

Can e-learning be used as an effective training method for people over age 50? A pilot study

Marian Stoltz-Loike PhD

CEO, SeniorThinking LLC

179-20 Tudor Road, Jamaica, NY 11432, USA

E: mstoltz-loike@seniorthinking.com

Roger W. Morrell PhD

Director of Research, GeroTech Corporation

Reston, VA

Adjunct Faculty, Johns Hopkins University, School of Nursing

Baltimore, MD, USA

James D. Loike

Director of Technology, SeniorThinking LLC

Jamaica, NY, USA

M.Stoltz-Loike, R.W.Morrell, J.D.Loike. Can e-learning be used as an effective training method for people over age 50? A pilot study. Gerontechnology 2005, 4(2), 101-113. This research evaluated the effectiveness of an e-learning package (in CD-ROM format) called *BusinessThinking™* to teach technology skills and business information to adults aged 50-69. In the first pilot study, pre- and post-tests were conducted to determine if seven participants could learn career-related material. In the second pilot study, pre- and post-test assessments were used to evaluate whether seven other participants could gain PowerPoint skills. Results suggested that this e-learning package would be an effective training platform to enable mature adults to learn skills and information from two very different sets of material. On average, the participants improved 23% on the post-test scoring of the career management material and 46% on the post-test scoring on PowerPoint skill development.

Keywords: e-learning, computer- based training, older adults, CD-ROM

There is a substantial literature that focuses on adult learning and literacy. Yet, after 80 years of research on this issue there is no single answer, theory, or model of adult learning. As computer-based e-learning becomes more normative in schools, at work, and at home, the need to re-focus on the many adult learning and literacy models and to review and revise old models and develop new ones, becomes increasingly important. These models need to become

more inclusive of new learning platforms and more descriptive of learning differences across adults at various ages. It is not completely clear that adults over the age of 50, for example, can benefit from e-learning formats. As e-learning becomes an important platform for skills acquisition across different organizations and for employees at companies as diverse as The Sports Authority, AT&T, and IBM, there is a risk that mature adults may have problems

with e-learning and therefore could be excluded from opportunities for acquiring new skills.

The research outlined in this article is designed to examine whether mature adults are able to effectively use e-learning methods (CD-ROMs) to gain technology skills and acquire new information. Three factors influence this research focus: (i) the American workforce is getting older; (ii) many companies need to and are motivated to employ mature workers; and (iii) e-learning will play an important role in the inclusion of older people in the workforce, if they can use and access e-training.

E-LEARNING

E-learning, defined as computer-based training via corporate intranets, the Internet, or with a CD-ROM, is becoming a popular alternative to face-to-face training¹. Organizations are eager to conduct e-training because it is dynamic, less expensive, eliminates many training costs relating to travel and facilities and requires employees to spend less time away from their desks². E-learning can be self-paced and self-directed and material can be tailored to a learner's proficiency and customized to the learning styles and preferences of different users. As businesses become more dispersed, the availability of e-learning to organizational employees anytime, anywhere and around the world is an attractive feature. For these reasons, companies are expected to increase their current spending on e-learning from \$3 billion to \$10 billion by 2007³.

E-learning is becoming popular for many different kinds of jobs. E-learning is used to train cashiers at companies such as Sports Authority; mechanics at Michelin; and sales reps at Toyota - Canada. Both hard business and soft management skills are e-trained and elec-

tronic kiosks are becoming common for new employee applications. Facility with technology and e-learning across businesses and across organizational levels is becoming critical for building business-related knowledge.

E-Learning and the older worker

The American workforce is getting older. Today, there are more employees over 40 than under 40⁴. More than one-fourth of today's workforce will soon be over age 50⁵ and will continue to grow as the vast population of Baby Boomers age and mature workers postpone retirement³. Many members of the Baby Boom generation (born between 1946 and 1964, and numbering 76 million in the USA) are choosing to remain in the workforce because of financial and personal reasons. Organizations need mature employees to remain active participants because of the knowledge, skills, and expertise that they bring to the workplace and to protect organizations from the financial disaster of enormous pension payouts to retirees³. There are too few Gen Xers (individuals born between 1964 and 1981, and numbering approximately 48 million in the USA) to fill the gap if the Baby Boomers leave the workforce as they become eligible to retire. Consequently, leading edge companies have been exploring strategies for rehiring retirees and retaining mature employees³.

