Exploring the Connection between Age and Strategies for Learning new Technology Related Tasks

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Abstract

This paper discusses the connection between age and strategies for learning new technology related tasks. Many users have to learn about new devices and applications on a frequent basis and use a variety of strategies to accomplish this learning process. Approaches to learning new technology related tasks vary and can contribute to a user's success or failure in mastering these tasks. Little research exists on how this affects older users actively pursuing education. This study focuses on how learning strategies, types of errors, and attitude can vary among users of different age groups. A survey was administered to two user groups, one was a group of traditional age students taking introductory general education courses at a Mid-Atlantic comprehensive university, the other was a group of members of the Osher Lifelong Learning Institute at the same university. The results of this study highlight the importance of considering age related changes in learning styles, types of error, and attitude when introducing new technology related tasks. The paper concludes with a summary of considerations for content delivery and plans for future research.

Keywords: learning strategies, new technology tasks, age

1. INTRODUCTION

Technology is integrated into many daily tasks, such as driving cars with global positioning systems, communicating with cell phones, or using the Internet for research, online banking, or education. In the current environment of fast evolving technologies, users are often in situations where they need to learn new tasks related to technology. Examples of such technology related tasks include learning to use newer versions of well-known devices (such as smart phones) or learning how to use newer applications (such as social networking applications) in a relatively familiar environment such as the internet. Approaches taken to learn such technologies vary, and can contribute to success or failure. Research has been investigating how individuals approach innovative technology, and what types of strategies individuals employ when learning new technologies or new tasks related to technology (Rogers, 1995; Dunlosky and Connor, 1997; Czaja and Lee, 2008). While there has been considerable research examining adoption of innovative and new technologies, an area that is perhaps less well understood is how an individual's attitude, types of error, and approach towards learning new technologies change with

age. Gaining insight about age related factors influencing learning strategies is becoming even more critical with the growing number of older adults actively seeking education and training (Lakin, Mullane et al., 2007).

2. BACKGROUND

Computer use by seniors is steadily increasing; more seniors are now online than in the past and outpace younger users when it comes to online health information, government websites and religious information (Fox and Jones, 2009). More adults age 50 and over than ever are enrolling in higher education, and higher education institutions are working on identifying how program delivery can be adapted to serve this increasing population (Lakin, Mullane et al., 2008). Older users primarily seek higher education for intellectual stimulation, sociability, and skills enhancement; to serve the needs of this population, higher education programs should evaluate current learning formats and possibly create new learning formats considering senior preferences (Lakin, Mullane et al., 2008).

Unfortunately, many older users find that technology products are not easy to use, and often experience problems, especially when using complex software. This user group often uses less efficient search strategies when using the internet, encounters more errors than younger users, and also has more difficulty recovering from these errors (O'Connell, 2007; Czaja and Lee, 2008). However, with training and support, older users could successfully complete their tasks and have a positive user experience (Czaja and Lee, 2008).

Research shows that training results are influenced by how older users learn and also that younger and older users differ in their approach to problem solving (Mead and Fisk, 1998; Chadwick-Dias, Tedesco et al., 2004; Fairweather, 2008). For example, ATM training for older users has been especially successful when an active, hands-on approach was used. Comparing conceptual training (declarative principal) with action training (hands-on), action training has shown to be superior for training older adults. Older adults retained more and better when a practical, hands-on, purpose driven approach was used. Although both younger users and older users retain performance better on procedural tasks than on episodic memory tasks, the procedural advantage was larger for the older adults than for the younger adults (Mead and Fisk, 1998).

In addition, task performance is influenced by cognitive, perceptual, and motor abilities, which decline with age. This may affect many tasks, including analysis of complex processes, perceiving and comprehending visual information, or basic pointing and selecting tasks when interacting with computer applications (Chadwick-Dias, Tedesco et al., 2004; Czaja and Lee, 2008). Task performance in older adults is also affected by changes in information processing speed and working memory (Rogers, Hertzog et al., 2000). Moreover, aging is an individualized process, and although certain trends and preferences have been observed, abilities and experiences can vary considerably among this user group (Czaja and Lee, 2008).

