Exploring the Relationship Between Computer Proficiency and Computer Use Over Time in the PRISM Trial

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Abstract. The aim of the PRISM trial was to examine the potential benefits of a Personal Reminder Information and Social Management (PRISM) computer system on the well-being and perceived social support of an older adult sample at risk for social isolation. Participants ($N = 300$) were randomly assigned to receive the PRISM system, which was designed to support social connections, information gathering, prospective memory, and access to local and national resources, or a binder that contained similar information. The intervention lasted one year, and the computer usage of the PRISM group was monitored. This trial represented a unique opportunity to explore potential barriers to the adoption and continued use of information and communications technologies. Specifically, this paper explored the relationship between computer proficiency and use of the PRISM system over time. Contrary to what one might predict, participants with initially low proficiency used the system more over the course of the trial ($r(123) = -.22$, $p < .05$). The fact that even those with the lowest levels or proficiency were able to become among the most active PRISM users may reflect that the system was designed well for older adult computer novices (the intended target of the intervention). Over the course of the trial, participants assigned to the PRISM condition improved substantially in their computer proficiency. Increased computer proficiency from baseline to 12 months was a much strong predictor of system use ($r(123) = .53$, $p < .001$), possibly reflecting increased proficiency as a result of greater use over time. Overall, data suggest a complex relationship between computer use, computer proficiency, and changes in computer proficiency over time worthy of additional exploration to further understand the effects of, and barriers to, the use of information and communications technologies.

Keywords: Older adults · Technology · Computer proficiency

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1 Introduction

Information and communications technology (ICT) has the potential to assist older adults and help them maintain their independence in a variety of ways [1]. For example, ICT allows access to information about local and national resources and organizations that can assist older adults with important daily activities such as shopping, transportation, and meal preparation. The Internet has useful information related to maintaining mental and physical health and remaining safe (e.g., fall prevention strategies). Calendaring and reminder software applications can help support prospective memory by providing alerts related to upcoming appointments and when medications need to be taken. Social media and videoconferencing software can help older adults connect with friends and family. Finally, gaming and other leisure activities can be supported by ICT. Overall, there is a great deal of potential for ICT to enhance the well-being and quality of life of older adults, especially those who may be at risk for social isolation [2].

Unfortunately, there still exists a large digital divide, with older adults adopting ICT to a much lesser extent compared to their younger counterparts. For example, in the United States, fewer than one third of older adults (65+) owned a tablet computer in 2015, and fewer than one third owned a smartphone. This is striking compared to the 50 % tablet computer and 86 % smartphone ownership rates among adults 18 to 29 years of age [3]. While only 15 % of adults in the US. do not go online, 44 % of older adults do not [4]. Lower ICT adoption rates suggest that many older adults, especially those in the older cohorts or of lower economic or educational status, may not have access to the benefits that ICT offers.

Why is it that older adults are less likely to adopt ICT? Both cognitive and attitudinal barriers to technology adoption have been observed. For example, higher levels of fluid intelligence and lower levels of computer anxiety predict technology use and adoption [5]. Many adults not online feel that the Internet is not relevant to them, and others report or worry that the Internet is too difficult for them to use or learn to use [4]. These concerns are consistent with models of technology adoption that predict that perceived usefulness and perceived ease of use are among the most important factors influencing technology acceptance and adoption [6, 7]. It is also important for technology design and technology-training protocols to take into account the abilities, needs, and preferences of older adults [8, 9], as poor ICT design and training are also likely contributors to lower adoption rates.

The current paper explores how initial ICT proficiency, and changes in ICT proficiency, relate to long-term ICT use. Data were collected as part of the Personal Reminder Information and Social Management (PRISM) system trial (see [10] for a detailed description of the trial and procedures). The aim of the trial was to provide robust evidence for the benefits of access to the Internet and an easy-to-use computer system, with respect to reducing the isolation and improving the well-being of older adults at risk for social isolation. The PRISM system was designed for older adults with little or no previous computer experience, and featured components to connect older adults with friends and family members and provide access to important information about local and national resources. Digital games offered the opportunity for leisure activities and calendaring software was included to help support prospective memory. A classroom

feature included text, links, and videos aimed at improving knowledge of various topics such as health and transportation.