Four significant factors are impacting the need to develop cutting edge e-learning material for mature adults. First, business is recognizing the need to retain mature employees in the workforce. Second, in the rapidly changing business environment of the 21st century, employees must engage in continuous learning and customized training and development to build business knowledge and skills critical to success. Third, many organizations are replacing

traditional training and development with e-learning. Fourth, an inability to access and use e-learning courses can place mature adults at a disadvantage.

Theories of Adult Learning

Two streams of research on adult learning are noteworthy—one focuses on self-directed learning; and the other focuses on the context of learning. Research and theories related to individual styles of learning have focused on how adults self-direct learning relative to personal life situations, life experience, and social and cultural factors^{6,7}. The models of Tough⁶ and Knowles⁷ assume that learners self-diagnose their learning needs, identify resources and instructional formats, develop learning plans and assess the outcomes.

In his seminal work, Knowles⁷ acknowledged that adult life experience impacts learning and is the basis of mature self-directed learning. Tough⁶ found that 90% of participants in his study had engaged in 100 hours of self-planned learning projects in the previous year related to jobs; home and personal responsibilities; and leisure time interests (see^{8,9} for a review of other models of adult self-directed learning). Later models of self-directed learning are less linear than these earlier models and assume that: (i) the learner interacts with his/her environment; (ii) the context in which he/she learns affects learning; and (iii) the type of learning influences the success of information mastery¹⁰⁻¹².

Since the late 1990's, there has also been a steady shift from research on self-directed learning and its focus on the individual to a greater focus on the context of learning¹³. A second theory of adult learning relates to context-based or situation-based learning and suggests that the context and social

nature of a situation are critical to the learning experience¹⁴⁻¹⁶. Context-based learning occurs in the workplace where people are engaged by other learners who have different levels of mastery and who together become part of a learning community^{13,15}. Learning communities may form at work, in a family, in a classroom, in an online community, or in a neighborhood.

E-learning can be viewed as a form of self-directed learning. When it is well-designed, e-learning allows learners to master information at their own pace, review information as often as they would like, access additional information resources, and self-test for understanding. Based on the theories mentioned^{6,7}, learning should be optimized using e-learning. Additionally, e-learning can be designed so that the user experience can be varied to accommodate different learning styles, which should further enhance the learning experience.

Although the Internet represents one of the major technological innovations of the last part of the 20th century, there is almost no research on the effectiveness of this technology for adult learning and literacy^{17,18}. Related research about usage and design of Internet sites for adults is significant. By 2000, Americans over age 60 had already become the fastest growing new user group on the Internet¹⁹. It has been shown that older adults can capably use the Internet, but their ability to access web pages or use specific web sites has been shown to be related to the site's design, method of content delivery, and the use of certain typography characteristics, color, and graphics (see National Institute on Aging (NIA) guidelines on developing accessible online materials for older adults²⁰⁻²⁵).

Research conducted in school settings is suggestive of the link between e-learning as both context-based learning and self-directed learning. One study²⁶ concluded that to be effective, computer-based training needs to: 1) actively engage learners; 2) have participants engage in group learning; 3) provide frequent interaction and feedback; and 4) connect learning to the real world. Learning technologies are ideally suited to providing frequent and immediate feedback to learners²⁶. However, to be effective, learning must be customized to the right level for learners²⁷. Whether mature adults can effectively learn information via e-learning has not yet been well-documented as there have been few studies conducted that compare the impact of different delivery methods on mastering e-knowledge by mature adults (with the exception of^{3,28-30} and discussions in^{17,18}). The pilot research discussed below focuses on e-learning as a form of self-directed learning.

Summary

This pilot research evaluated whether mature adults can learn new business-related information or build new business-related skills using e-learning material. Several factors may impede the ability of mature adults to master e-learning material. The first factor is how easy it is to use the material, i.e., its 'usability', including navigational features and ease of reading and comprehending the material presented. The second factor is the difficulty in mastering the educational content of the material. To evaluate whether mature adults can use and learn computer-based material, we developed e-learning material customized to mature adults with courses that enable users to build a better understanding of career development (career management and pre-retirement planning) and other courses that help users learn how to use technology applica-

tions (Word, PowerPoint, Excel, or Internet Search Engines). *BusinessThinking™* is an innovative educational product with an e-learning platform or Very Fast Learning Module (VFLM), that is designed to enable people over age 50 to quickly understand and master technology applications and other information. Construction of the material was based on the 2002 NIA Elder-Accessibility guidelines³¹. Results of previous research on the usability of a subset of the course material indicated that the navigation system incorporated in the CD-ROM-based materials was user-friendly for people over age 50 as almost no errors were made in navigation during usability testing. Users also had positive opinions of all the material³. In the research discussed below, we evaluated the ability of participants to learn and apply information in the e-courses to determine how effective the material is in building content mastery. Data about opinions, motivation, experience, and background were also collected to see how these factors are related to the self-directed adult e-learning experience.

