

Effects of Training and Support on Patient Portal Ease of Use Among the Elderly

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Abstract

In the organizational setting, training and support is provided when new information systems (IS) is introduced. Consumers, in contrast, are less likely to receive training when considering to use a new IS for personal use and are motivated by a balance of utilitarian and hedonic factors. Computer anxiety hinders older people finding enjoyment in IS, even though they find the IS useful. This intervention study concerns the effect of training and support on older IS users' perceptions of patient portal ease of use (PEU) for reviewing and managing their digitized health records. The treatment group received comprehensive training based on Bandura's self-efficacy model. The study found that those who received the training and were provided with on-demand support had increased computer confidence and self-efficacy, reduced computer anxiety, and increased PEU of the patient portal. The findings contribute to the technology acceptance literature and the motivation of elderly to use an IS.

1. Introduction

In the age of digitization and government regulations, patient health information that was once stored on paper is now stored digitally. Many studies have investigated the advantages and challenges of electronic medical and health information and have found that efficient access to relevant health information is one of the major benefits of electronic health information [1].

Communicating with healthcare providers is a concern of patients, as they often feel that their communication is restricted to their face-to-face appointments, during which they often feel rushed and sometimes intimidated [1,2]. Importantly, electronic health records (EHR) software, specifically, patient portals, include the capability to provide patients with access to their health records and laboratory and diagnostic results and to schedule appointments, request medication refills, make payments, download

and complete forms, view educational material, and send secure messages to providers [3]. Portals are defined as a "single door to [health] information" [4 p.690.]. They increase administrative efficiency and accessibility as well as communication between patients and providers. These portals are also viewed as a tool to increase patient satisfaction and to involve patients, especially elderly patients, in their own care [5].

Elderly people have varied levels of experience with computers and the Internet. The Pew Research Center [6] found that, in the United States, individuals 65 years and older have shown an increase in regular Internet use, from 12% in 2000 to 67% in 2017. Nevertheless, approximately half of these elderly users indicate that they need help with using technology. This "barrier to adoption ranges from physical challenges to lack of comfort and familiarity with technology" [6 p.3]. Only 26% of Internet users aged 65 and over state that they are very confident about using computers or other devices to do what they need to online. Older people are more likely to say that they need someone to initially show them how to use devices or the Internet. Three-quarters of seniors who go online use the Internet daily, indicating that after initial help, older users have the interest to use the technology regularly after they got familiar with it.

This intervention study investigates the effect of training and support for older people in regard to their perceived ease of use of a patient portal. The training was based on Bandura's self-efficacy model. Computer anxiety, confidence, and self-efficacy were measured, using corresponding subscales from the Computer Attitude Scale and Computer Self-Efficacy Scale. The questionnaire was administered before and immediately after the training and then 6 weeks after the training. We used a pre-post repeated measures design that involved 108 participants who were 65 years and older in a training-and-control group setting, with randomized assignment of participants. This study expands the understanding of older IS users' training needs for the use of patient portals and adds to the literature on the various technology acceptance models.

2. Background and literature review

Hospitals and providers' offices are digitizing their patients' health records and information to enhance quality of care and reduce risks, as provided through timely access to relevant health information. In the United States, certified EHR systems provide patients with access to their personal health information. Studies suggest that patient engagement increases patient satisfaction and health outcomes and reduces cost [7] and that providers offer patient portals to enhance communication between themselves and patients [8]. Studies also indicate that older adults are less likely to use patient portals [9-11]. The characteristics of older adults who are less likely to use patient portals included having less education, low health literacy, less experience with technology, and low computer confidence and self-efficacy [12,13]. Recent multiple focus group-based research [14] found the following themes among older people in regard to technology use for health care, specifically, patient portal adoption:

- Having limited or poor relationship with technology: "Difficulty troubleshooting without having access to live technical support," "no prior experience and training using computers," "afraid of making a mistake," "lack of knowledge, which caused avoidance of portals or reliance on family members"
- Experiencing fear and frustration with technology and portals: "not understanding the security risks but afraid of them"
- Being willing to adopt portal with support: "Lack of confidence in their own abilities but interested in someone's accessing the portal on their behalf," "indicating that task specific training would help them to learn the purpose of each function"
- Viewing portals as beneficial: "Interested in finding personal information and results and communicating with providers."