The design of the PRISM system was based on an iterative, user-centered design process. PRISM prototypes were presented to older adults and the system was modified based on feedback. The modified system was then pilot tested with representative participants. Training procedures and materials were also pilot tested. Additional refinement to the system and training protocol and materials were made based on the pilot testing. With the attention given to the design of the PRISM system, training, and help system, one hypothesis explored here is whether there would be minimal correlation between initial ICT proficiency and PRISM usage over the year-long intervention. This would be a sign of success with respect to the design process and training protocol developed. Another hypothesis relates to whether access to an easy to use system and computer training might substantially improve ICT proficiency from the start of the trial to the end of the trial, and whether this improvement in proficiency might be an important predictor of system use.

2 Methods

All trial procedures have been described previously [10]. Briefly, 300 participants were recruited and randomly assigned to receive the PRISM computer system in their home, or a notebook containing much of the same information as the PRISM system (e.g., paper versions of classroom activities and resource guides, non-digital games). Participants were 65 years of age or older, lived alone, engaged in minimal work and volunteer activities, and used computers and the Internet minimally. Activity on the PRISM system was monitored (which system features were accessed and when). Our main measure of activity reported here is the number of days on which any activity on the PRISM system was observed (measure could range from 0 to 365 days). The reported analyses focus on participants in the PRISM condition who had computer proficiency data at the start of the trial and at the end of the 12-month trial period ($N = 125$). Computer proficiency [11] was measured using a validated survey (Computer Proficiency Questionnaire, or CPQ) that was administered prior to PRISM training, and once again approximately 12 months later. CPQ scores range from 6 (minimally proficient) to 30 (extremely proficient) with a higher score indicating higher proficiency. PRISM training was accomplished over the course of three home-based training sessions.

3 Results

Overall, participants used the PRISM system frequently, however there was substantial variability in system use. Over the year-long trial, on average, there was system activity on approximately 202 days ($SD = 106$). Prior to the start of the trial, PRISM participants had very low computer proficiency ($M = 10$, $SD = 4$). At the end of the trial, proficiency

was substantially higher ($M = 18$, $SD = 5$). Note on this scale, floor is a score of 6, and ceiling is a score of 30.

First we explored whether system activity might be explained by initial levels of computer proficiency. Do participants who start with initially lower levels of proficiency use the system less? This would be evidence that the design of the PRISM system and associated training could not overcome a lack of previous computer experience and proficiency. Surprisingly, the opposite was true. Those with initially lower computer proficiency used the system more over the year-long intervention ($r(123) = -.22$, $p < .05$). Some of the most active PRISM users were those who started out with the lowest levels of computer proficiency (Fig. 1). It should be noted overall, through, that initial proficiency seemed to play a relatively minor role, accounting for only 4.8 % of the variance in system usage.