In comparison, younger technology users are often called the net-generation due to the fact that they are introduced to technology at a very early age. Younger users are often active in communication technology such as social networking, and especially like working in a collaborative environment. Almost all teens (97%) between the age of 12-17 play in online games, and over half participate in social networking (Fox and Jones, 2009). This preference for collaborative environments has implications for student learning: wikis, blogs, twitter, or second life have been successfully integrated into many learning environments and offer students options for knowledge construction and knowledge building in a collaborative context (Bruckman, Bandlow et al., 2008; Pusey and Meiselwitz, 2009).

The following work investigates the connection between age and learning strategies for learning new technology related tasks considering elements of educational learning theory and human-computer interaction. The aim of this study is to identify possible user preferences and trends which could assist in developing and supporting learning environments for senior users pursuing continuing education.

Educational Theory

Learning environments have undergone a change in the 20th century and moved from a more structured, outcome focused approach to a less structured, open-ended focused approach. Within the large body of educational

theory, the two cornerstones of this movement can probably best be described with the principles of behaviorism and constructivism. Behaviorism represents the structured approach; constructivism represents the open-ended approach, with many variations in between. Behaviorist theory defines learning as an individual's response to events and is very outcome oriented – the expectation being that behavior resulting in desired outcomes is likely to be repeated (Skinner, 2009). Behaviorist models of learning are often applied where knowledge can be separated into smaller chunks of material that is related to certain skills, for example in computer-based instruction dealing with well defined areas of skill development or in clinical applications, for example for children with autism (Jonasson, 2001; Charlop-Christy, Carpenter et al., 2002).

Constructivist learning environments focus on knowledge building in context and collaboration, and promote higher order thinking skills. Social context becomes increasingly important in the meaning making process where learners construct their own knowledge and use a process of social negotiation to share multiple perspectives of reality (Jonasson, 2001). Learners are highly involved in the learning process and often shape their own learning experience (Land and Hannafin, 2000; Jonasson, 2001). Learning environments today cover a wide range of models ranging from behaviorism to constructivism. Student-centered learning, applied learning, problem-based learning, microworlds, or situated cognition are only a few examples describing learning environments emphasizing varying degrees on the scale between strict behaviorist and strict constructivist learning environments (Land and Hannafin, 2000).

Human-Computer Interaction

The human-computer interaction literature identifies different approaches to training computer users on how to learn a new application. Most of these research studies focus on how to improve user task performance, primarily on office automation applications such as word processing, spreadsheet software, and database software, or web browsing (Lazar and Norcio, 2003).

These different approaches include exploratory training, procedural training, error management training, and conceptual models (Dormann and Frese, 1994; Nordstrom, Wendland et al., 1998) . In procedural training, users are told the specific actions and steps to take, and are encouraged to repeat those actions. In exploratory training, users are not told exactly what to do. Rather, they are given information about the overall environment, and are encouraged to learn by exploring. Error management training assumes that errors will occur, and that users need to be prepared for dealing with errors. Error management training involves teaching people strategies for responding to errors, and also provides users with positive reinforcement about errors (e.g. "you can learn from your error" and "great! You have made an error!"). Conceptual models are graphical representations of systems, to explain how they operate (Sein, Bostrom et al., 1987; Sein and Bostrom, 1989). Minimalist documentation and training are approaches to present only basic information to the user (Carroll, 1984). Similarly, a classic article on the HCI literature talks about the "training wheels interface" where all of the advanced features are turned off, providing a limited experience, but also a limited chance of making an error (Carroll and Carrithers, 1984). It is well-documented in the HCI literature that different user populations have different interface-related needs (Shneiderman, 2000). For instance, older users have different interface needs from young users, such as requiring larger clickable icons and fonts (Mead, Spaulding et al., 1997; O'Connell, 2007). Older users also tend to have more problems confronting and dealing with errors (Birdi and Zapf, 1997), and find it challenging to deal with multiple application windows and scrolling text (National Institute on Aging, 2002).

It seems that there is likely a connection between the procedural concept used in the HCI literature, and behaviorism in the education literature. Similarly, there is likely a connection between exploratory approaches in the HCI literature, and constructivism from the education literature. Training in the HCI literature is often focused on the novice user, someone who is new to computing, or new to a new category of applications, but as the HCI community has focused less on training, that definition may have become outdated. Very few individuals could now be considered "new to computing" in the industrialized world, rather, "new to a task" might be a better term. The focus of this study is not on people who have never used a computer, but rather on users who have to learn new tasks associated with a new

type of device, or a new category of software application.

