND, R. J., FORTIER, M. & GUAY, F. (1997). Self-determination and persistance in a real-life setting: toward a motivational model of high school dropout. *Journal of Personality and Social Psychology*, **72,** 1161–1177.

VALLERAND, R. J. & BISSONNETTE, R. (1992). Intrinsic, extrinsic, and amotivational styles as predictors of behavior: a prospective study. *Journal of Personality*, **60,** 599–620.

VENKATESH, V. (1999). Creation of favorable user perceptions: exploring the role of intrinsic motivation. *MIS Quarterly*, **23,** 239–260.

VENKATESH, V. & DAVIS, F. D. (2000). A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science* (forthcoming).

VENKATESH, V. & DAVIS, F. D. (1996). A model of the antecedents of perceived ease of use: development and test. *Decision Sciences*, **27,** 451–481.

VENKATESH, V. & MORRIS, M. G. (2000). Why don't men ever stop task for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly* (forthcoming).
VENKATESH, V. & SPEIER, C. (1999). Computer technology training in the workplace: a longitudinal investigation of the effect of mood. *Organizational Behavior and Human Decision Processes*, **79,** 1–28.
WATSON FRITZ, M. B., NARASIMHAN, S. & RHEE, H. S. (1998). Communication and coordination in the virtual office. *Journal of Management Information Systems*, **14,** 7–28.
WHITE, C. E. JR. & CHRISTY, D. P. (1987). The information center concept: a normative model and a study of six installations. *MIS Quarterly*, **11,** 451–458.
WEBSTER, J. & MARTOCCHIO, J. J. (1992). Microcomputer playfulness: development of a measure with workplace implication. *MIS Quarterly*, **16,** 201–226.
WEBSTER, J. & MARTOCCHIO, J. J. (1993). Turning work into play: implications for microcomputer software training. *Journal of Management*, **19,** 1127–1146.
WEBSTER, J. & MARTOCCHIO, J. J. (1995). The differential effects of software training previews of training outcomes. *Journal of Management*, **21,** 757–787.
WHALEN, T. & WRIGHT, D. (1998). Distance training in the virtual workplace. In M. IGBARIA & M. TAN Eds. *The Virtual Workplace*, pp. 87–107. Hershey, PA: Idea Group Publishing.
WILKES, R. B., FROLICK, M. N. & URWILER, R. (1994). Critical issues in developing successful telework programs. *Journal of Systems Management*, **45,** 30–34.

Paper accepted for publication by Associate Editor, Professor P. Barker

Appendix: Measurements scales

Behavioral intention to use
Assuming I had access to the system, I intend to use it.
Given that I had access to the system, I predict that I would use it.

Extrinsic motivation
Using the system improves my performance in my job.
Using the system in my job increases my productivity.
Using the system enhances my effectiveness in my job.
I find the system to be useful in my job.

Intrinsic motivation
I find using the system to be enjoyable.
The actual process of using the system is pleasant.
I have fun using the system.

Note: All items used a 7-point Likert scale.