The above themes clearly indicate that older people have an interest in portals but that their lack of confidence and self-efficacy as well as computer anxiety hinder their perceptions of the effort that it takes to use a patient portal. It is clear that there is demand for training in the use of patient portals, and accessible support may increase confidence and reduce anxiety, resulting in older individuals' finding portal use to be easier. The literature includes several empirical studies in which technical and user support is given to healthcare stakeholders, rather than patients, in the use of electronic patient records [15,16]. Thus,

the role of technical support on the perceived ease of use of a patient portal, especially for older users, warrants research.

Although much attention has been paid to the characteristics of older adults who do not adopt patient portals, little has been given to how older people's perceptions of ease of use of patient portals changes when they receive customized training and on-demand support. To this end, our research was guided by the following research question: To what extent do computer self-efficacy, computer anxiety, and computer confidence change due to training the elderly, and how does this change affect the perceived ease of use of patient portals?

2.1 Theoretical background

Organizational software users usually receive training on how to use a new information system (IS) effectively and efficiently to increase productivity [17]. Consumers, in contrast, are less likely to receive training when considering to use a new IS for personal use and are motivated by a balance of utilitarian and hedonic factors [18,19]. Utilitarian factors are objective in nature and refer to the usefulness or cost benefit of the IS. Researchers have found that technology acceptance is greatly influenced by these objective factors, which, in technology acceptance models, comprise *perceived usefulness* [20,21]. Hedonic factors concern the enjoyment and ease of use of the technology; more recent acceptance models refer to this as *perceived ease of use* [18, 22-25].

A variety of acceptance models have evolved in recent decades, but all grew out of the Technology Acceptance Model (TAM), introduced by Davis [26], which evolved from the Theory of Reasoned Action (TRA) by Ajzen and Fishbein [27]. Both of these powerful and parsimonious theories [28,29] assume that an individual's acceptance of IS is determined by the following two major variables:

- Perceived Usefulness (PU)—utilitarian factor: "The degree to which a person believes that using a particular system would enhance his or her job performance" [20 p.320].
- Perceived Ease of Use (PEU)—hedonic factor: "The degree to which a person believes that using an IT will be free of effort" [20 p.320].

This study explores the PEU of patient portals by the elderly through the lens of the PEU construct in acceptance models. It has been shown empirically that PEU has a direct positive effect on behavioral intention, which, in turn, has a direct effect on use behavior. Therefore, a better prediction of the driving

forces of PEU will increase understanding of the intention to use and actual use of patient portals.

More recent acceptance models have the same underlying constructs, which have been proven to affect intention and use. Social influence processes and cognitive instrumental processes, such as job relevance and output quality, were incorporated into later acceptance models, such as TAM2 [29]. Venkatesh and Bala [21] further identified PEU determinants in TAM3, namely, anchor determinants (computer self-efficacy, perception of external control, computer anxiety, computer playfulness) and adjustment determinants (perceived enjoyment, objective utility). Venkatesh [24] suggested that perceived enjoyment, computer self-efficacy, and perception of external control play a strong role in PEU even after individuals gain experience with a new system. In contrast, computer anxiety and playfulness were found to diminish over time.

PEU of an information system is supported by Bandura's self-efficacy research [32] and defined as "judgement on how well one can execute courses of action required to deal with prospective situation" [32 p. 122]. Davis [20] drew the association between self-efficacy and PEU as proximal determinants of behavior. Our intervention study is based on Bandura's self-efficacy theory as applied to computer training.

Bandura's self-efficacy theory [31] is a major part of his social learning theory. According to Bandura's self-efficacy theory, combining the four indicators of efficacy expectations in a training program will increase computer self-efficacy, and based on the literature, we argue that it also will increase computer confidence and lower computer anxiety. These determinants, coupled with accessible support, will increase PEU.

Infrastructural and user support after training is comparable to the facilitating conditions in the unified theory of acceptance and use of technology (UTAUT) model and has been shown to affect technology use and trust in users' own abilities [21, 29, 32-36].

3. Conceptual framework and hypotheses

We empirically measured the effect of training on these constructs and on elderly people's PEU of their patient portal. We measured training effectiveness, using computer self-efficacy, computer anxiety, and computer confidence scales. Self-efficacy, anxiety, and confidence were found to be strong determinants of PEU. The conceptual model is shown in Figure 1, which indicates the theoretical model of PEU and its constructs that are affected by computer and patient portal training.