3. METHODOLOGY

It was the purpose of this research to investigate the following relationships: a) between age and learning strategies when learning a new technology related task, b) between age and types of problems encountered when learning a new technology related task, and c) between age and attitude towards learning a new technology related task. In addition, relationships regarding the employment situation were also evaluated, as well as differences related to gender. Two groups participated in this study. One group of participants consisted of 46 students enrolled in several general education courses at a medium-sized comprehensive university in the Mid-Atlantic. All courses were introductory course, were open to all students, and did not require any prerequisites. The second group of participants consisted of 95 members of the Osher Lifelong Learning Institute affiliated with the same medium-sized comprehensive university in the Mid-Atlantic. The Osher Lifelong Learning Institute offers adults age 50 and older opportunities for continued learning, along with programs and activities for social and cultural enrichment.

A survey was administered at the end of the Spring 2010 semester to both groups. The survey consisted of a total of 12 questions (with subcategories). Included were questions collecting demographic data, questions addressing procedural/behaviorist and exploratory/constructivist learning strategies, questions related to the types of errors user encounter, and questions inquiring about user attitudes when learning a new technology related task. The survey was administered online and was purposely brief (after some initial consultations with the administration of the Osher Institute), to encourage participation and limit possible challenges of the online environment. The survey also included room for open ended comments.

4. RESULTS

The following section reports the results of the study, including the description of the respondents, learning approaches, most likely problems encountered, and attitudes when learning a new task related to technology.

Description of Respondents

The sample for the younger age group was taken from several introductory computer science courses. In this group, a total of 46 students responded, and more than half of the students were female (69.6%). The majority of students were in the traditional full-time college student age range; 52.2% were 20 years or younger, 43.3% were between 21-30 years, and only 4.3% were older than 31 years. Of this group 63% were working, and 77.4% of those students employed were working up to 20 hours per week.

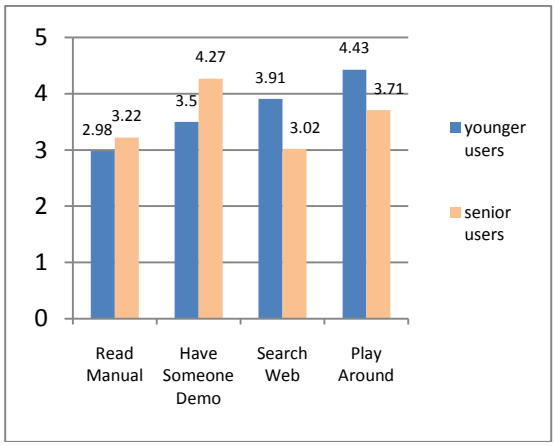
The sample for the senior age group was taken from members of the Osher Lifelong Learning Institute affiliated with the university. A total of 95 members responded, 72.6% were female. The majority of respondents (78.9%) were 66 years or older (21.1% were between 66-70 years old, 33.7% were between 71-75 years old, and 24.2% were 76 years or older). The number of working/non-working members was almost evenly divided, 49.5% were working, and of those respondents 77.6% were working up to 20 hours per week.

Considering hardware, the majority of seniors were using traditional desktops, whereas the younger user group used more laptops and smart phones. In the application areas, both groups used email and web browsing/searching often, but the younger age group used social networking sites often (daily), whereas the senior age group used this type of application rarely (once a week or less).

Procedural/Behaviorist vs. Exploratory/Constructivist Approach

Several questions addressed the learning approach when users are faced with learning new tasks related to technology. The questions addressed a range of approaches, including mainly procedural/behaviorist approaches such as reading a manual, moderately procedural/behaviorist approaches such as watching a person demonstrate the topic, moderately exploratory/constructivist approaches such as searching the web for information, and mainly exploratory/constructivist approaches such as playing around with the device or software to figure it out. Users responded on a 5-point scale (1=strongly disagree, 5=strongly agree), indicating how much they favored each approach. Table 1 presents the results of younger and senior users rating their preference.