METHODS

All participants in this research were recruited through the five SeniorNet Computer Training facilities located in Southern Maryland, Metropolitan Washington, D. C., and Northern Virginia from a subject pool of approximately 200 individuals over the age of 50. SeniorNet is the largest online organization of mature adults in the country. The Director of the Center for Productive Aging for the Jewish Council for the Aging (JCA), the administrative group that oversees the SeniorNet Training Centers located throughout the Metropolitan Washington, D.C. area, coordinated the recruitment of participants with the research team. Individual participants were tested in a quiet, private room and a moderator was available at all times

for assistance. Testing was held at the Chevy Chase, Maryland SeniorNet Training Site which is easily accessible by car and subway for all residents of Metropolitan Washington, D.C.

Study 1: A Pilot Test of the Ability of Mature Adults to Learn Business-Related Information in CD-ROM Format

The first study used a subset of the *BusinessThinking™* courses and focused on business skills related to career management and pre-retirement planning (and will be referred to as Business-Related Information). In this pilot study, we evaluated participants' ability to learn from the material.

Participants

Three females and four males participated in the testing of the Business-Related Information courses, ranging in age from 54 to 67 with an average age of 63.6 years. There was a range of educational backgrounds (from high school to advanced degrees) and participants' ratings of their own health were good to excellent. Two of the participants were African American and the remaining five were White. All participants scored above the norm on the vocabulary test. Four of the participants self-rated their computer experience at level 3, two at level 4, and one at level 5, where 1 = no skills and 5 = highly skilled. The self-rating was based on responses on the Prior Experience with Technology Questionnaire described below. English was the first language of all individuals and there were no signs of dementia or vision problems within this sample or within the sample tested in the second study outlined below. Each individual was paid \$100 for participation.

Instruments

Demographics questionnaire

A demographics questionnaire was administered to define the sample of participants for selection purposes by

gender, age, level of education, race, perceived health, and health in relation to others their own age; and to determine if English was their first language.

Prior experience with technology questionnaire

The Prior Experience with Electronic Technology Questionnaire was modified from an instrument developed by K.V. Echt, PhD, Research Health Scientist at the Rehabilitation Research & Development Center, VA Medical Center, Decatur, GA³². Items in this instrument include: previous use of computers for business and personal purposes; prior use of other electronic devices; estimate of current Web use; frequency of Web use; and self-rating of computer skills. This instrument was used to define the samples.

Opinions questionnaire

This questionnaire represents a quantifiable individual impression of the software that the participants completed when they returned for the post-test. Opinions measured include: (i) Seven items on participants' overall opinions of the software package (e.g., I liked the software package); (ii) Seven items about participants' opinions about ease of moving around the software package - navigation (e.g., I had no problems moving around the software package); (iii) Six items about participants' opinions about the quality of the information presented in the software package (e.g., The information was easy for me to understand); and (iv) Ten items about participants' opinions about the design of the software package (e.g., The text was large enough for me to read easily). Items were scored using a five-point Likert scale ranging from 'Strongly Disagree' (1), indicating a very low opinion, to 'Strongly Agree' (5), indicating a high opinion, on the 30 items. An average sample score of '4' or above is considered to be an indication that there is

a consensus of approval (positive opinion) on an item within a questionnaire or across items within a category.

Shipley institute of living scale - Vocabulary subtest/ Gardner & Monge vocabulary test

The Vocabulary subtest of the Shipley Institute of living scale³³ consists of 40 multiple-choice items for which the respondent is asked to choose out of four words the one that is closest in meaning to a target word. The Vocabulary subtest relies on verbal skills that include reading ability, verbal comprehension, acquired knowledge, long-term memory, and concept formation. Comparisons to administration of the Vocabulary Subtest in related research indicates that an average score of 34.5 correct responses would be representative of the general population for adults aged 50 – 69³⁴. The Gardner & Monge Vocabulary Assessment³⁵ was used in the second study as a substitute for the Shipley Scale because some of the participants in the second study were already familiar with the Shipley, having completed the instrument in previous, unrelated research conducted by the second author of this article. The two instruments are highly correlated and were used to define the samples tested in the two studies reported here.