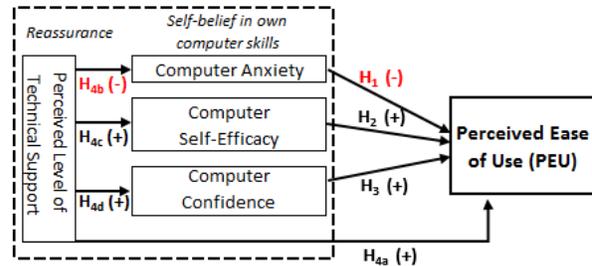


Figure 1. Conceptual framework

Computer anxiety is defined as the degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers" [24 p. 349, drawn on 37]. Empirical studies have found that computer anxiety is negatively related to confidence and comfort with computer use [38] and positively related to poor computer use and resisting the adoption and use of computer software [39,40]. Therefore, we posit:

Hypothesis 1: Training decreases computer anxiety and will increase the PEU of patient portals by the elderly.

Computer self-efficacy is defined as the degree to which an individual believes that he or she has the ability to successfully perform a specific task/job, using the computer [41-43]. Bandura's self-efficacy concept has been used in the computer use context in many studies and empirically shown to be positively related to users' perception of software ease of use. Therefore, we propose:

Hypothesis 2: Training increases computer self-efficacy and will increase the PEU of patient portals by the elderly.

Computer confidence is defined as "one's ability to do well in activities that involve the computer" [44 p.429]. Confidence has been measured in several empirical works to evaluate user characteristics that influence computer use [45,46] and perception of effort it takes to use computers [20]. Hence, we posit:

Hypothesis 3: Training increases computer confidence and will increase the PEU of patient portals by the elderly.

Technical support is used directly as a predictor of IS ease of use and is part of a group of perceived resources [47]. Perceived resources are similar to perceived behavioral control construct in the theory in planned behavior "... the presence or absence of requisite resources and opportunities" [48 p. 457].

Ralph defined technical support as involving "people trained to help users in solving problems related to computer hardware and software" [49 p. 57].

It can be in a variety of forms, such as in person, over the phone, through instant messaging, and so forth. Numerous empirical studies have identified technical support as one of the most important factors in technology acceptance and user satisfaction with ISs in multiple industries [50-52]. Commercial or consumer IS support, including technical support, results in more favorable attitudes that should lead to greater acceptance and the success of personal computing systems [53]. Lack of technical support, however, has been shown to be a barrier to adopting an IS in the field of healthcare [54,55] as is a lack of help from peers [56,57]. Hence, we propose:

Hypothesis4a: An increase in the perceived level of computer technical support will increase the PEU of patient portals by the elderly.

Adult and elderly learners are often characterized as having a lack of confidence when learning the use of new software and require support [58]. Infrastructure and technical support were found to positively influence IT usage perceptions and increase user confidence and comfort with the software [59]. Researchers have studied technical support as a sub-construct of other variables [59,60] or as a construct of its own that directly affects technology ease of use [61,62]. To enhance technology learning outcomes and satisfaction, technical support should be provided, as it increases confidence in users' abilities to perform the tasks learned in training [63]. Thus, we hypothesize that technical support is also a sub-construct of computer anxiety, computer self-efficacy, and computer confidence:

Hypothesis4b: An increase in perceived level of computer technical support will decrease computer anxiety among the elderly.

Hypothesis4c: An increase in perceived level of computer technical support will increase computer self-efficacy among the elderly.

Hypothesis4d: An increase in perceived level of computer technical support will increase computer confidence among the elderly.

5. Methodology

This randomized, control-group, repeated-measures intervention study involves the measurement of context- and learner-specific training's effect on comfort of using a computer and, ultimately, on PEU of a patient portal. Computer confidence, self-efficacy, and anxiety were measured, and the results between the training and control groups were compared three times: (1) before training, (2) immediately after training, and (3) 6 weeks after training. The control group received training after the final assessment was taken.

5.1. Participants and setting

Computer training was offered to a group of volunteers aged 65 years or older who identified themselves as uncomfortable with computers yet interested in accessing their own personal health records through a patient portal. We recruited participants from health fairs in the United States and retirement homes as well as asked volunteers to encourage their qualified acquaintances to sign up. An informed consent form was provided to all participants.