Table 1. Procedural/behaviorist vs. exploratory/constructivist approach preference



Results show that younger users clearly prefer the mostly exploratory/constructivist approach. When mastering a new technology related task, they would rather search the web for information or play around with new equipment or applications until they can figure out how to use the new device or software. Younger users least liked the mostly procedural/behaviorist approach of reading the manual (M=2.98, SD=1.13). Senior users preferred the moderately procedural approach of watching someone demonstrate the task (M=4.27, SD=0.98), and they least preferred the moderately exploratory approach of searching the web for information (mean=3.02, SD=1.42).

Common problems when learning a new technology related task

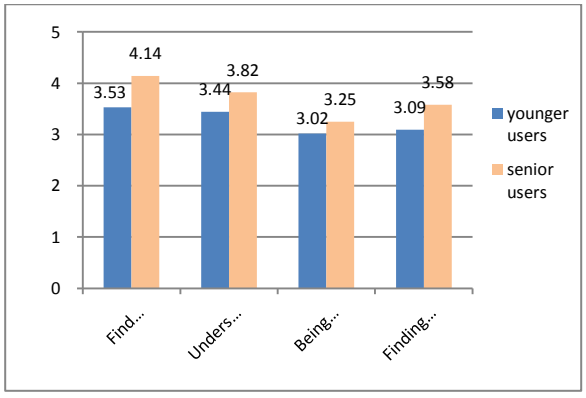


Table 2. Most likely problems

The survey results demonstrate that most users in the younger as well as in the senior age group are experiencing similar problems. Users responded on a 5-point scale (1=strongly disagree, 5=strongly agree) indicating the magnitude of the issue. Table 2 below presents the most likely problem users encounter when they set out to learn a new technology related task.

Surprisingly, the order of most common problems is identical for younger and senior users; the most common issue for both age groups is finding a particular functionality. Although seniors (M=4.14, SD=0.99) rate this problem as slightly more significant than younger users (M=3.53, SD=0.96), locating a particular functionality is the number one problem for all surveyed users. The number two issue for younger as well as senior users is the clarity of error messages; both user groups rate the problem of understanding error messages as the second largest obstacle when mastering new technology related tasks. Finding help is ranked third, and being generally lost is ranked fourth in the order of common problems.

Attitudes when learning a new technology related task

Users responded on a 5-point scale (1=strongly disagree, 5=strongly agree) indicating the degree of the attitude. Younger users generally had a more positive viewpoint when learning new tasks related to technology. Table 3 summarizes user attitudes towards learning these tasks.

Table 3. Attitudes

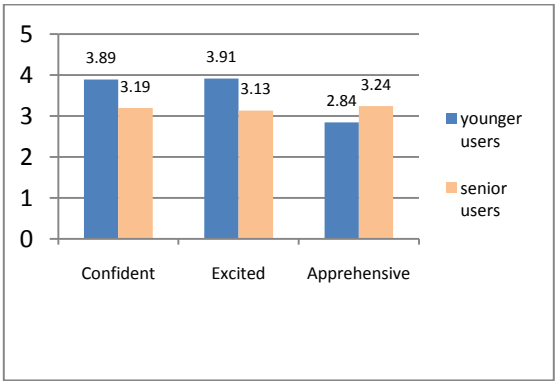


Table 3 displays that the majority of younger users show positive attitudes. Younger users reported high confidence (M=3.89, SD=0.93) and excitement (M=3.91, SD=0.86), whereas the highest ranked attitude within the senior user group is apprehension (mean=3.24,

SD=1.37). However, rankings for the senior user group are very close, with apprehension only slightly higher rated than confidence.

Correlation between Age and Learning Strategy Approach, Common Problems, and Attitudes

This section reports results pertaining to the research question: Is there a significant relationship ($p<0.05$) between age and learning strategy approach, age and common problems, and age and attitude when learning a new technology related task? A positive relationship between age and any of the factors would demonstrate that when the age increases, the other factor also increases. A negative relationship between age and any of the factors would demonstrate that when the age increases, the other factor decreases. Table 4 presents an overview of the significant correlations using Pearson's correlation.