Mini-mental state examination (MMSE)

The Mini-Mental State Examination is a widely used method for assessing cognitive mental status^{36,37}. The MMSE represents a brief, standardized method by which to grade cognitive mental status. It assesses orientation, attention, immediate and short-term recall, language, and the ability to follow simple verbal and written commands. Results indicate level of cognitive function and were used for screening participants.

Vision assessment: Snellen eye chart

The Snellen Vision Test is a standard

test to assess visual acuity. A score of 20/20 - 20/30 corrected binocular vision is an acceptable range to indicate there are no visual problems that might interfere with this research. Individuals whose vision did not fall within this range were excluded from participation in this research.

50-item Questionnaire

Participants received a 50-item set of questions focused on career management and pre-retirement issues consisting of 26 True-False questions and 24 multiple choice questions to evaluate their ability to learn information presented in the course material. Twenty five questions focused on pre-retirement planning (e.g., True or False: More than half of workers aged 25 to 64 do not own retirement accounts of any kind. Or select the correct answer: Among working women: (i) Half receive no pension; (ii) Those who have a pension, receive half the amount men do; (iii) Half are less confident than men that they will achieve financial independence and cover basic costs of retirement; or (iv) All of the above). Twenty-five questions focused on career management (e.g., True or False: What you learn outside of work is not easily transferred to the job that you do. Or select the correct answer: Transferable skills: (i) refer to new skills that you learn when you change jobs; (ii) are the skills transferred from one employee to another; (iii) refer to skills that you master in one job that can be applied to another position; or (iv) are the skills transferred from a manager to an employee). This questionnaire served as the pre-test and post-test measure of learning of the course material.

Procedure

1. Participants read and signed a consent form approved by an independent IRB.
2. Participants were given a brief descrip-

tion of the goals of the study.

3. Participants completed demographics and previous computer experience questionnaires.
4. Participants completed the Shipley Vocabulary Assessment.
5. Participants were individually assessed for vision and their status on the Mini-Mental State Exam.
6. For the pre-test, participants completed the 50-item questionnaire related to the course material on career management and pre-retirement planning.
7. Participants took the CD-ROM home to read and work through the business-related information courses at their own pace. They were asked to work on their own and not seek assistance from others, and to keep a record of time on a day-by-day basis spent working through the course material.

Return visit 1 week later:

1. Participants completed the Opinions Questionnaire as one of the outcome measures;
2. For the post-test, participants completed the 50-item questionnaire again; and
3. Participants were allowed to ask questions about their experience in the project.

Pre-test/Post-test scoring

The pre-test and post-test consisted of items that composed the 50-Item Questionnaire. Each question was scored a 1 if a participant answered correctly and a 0 if the response was incorrect. The dependent measure was the change between pre-test and post-test scores on each item and across items.

Results of Study 1

As noted above, participants were asked to give opinions about the course on a scale of 1 to 5 on a series of items where 1 represented a low opinion and 5 represented a high opinion (*Table 1*).

Participants ranked the overall course as a 4.0. They agreed that this was a good course. Participants also reported that information presented was good (average rating = 4.4) as was the overall design of the software (average rating = 4.3). They rated the navigation system of the software the highest (average rating = 4.8).

In order to evaluate how much the participants learned from the e-course material a pre-test and post-test were administered to each participant (see Methods section above). It was demonstrated that the individuals could take the CD-ROM home, work through it at their own pace and increase their knowledge of the information. Each of the participants increased their pre- to post-test knowledge scores by at least 10 percentage points (*Table 2*). On average, participants improved about 23 percentage points on the post-test scoring. Participants reported that they had spent an average of 2.75 hours using the course material during the one-week interval between the pre- and the post-test. No participant spent less than 1.75 hours or more than 6 hours using the e-learning material and none of the participants reported that they received any assistance in learning the material from others.