The training also included a detailed printed manual that consisted of screenshots of five patient portals from the large providers in the area and short explanations of what each field and button represent. Registration, appointment scheduling/modifying, messaging doctors, and prescription refill requests were detailed step by step for each portal. This manual and the purpose of the patient portal were covered after a basic computer and web browser skills review. The training was delivered face to face by qualified instructors, who covered pre-established material in an agreed way that followed Bandura's self-efficacy expectations. Participants engaged in training until they felt that they could comfortably log into a test account on a portal and perform basic transactions. Most participants needed only one session.

5.2. Instrumentation

Subscales from Gressard's Computer Attitude Scale [64] was used to measure computer anxiety (CA) and computer confidence (CC). The 10-item Likert-scale answers for CA ranged from "strongly agree" to "strongly disagree," with higher scores' indicating lower levels of anxiety. Similarly, CC also was measured by 10 items, with higher scores' indicating higher computer confidence. The computer self-efficacy (SE) construct was measured through Compeau and Higgins' 10-item instrument [65], with questions that started with, "I could complete the job, using the software package . . ." and 10 response items that included statements such as, ". . . if there was no one around to tell me what to do as I go along." Answers were *yes* or *no*, and respondents chose from a 1-10 scale that ranged from "not at all confident" (1) to "totally confident" (10). Only *yes* answers and their corresponding answers were counted for scoring, and, again, higher scores indicated higher SE.

Content validity was reviewed by experts who worked with older adults in a validity survey and were based on six responses. The content validity indexes ranged from 0.89 to 0.98 for representativeness and 0.85 to 0.94 for clarity. Reliability coefficients were 0.92, 0.90, and 0.89 for CA, CC, and SE, respectively.

Other studies also found high internal consistency scores for these scales [66].

5.3. Data Collection

Eligible participants were randomly assigned to the training (intervention) group or the control group, which did not receive training until the study was concluded. The survey, including the CA, CC, and SE items, was administered prior to training, immediately after training, and 6 weeks after training.

6. Results

Initially, there were 126 participants, but multiple people discontinued their involvement during the study. A total of 109 participants of a variety of ethnicities finished all three surveys. The mean age was 70.4 years, 68% of the participants were female, and all participants had some kind of formal education. In addition, 48% of the participants defined themselves as unfamiliar with computers, 32% defined themselves as somewhat familiar, and 20% indicated that they are fairly familiar with computers. Further, 62% of participants revealed that they have no Internet access, and 82% of participants indicated that they feel that patient portals are good idea even though they are accessed through computers.

6.1. Analysis of variance

We analyzed the repeated measures analysis of variance (ANOVA) of the mean scores across participants at the three time intervals (before training, immediately after training, and 6 weeks after training). A total of 48 participants completed the training, and 61 were in the control group. We chose a repeated-measures ANOVA versus an independent (between-subject) ANOVA because the repeated-measures ANOVA further divides the within-group variability (that is, the error term in an independent ANOVA) into subject variability and a smaller error term. We used SPSS statistical software for the pairwise, repeated-measures ANOVA analysis.

Table 1 summarizes the mean scores of the CC, CA, and SE questionnaire across participants in the treatment group and their F-score across the three measurement points. Before training (T1), Right after training (T2) and 6 weeks after training (T3). The control group maintained a relatively similar level to the baseline across the measurement points, their score is decreased but not significantly.

	T1	T2	T3
CA (Mean/SD)	24.68/4.67	36.18/6.13	32.81/5.91
CC (Mean/SD)	27.11/5.41	36.18/6.13	32.81/5.91
SE (Mean/SD)	38.81/6.93	67.43/8.07	61.83/7.63
F (df _{time} /df _{error})	34.71***	19.95***	26.42***

***p<0.001

Table 1. Mean scores of treatment group

6.1.1. Computer anxiety

The CA scores increased compared to the baseline scores. This indicates reduced anxiety related to using a computer and to accessing the patient portal after training.

Baseline CA score mean (M) = 24.68 (SD = 4.67);

After training, M = 36.18 (SD = 6.13);

6 weeks after training, M = 32.81 (SD = 5.91).

The change in CA level was statistically significant over time, $F(2, 94) = 34.71, p < 0.001$.

6.1.2 Computer confidence

The CC scores also increased compared to the baseline scores. This indicates increased confidence in computer and patient portal use after training.

Baseline CC score mean (M) = 27.11 (SD = 5.41);

After training, M = 41.93 (SD = 7.03);

6 weeks after training, M = 38.39 (SD = 6.61).