Table 4. Pearson Correlations

		Age	Demo	Search Web	Play Around with It	Excited
Age	Pearson Corr.	1	.316(**)	-.313(**)	-.326(**)	-.312(**)
	Sig. (2-tailed)	.	0	0	0	0
	N	141	138	134	137	132

(**) Correlation is significant at the 0.01 level (2-tailed)

Analysis of the relationships (using Pearson correlation) indicates that some moderate relationships exist. A moderate positive relationship exists between age and the moderately procedural/behaviorist approach of having someone demonstrate the new task. This seems to imply an increased preference for moderately procedural/behaviorist approaches with increased age. Further, three moderate negative relationships are reported. A moderate negative relationship between age and the moderately exploratory/constructivist learning approach of searching the web demonstrates that as age increases, the preference for moderately exploratory/constructivist learning approaches decreases. Another moderate negative relationship between age and the mainly exploratory/constructivist learning approach of playing around to figure out the new task also demonstrates that as age increases, the preference for mainly exploratory learning approaches decreases. Lastly, a moderate negative relationship between age and excitement showed that as age increases, excitement about learning new tasks related to technology decreases. There were no significant relationships reported between age and common problems encountered when learning a new technology related task.

Gender

Learning preferences by gender were evaluated using ANOVA. Results showed a significant difference among gender and moderately procedural/behaviorist learning strategies ($F_{(1,135)} = 30.75$, $p<0.0005$). Overall, in all users, a significant difference was identified for learning approaches among gender. A moderately procedural/behaviorist approach was clearly preferred by female participants, and this was confirmed overall as well as for the separate age groups of younger users ($F_{(1,45)} = 34.52$, $p<0.0005$) and senior users ($F_{(1,89)} = 8.07$, $p<0.05$).

5. DISCUSSION

In this study we report the results of an exploratory study investigating the relationship of age with learning strategies, problems faced, and attitudes in the context of learning involving new technologies. The results of this study show that user preferences for learning strategies when learning a new technology related task may differ depending on the age of the user. The study indicates a moderate correlation between age and preference of procedural and exploratory learning. Results show that as age increases, the preference for moderate procedural/behaviorist learning strategies increases and the preference for mainly exploratory/constructivist learning strategies decreases. Senior computer users in this study prefer a moderate procedural approach with the option for interaction. This finding is also supported by many comments to open ended questions, where senior users described their good experience with demonstrations and tutorials. However, it should be noted that they preferred to have person-to-person contact; senior users clearly preferred someone demonstrating a feature or device over watching online tutorials. Younger users preferred the largely exploratory/constructivist approach and least favored the largely procedural/behaviorist

approach. In addition, the level of excitement about learning new tasks related to technology declined with age.

Another item, the number of hours per week individuals were working, did not show any correlation to learning strategies, types of error encountered, or attitudes. Also, the number of hours per week individuals used their computer for work or for fun/play did not show any correlation to learning strategies, types of error encountered, or attitudes.

Gender in both younger and senior users revealed similarities regarding learning approaches. Overall, a moderately procedural/behaviorist approach was preferred by female participants.

Interestingly, the study showed that ranking of the most common problems was identical for younger as well as senior users; suggesting that users learning new technology related tasks are faced with the same problems, but use different strategies to overcome these problems.

It should be noted that most of the participants were traditional age students and participants 50 years and older, the survey had few participants in the age group between 35-50 years. Further, all participants in the senior user group were a members of the Osher Lifelong Learning Institute at the university.
This study was a pilot study for a larger study to follow, and due to the brevity of the survey, results were limited. Future research intends to expand the survey and the age groups of participants. A larger study to follow is planned with an increased participation in the middle age group (35-50 years) as well as a more disaggregated scale of learning approaches, and possibly integrating the VARK approach (visual, auditory, reading, and kinetic preferences). Further research will also investigate the integration of face-to-face contact between instructor and learner as well as between learner and learner. For example, learning approaches supported by tutorials and demonstrations involving face-to-face support in several forms, such as tutorials with personalized, live chats, or introductory movies including a question and answer session could be possible options.

Evaluating learning strategies in relation to age has the potential to increase functionality and usability of new devices and software. Learning strategies could be supported by interfaces and help features to make learning new technology related tasks more efficient, especially for seniors. This in turn could shorten training and/or learning time and lead to a more efficient process when mastering new technology related tasks.

Moreover, results showed some gender preferences across age groups, and also pointed out that younger and older users agree on the most common problems; increased instructor awareness about user learning strategies when learning new technology related tasks could improve the learning process for both, younger and senior users.

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