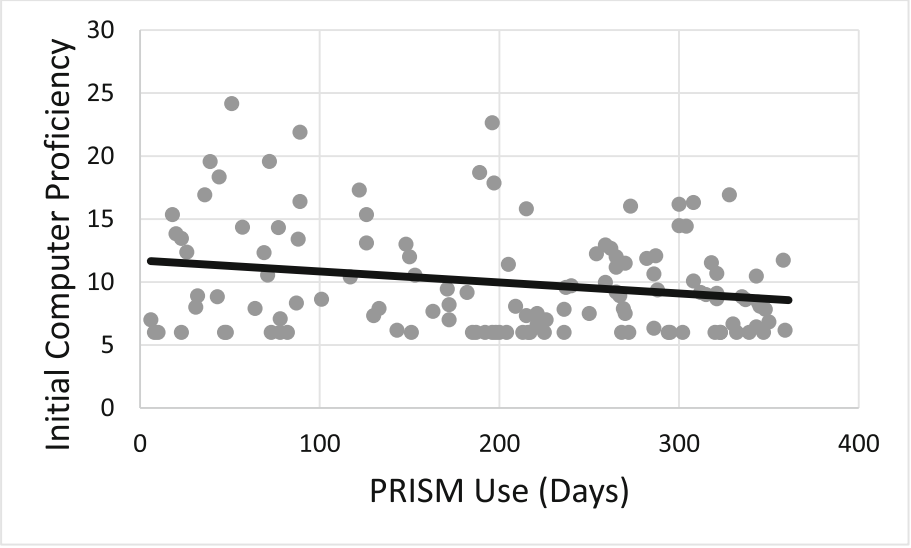

Fig. 1. The relationship between initial computer proficiency, as assessed by the CPQ at the start of the trial, and the number of days the PRISM system was used.

Final computer proficiency (assessed at the end of the trial) was a positive predictor of PRISM use ($r(123) = .38$, $p < .001$, Fig. 2), as was the increase in proficiency from baseline to 12 months ($r(123) = .53$, $p < .001$). Unlike initial proficiency, final proficiency and increases in proficiency were associated with increased PRISM use. A number of potential mechanisms might explain this relationship: (1) participants who were unable to acquire sufficient proficiency used the system less over the course of the trial, (2) participants who used the system more gained more proficiency through greater use, and (3) some third variable, such as computer anxiety, discouraged both use and the acquisition of proficiency.

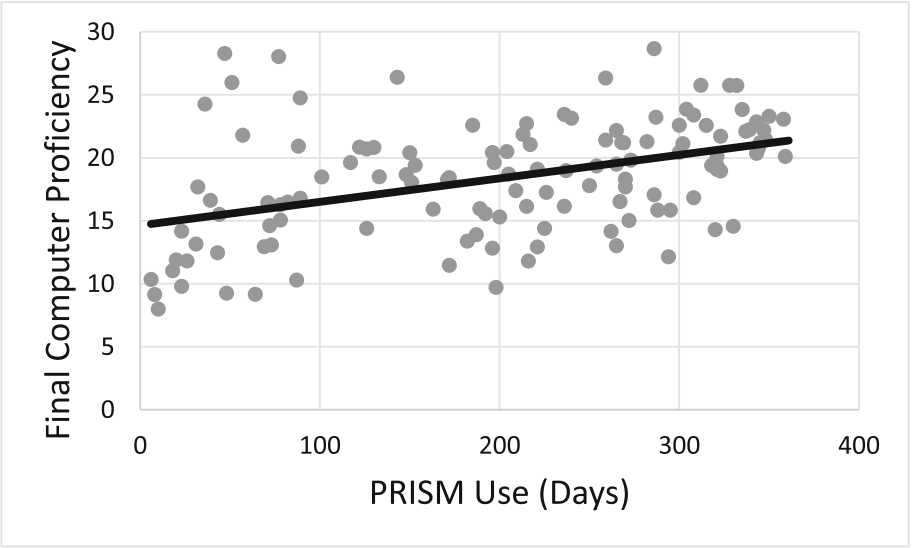

Fig. 2. The relationship between computer proficiency at the end of the trial, as assessed by the CPQ, and the number of days the PRISM system was used.

To further explore potential mechanisms, we examined how initial and final computer proficiency might predict PRISM use early in the trial versus late in the trial (Table 1). Interestingly, final computer proficiency was predictive of system use even very early in the trial (predicting usage during the first month of the trial as successfully as during the final month).