The change in CC level was statistically significant over time, $F(2, 94) = 19.95, p < 0.001$.

6.1.3. Computer self-efficacy

The SE scores increased compared to the baseline scores. This indicates increased computer self-efficacy after training.

Baseline SE score mean (M) = 38.81 (SD = 6.93);

After training, M = 67.43 (SD = 8.07);

6 weeks after training, M = 61.83.81 (SD = 7.63).

The change in SE level was statistically significant over time, $F(2, 94) = 26.42, p < 0.001$.

6.2. Partial least squares

Partial least squares (PLS) is a second-generation regression model that combines a factor analysis with linear regression, making only minimal distribution assumptions [67]. We chose to measure the path coefficients in the conceptual model to see the determinants of PEU of patient portals before training (T1), in immediate response to training (T2), and 6 weeks after training (T3). Venkatesh and Davis used stepwise regression analysis when empirically testing their TAM2 model [29]; they opted against structural

equation modeling due to the two-item scales in the measurement model that can cause instability in the parameter estimates. Our conceptual model has far fewer constructs, and the number of measurement items is sufficient for the model; hence, PLS appears to be a reasonable choice for path analysis. Gefen et al. [67] tested TAM using four different methods, and PLS was found to provide strong predictive power in construct relationships. Several researchers regard PLS to be superior to more rigorous covariance-based structural equation modeling (SEM) [68-70].

6.2.1. Instrumentation and Measurement Model

The same measurement scales were used for CA, CC, and SE across the three time periods, and we used Venkatesh's scales for PEU [29]. The Cronbach alpha for internal consistency across the three time periods were 0.82–0.92 for CA, 0.84–0.93 for CC, 0.81–0.91 for SE, and 0.86–0.97 for ease of use; therefore, high reliability could be assumed for all measurement scales. Principal component analysis, with direct oblimin rotation exhibited, strongly supported construct validity and showed low cross-loadings. Measurement items came from the literature [20, 47, 71-73], and the high reliability and validity are consistent with earlier empirical studies that use these items.

The measurement was created in structural equating software, SmartPLS, to assess the properties of the latent constructs. Sample covariance matrices were utilized to test the explanatory power and overall fit of the research model and, ultimately, the relative strengths of the causal paths between the variables described in the model. Common model-fit measures were used to evaluate the model's goodness-of-fit using pooled data, and all measures were within the tolerance limits found in the literature. Non-normed fit index (NNFI): 0.927 (>0.90), comparative fit index (CFI): 0.931 (>0.90), root mean square error of approximation (RMSEA): 0.077 (<0.10), normed chi-square: 2.014 (<3.0), GFI: 0.935 (>0.90).

6.2.2. Explaining perceived level of patient portal ease of use

Table 2 provides a summary of the effect of CA, CC, SE, and perceived level of technical support (TS) on perceived level of patient portal perceived ease of use. SE was shown to be a strong determinant of perceived ease of use, which is consistent with the literature [71]. CA was a significant secondary determinant. Perceived level of TS had a somewhat strong effect on perceived level of patient portal ease of use among the elderly, but its effect weakened as

time passed after training, also consistent with longitudinal technology acceptance literature [29].

Time of Measurement	R ²	β
<i>Before Training (T1)</i>	0.46	
Computer Anxiety		0.39*
Computer Self-Efficacy		0.48**
Computer Confidence		0.12*
PL of Technical Support		0.24*
<i>Right After Training (T2)</i>	0.56	
CA		0.34**
SE		0.45*
CC		0.19**
TS		0.33**
<i>6 Weeks After Training (T3)</i>	0.48	
CA		0.41*
SE		0.45**
CC		0.23*
TS		0.18*

*P<0.05, **P<0.01

Table 2. Regression results explaining PEU

7. Discussion

Intervention studies have found training to be an important factor in technology acceptance. Nevertheless, the design of the training and its specific psychological effect on users' perceptions has not been studied. Based on Bandura's self-efficacy theory, context and trainee-specific training have a significant effect on computer comfort among the elderly.

The limited understanding of meaningful training design to enhance acceptance is evident in literature [71]. Although computer self-efficacy is empirically proven to enhance perceived ease of use, as is objective usability, other psychological factors have not received attention. Following the literature, this study hypothesized that computer anxiety and computer confidence, along with perceived level of technical support, have positive effects on perceived ease of use of patient portals among the elderly.