The first pilot study assessed the ability of the participants to learn about Business-Related Information. We found that people over age 50 could improve their knowledge using the developed e-learning courses. Next, we conducted another pilot study to evaluate whether e-learning could also be used to teach mature adults how to use technology applications. In order to do this, we developed and evaluated another set of courses that were designed to teach/enhance the user's ability to use PowerPoint.

STUDY 2. PILOT TEST OF THE ABILITY OF MATURE ADULTS TO LEARN FROM THE BUSINESS THINKING™ POWERPOINT COURSES IN CD-ROM FORMAT

Participants

Three males and four females participated in testing, ranging in age from 54 to 68 with an average age of 61.3 years. Education ranged from high school to advanced degrees. Participants' perceived health ranged from very good to excellent. Two of the participants were African American and the remaining five were White. All but one of the participants scored above the norm on the Gardner & Monge Vocabulary Assessment (average score = 23.3 which is above the norm for 50 - 69 year olds). All participants self-rated their computer experience at level 3 or above as measured by the 'Prior experience with technology' questionnaire, however, five participants indicated they had no previous PowerPoint experience; the remaining two individuals rated themselves at

2 or 3 (low skills). This sample was composed of different individuals than those who participated in the first study. Demographic characteristics were matched as closely as possible to make results of the two studies comparable.

Instruments / Procedure

Day One

Testing procedures and instruments were the same as in the first study with the following exceptions:

1. Participants completed the Gardner & Monge Vocabulary Assessment.
2. Participants completed 18 PowerPoint tasks that were considered representative of the demands of the PowerPoint program. They were rated between 0 and 3 on their ability to complete each task (pre-test and post-test). PowerPoint tasks involved asking participants to do basic PowerPoint procedures (e.g., Select a specific background; Enter information in Title or Text box; Change background

Table 1. Overall average ratings by response category recorded from the opinions questionnaire for Study 1. 'Overall Opinion' was a separate category and not a summary measure

Opinion Score	Overall Opinion	Navigation	Information Presented	Design
Rating	4.0	4.8	4.4	4.3

Table 2. Percent correct scores (out of 50 items) on pre/post-tests and time spent reviewing the CD-ROM (in hours) using the software when it was taken home in Study 1

Subject number	Pre-test	Post-test	Time (hours)
Subject#1	84%	94%	1.75
Subject#2	72%	94%	1.50
Subject#3	76%	96%	6.00
Subject#4	74%	94%	3.25
Subject#5	68%	96%	2.25
Subject#6	72%	94%	2.25
Subject#7	52%	92%	2.00
Average across participants	71%	94%	2.71

color; Insert an image; or Change size of an image.)

Return Visit 1 Week Later

Participants completed the 18 PowerPoint tasks (post-test) again.

Pre-Test / Post-Test Scoring

Participants received a score of 0 (unable to begin, asks questions of session moderator, or requires an intervention by moderator to perform the task), 1 (begins task, but cannot complete), 2 (performs two or more steps but cannot complete task), or 3 (completes entire task successfully) for each task. A perfect score equaled a total of 54 points (or 18 tasks x 3 points/task). The dependent measure was the change between pre-test and post-test performance on each task and across tasks.

Results for Study 2

The main finding of this pilot study is that working independently, mature

adults could learn PowerPoint skills from the e-learning software. It was demonstrated that participants could take this subset of the CD-ROM course material home, work through it at their own pace, receive no assistance from others, and learn from the material as outlined in Table 3. A 46% increase in performance scores was observed in a post-test assessment with participants spending an average of 3 hours using the material. At the post-test, participant performance had improved to 96%-100% (average=99%) correct responses after using the material between 1 and 5 hours (average=2.86 hours).

As indicated by responses to the Opinions Questionnaire, participants were also generally pleased with the overall design of the course on learning PowerPoint (average opinion score = 4.1). Presentation of material, navigational properties of the program and the over-

Table 3. Percent correct performance on PowerPoint tasks on pre/post-tests and time spent reviewing the CD-ROM when it was taken home in Study 2

Subject number	Pre-test	Post-test	Time (hours)
Subject#1	54%	100%	1
Subject#2	70%	100%	2
Subject#3	57%	100%	3.5
Subject#4	48%	100%	5
Subject#5	63%	100%	1.5
Subject#6	19%	96%	3
Subject#7	60%	96%	4
Average across participants	53%	99%	2.86

Table 4. Overall average ratings by response category recorded from the opinions questionnaire in Study 2. 'Overall Opinion' was a separate category and not a summary measure

Opinion Score	Overall Opinion	Navigation	Information Presented	Design
Rating	4.1	4.2	4.2	4.6

all design of the course were also rated favorably (average scores = 4.2, 4.2, and 4.6, respectively). See Table 4.