Table 1. Correlations between PRISM usage during the first and final months of the trial, and computer proficiency at the start and end of the trial. ** $p < .01$

	Initial proficiency	Final proficiency
Month 1 Use	−.07	.30**
Month 12 Use	−.13	.27**

This pattern suggests that whatever mechanism is at play in producing the observed relationship between PRISM usage and final proficiency had an influence very early in the trial. One possible explanation is that this relationship partially reflects individual differences in the success of learning during the PRISM training protocol. Some participants may have gained more from training than others, producing a long-lasting effect on subsequence use, starting during the very first month of usage.

4 Conclusion and Discussion

The PRISM trial was successful in that participants used the PRISM system frequently. However, individual differences were observed with some participants using PRISM

substantially more than others. Encouragingly, even participants with minimal initial computer proficiency were able to learn and use the system. This may reflect success of the iterative design process and the careful development of training protocols and materials. Initially low levels of computer proficiency did not act as a barrier to the adoption and use of the PRISM system. This finding is consistent with the Unified Theory of Acceptance and Use of Technology (UTAUT) which proposes that a variety of facilitating conditions (in this case, the PRISM help system and PRISM training) can have a positive impact on use behavior [6].

Why might have participants with higher levels of proficiency used the system less over the year-long intervention? Participants were selected based on the fact that they did not own a computer and that they had minimal Internet/computer experience over the past three months. However, even among this sample previous computer and Internet experience may have varied (i.e., prior to the three months before recruitment into the study). If some participants had more experience using computers and the Internet over their lifetime, the system may not have been as novel and they may have used the system less as a result. The sample might also have included some participants who used computers in the more distant past, resulting in initial proficiency, but who may have ended up becoming non-computer users because of their lack of interest in or perceived value of computers. This could explain a relationship between initially high proficiency and a lack of use of the PRISM system. Participants who were initially low in terms of proficiency may have also been more motivated to practice using the system, contributing to the observed pattern. Although we observed a significant relationship between initially higher proficiency and lower PRISM use, this accounted for less than 5 % of the variance in total PRISM use.

Results suggest a dynamic relationship between proficiency and system use. While initially lower levels of proficiency predicted higher levels of PRISM use, at the end of the trial higher levels of proficiency predicted higher levels of PRISM use. One of the strongest predictors of PRISM use was the *change* in proficiency from baseline to 12 months. An interesting finding was that final computer proficiency predicted use during the first month of the trial. One explanation for this finding might be that, as previously stated, gains in proficiency partly reflect individual differences in learning during the three training sessions at the start of the trial. Another explanation is that PRISM use during the first month may have encouraged a habit of use in subsequent months. This habit of use then may have resulted in greater use overall, and increased proficiency as a result.

In explaining individuals differences in the adoption and use of ICT systems such as PRISM, other factors may play larger roles than initial ICT proficiency, especially when the system is well-designed for non-users and older adults. Related to use, a variety of individual difference characteristics appear to be related to older adults' attitudes toward the PRISM system [12]. These include factors such as self-efficacy, computer interest, demographic variables, and personality characteristics.

About Measuring ICT Proficiency. In this study we used the Computer Proficiency Questionnaire (CPQ) to assess computer proficiency [11]. Previously reported analyses have demonstrated the reliability and validity of this measure. Results reported here

further speak to the validity of the CPQ. Here we have demonstrated that the CPQ is sensitive to change over time and that changes in CPQ correspond to different levels of PRISM use. However, it should be noted that more and more people are accessing the Internet and software through tablets and smartphones, necessitating the need for an analogous measure to the CPQ specific to mobile devices [13].

Future Directions. In this paper we present an initial analysis of one potential predictor of overall system use. Many other analyses are also possible such as examining how proficiency as measured by various CPQ subscales relate to use of the various individual features of the PRISM system (classroom, Internet, email, games, etc.). Future analyses will examine other possible predictors (e.g., proficiency, attitudes, demographics, personality attributes), to determine which are the best predictors of PRISM use, and continued use over time. Overall, the results will provide insight into factors that facilitate or act as barriers to the adoption of ICT among older adults.

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