The repeated-measures ANOVA showed statistically significant changes in the mean scores of computer anxiety, computer confidence, and computer self-efficacy across the temporal measurements. In addition, the results indicated that the control group did not experience an increase in CA, CC, or SE. The training was shown to increase computer self-efficacy and computer confidence and to reduce computer anxiety in the context of patient portal use among the elderly. The significant changes in the above scores were maintained 6 weeks after training, even though no additional training was provided.

PLS found SE to be the strongest determinant across all three measurement points. This can be attributed to the fact that elderly people find it important to acquire skills that enhance their ability to perform tasks and actions, using computers. Elderly users are enthusiastic learners, and we found that the training, based on Bandura's self-efficacy model, worked well with their learning style. The sense of accomplishment, coupled with a positive emotional response and peer-related hands-on training, increased older individuals' perceptions of self-efficacy in regard to patient portal ease of use.

The increasing coefficients of SE and CC may be due to the realization of newly acquired skills and the enjoyment that they generate. Older computer users appreciate the confidence, self-esteem [74], and accomplishments that they gain through training [75]

The perceived level of TS showed an interesting result. TS, as a determinant of PEU of the patient portal by the elderly, was shown to be less significant prior to training. This may be due to the fact that elderly people do not know what to expect from TS and initially perceive it as not beneficial. As the training took place, however, elderly users realized that technical support would benefit them, as they may need only minor assistance to move forward. Hence, the strength of TS increased after training, and the increase in the other constructs (SE, CC, and CA) may be attributed to having TS available, providing peace of mind. Although the literature often uses TS as a precursor of self-efficacy and computer confidence, we opted to test its effect on ease of use directly as well. First, the perceived level of TS is considered when the ease of use of a software is consciously or unconsciously assessed. Having a resource to depend on should have a direct effect on the level of PEU. This is especially the case among the elderly, who may be less resourceful and creative with software use during their initial phase of learning it [76,77]. In addition, the large amount of new information may leave elderly users confused, and they are comforted by knowing that TS is available. The decline of the perceived importance of TS at 6 weeks after the training indicated that TS seemed more important immediately after training but that, once the regular tasks that involve the use a patient portal became a habit, the importance declined.

Understanding the key constructs of patient portal PEU for the elderly can help with effective training design and intervention [71]. The constructs that this study theorized and empirically tested proved to be strong indicators of patient portal PEU and the effect that training had on them.

This study contributes to existing acceptance theories by including a learner- and software-specific

training intervention. The existing literature has examined mainly software acceptance in an organizational setting in which software use is mandated. Therefore, PEU has not been properly investigated, as the focus was mainly on perceived usefulness. The voluntariness of software use is greatly dependent on the usability of the software, and this study addressed this issue and identified the constructs of PEU and the effect of training among the elderly.

Future research should investigate how peers influence elderly people to use patient portals. Feedback from this training indicated that some attendees took the training because they were "jealous" that some of their friends were able to log in to their own health information. Others said that their doctors recommended the patient portal or that they had received mail that indicated the availability of their information online. They indicated that their PEU of the portal and their lack of skills prevented them from exploring all that the patient portals had to offer.

8. Limitations

We designed one training session to reduce the chance of participants' not coming back and completing the survey; however, some participants did not show up or did not complete the follow-up survey at 6 weeks after training. This reduced the power of significance. Nevertheless, because we trained the control group after the study concluded and collected the same longitudinal samples, the major findings in this study were confirmed by their responses as well.

We did not include actual use to control for variations of SE, CC, CA, and TS between those who used the patient portals during the 6 weeks between the second and third measurement points and those who did not log in after training. Self-reported confidence and actual skills to perform an action in a patient portal may yield different results, and self-reported measures have been debated in IS research [78].

This study did not control for the actual level of TS, which may have resulted in a more granular elicitation of the phenomenon if the study had considered whether the comfort of knowing that help is available is sufficient to increase SE, CC, and CA or whether the actual use of such support has a different effect.

The comfort that users developed in a patient portal during training may not be the same when they are faced with a different user interface or menu layout. The perceived level of technical support may comfort users to rely on and users may lose confidence without the presence of support. Although being resourceful was outside of the scope of this study, it would worth to measure older users' self-efficacy and creativity when faced with an unfamiliar portal.

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