DISCUSSION

The focus of this research was to examine whether e-learning can be an effective framework for teaching various technology and business-related skills and information to mature adults. In the first pilot study, we evaluated participants' ability to learn from career-related course material. There was an average of 23% improvement between the pre- and post-test scores after using the e-learning material for about 2.75 hours. This indicated that people over age 50 could use the e-learning material and could learn new business information using an independent computer-based format as a medium for training. Although many of the participants had a fair degree of knowledge about career management and pre-retirement planning information (as indicated by average pre-test scores of 71%) there was still significant improvement to average post-test scores of 94%. This suggests that in future design of similar material, additional information on pre-retirement planning and career management should be added that may be less familiar but also useful for users.

In the second pilot study, we evaluated the ability of mature participants to learn how to use PowerPoint using only e-learning material. While all of the participants had some computer experience and were able to make intelligent guesses about how to use some basic features (reflected in their pre-test scores), they had little or no experience with the PowerPoint technology application or how to use some of its more customized features. Results revealed that participants improved on average by 46% to a near-perfect (99% correct) ability to use the PowerPoint material in just under 3 hours of

training using our PowerPoint-related course material at home with no assistance from others.

It is interesting to examine the differences in improvement scores between the two studies (i.e., 23% versus 46%). In the case of the pre-retirement information, results were dependent upon the ability of the participants to remember new text-based information. In the case of PowerPoint, participants were required to learn new skills. That is, participants were required to read the text and also perform hands-on manipulation of computer procedures in order to learn them. One possible reason for the greater improvement with the PowerPoint material is the difference in the material to be learned and the procedures required learning it. With PowerPoint, the to-be-learned information involved actually practicing the manipulations, thus reinforcing memory of the information, while the pre-retirement to-be-learned material required only remembering the text. No practice or memory enhancement techniques were involved with the pre-retirement material which suggests that future versions of the course might include exercises in which the reader must actually use text-based material of this nature in reinforcing exercises to facilitate memory by asking the user to apply the text-based material in some way as they proceed through the course. Additionally, performance of participants on the pre-retirement pre-test was already high, so there was less room for improvement among participants. In future research, relevant material could be included that may be less familiar to mature adults in the course material, and the pre/post-test questions could be made more difficult to answer. These strategies may lower the pre-test performance, providing more room for improvement in the post-test.

These pilot studies demonstrated that e-learning can be an effective tool to enable mature adults to learn material related to business information and technology applications when it is custom-designed for them. As with all pilot research, it is important to realize that these results are based on small samples and, therefore, these findings should be viewed within this context. The results reported emphasize the need for these studies to be replicated with larger groups in order to verify the results and to increase the generalizability of the findings. Furthermore, the e-learning methods were not compared to other traditional training methods (for instance, classroom materials in print). A comparison of different training methods could shed light on whether or not e-learning is an optimal method for teaching text-based material and skills to mature adults.

Notwithstanding these notes of caution, the results reported in this paper are enlightening within the larger context of the adult learning literature. Earlier work^{6,7} indicated that mature adults can master diverse information through self-directed learning. These pilot studies contribute data to the literature on self-directed learning, using computer based training as the medium for independent self-directed learning. In addition, well-designed e-learning is consistent with guidelines for the development of adult learning material when it is learner-centric, goal-driven, and occurs within a social context^{18,38,39}.

E-learning has the potential of providing a significant training and development format for mature adults because it is private, can be conducted at the learner's convenience, can be reviewed and repeated multiple times, and is available. Many of the e-learning courseware materials on the market assume a relat-

ively sophisticated knowledge of technology and e-terminology and familiarity with using e-learning. Those features that make e-learning courseware interesting and attractive to tech-savvy individuals may make it unhelpful and inaccessible to those who are less experienced with computer-based training.

As organizations move toward using a greater degree of e-training, they risk excluding mature employees from the e-training and development that is critical to their performance and success. This research provides some evidence that e-training can be an effective learning medium for mature adults. Therefore, e-training that is custom-designed for mature adults may well be used by organizations that value experience and talent and want to avoid the appearance of providing training only to some employees.

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