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Laver K, George S, Ratcliffe J, Crotty M. Measuring technology self efficacy: reliability and construct validity of a modified computer self efficacy scale in a clinical rehabilitation setting. Disability and Rehabilitation. 2012;34(3):220-7.

Abstract

Purpose: To describe a modification of the Computer Self Efficacy Scale for use in clinical settings and to report on the modified scale's reliability and construct validity.

Methods: The Computer Self Efficacy Scale was modified to make it applicable for clinical settings (for use with older people or people with disabilities using everyday technologies). The modified scale was piloted, then tested with patients in an Australian inpatient rehabilitation setting (n=88) to determine the internal consistency using Cronbach's alpha coefficient. Construct validity was assessed by correlation of the scale with age and technology use. Factor analysis using principal components analysis was undertaken to identify important constructs within the scale.

Results: The modified Computer Self Efficacy scale demonstrated high internal consistency with a standardised alpha coefficient of 0.94. Two constructs within the scale were apparent; using the technology alone, and using the technology with the support of others. Scores on the scale were correlated with age and frequency of use of some technologies thereby supporting construct validity.

Conclusions: The modified Computer Self Efficacy Scale has demonstrated reliability and construct validity for measuring the self efficacy of older people or people with disabilities when using everyday technologies. This tool has the potential to assist clinicians in identifying older patients who may be more open to using new technologies to maintain independence.

Introduction

Supporting people to remain living safely at home is becoming increasingly important in the context of an ageing population, limited health and aged care resources, and the community's strong desire to remain in one's own home [1]. At the same time, rapid advancements in technology have changed the way that daily activities are performed, both in the home and in the community. For older people (aged 65 years and over), or for people with disabilities, everyday technologies such as computers and microwaves may reduce the physical and/or cognitive demands associated with daily activities and improve the safety of the task, thereby supporting safe and independent living [2] . Furthermore, eHealth technologies, such as personal blood pressure meters and emergency call systems, are increasingly used for people with special health or care needs [3]. Rehabilitation clients are often older, and despite the apparent advantages of these technologies, there is a perception that older people are "technophobic" and resistant to experimenting with and utilising new technologies. This is somewhat confirmed by studies which show that older people generally express lower levels of technology acceptance and are more hesitant in adopting technologies relative to younger people [4-8]. Younger people with disabilities are likely to have similar technology needs and experience similar barriers to use, however may be more accepting of technologies due to greater exposure and experience. While everyday technologies offer the potential for increased independence, clinicians must be aware of issues around technology acceptance in this population.

Models of technology acceptance

Technology acceptance has been described as the, 'approval, favourable reception and ongoing use of newly introduced devices and systems' [9]. A variety of theoretical models to account for technology use have been described [10].

Davis's [11] 'Technology Acceptance Model' (TAM) is one of the most widely recognised models used to explain user acceptance of technology, particularly in the workplace where it has been applied to email, word processing programs and the internet [12, 13]. According to the model, it is the combination of 'perceived usefulness' and 'perceived ease of use' that forms someone's beliefs about a particular technology [11]. These beliefs are thought to predict the user's attitude towards the technology, which in turn predicts acceptance and actual usage. While the theory is well supported by the evidence [12, 13], criticisms of the TAM are that it lacks precision and ignores other influential factors such as the complexity of the technology and user characteristics (including gender, culture, experience and level of self efficacy) [13].

Venkatesh et al recently reviewed eight of the most prominent models of technology acceptance, including the TAM, and formed one unified model [10]. Known as the 'Unified Theory of Acceptance and Use of Technology' (UTAUT), the model proposes four key moderators of usage behaviour. These are: 'performance expectancy', (the extent to which an individual believes that using the system will help achieve gains in job performance), 'effort expectancy', (the degree of ease associated with use), 'social influence', (the degree to which the user perceives that others believe he/she should use the system) and 'facilitating conditions', (the degree to which an individual believes that technical supports are available). These moderators are influenced by gender, age, experience and voluntariness of use. The model was empirically validated in two workplaces (retail and financial services). The construct of self efficacy was considered but not included in the final UTAUT model as it was thought that 'effort expectancy' would account for the user's level of self efficacy.

Whilst these models provide useful information within a specific context, they may not be directly transferable to older people or people with disabilities using everyday technologies in a home or community setting. There are special considerations that must be taken into account for this group. Firstly, the heterogeneity of this group and impact of their physical, cognitive and psychosocial impairments suggests that user characteristics are likely to play a larger role in technology acceptance than may have been present in studies among younger working professionals [9]. Secondly, focus groups conducted in more diverse populations (including older people) have revealed that changes in physical, sensory and cognitive abilities, feeling “too old” and preferences for interacting with people rather than computers may result in reduced uptake of technology [5, 14], however these concepts have not been comprehensively addressed in the TAM or UTAUT. Thirdly, there are differences in technology acceptance when the adoption of the technology is mandatory compared to when adoption is voluntary [15]. Acceptance of a technology when recommended by a health professional in order to promote independence or maintain safety may be different to when chosen by a patient based on their own perceived needs or interests. Bandura’s social cognitive theory and the construct of self efficacy have received ongoing attention in the study of technology acceptance, both in relation to the TAM and UTAUT and as a predictor of technology use alone [16-18]. Self efficacy refers to an individual’s belief in their capability to organise and execute a course of action required to deal with prospective situations [19]. Individuals are thought to consider information about their capabilities (for example how capable they may be of using a new technology) and regulate their choices and efforts accordingly (for example, whether they choose to use it or not and to what extent) [18]. These beliefs are thought to be based on one’s previous performance accomplishments, vicarious experience, verbal persuasion and emotional arousal [19]. When applied to technology use, the theory suggests that people with higher levels of self efficacy would engage more frequently in technology related activities and persist longer in coping efforts whereas those with lower self efficacy would tend to 'give up' more easily. Self efficacy is a key predictor of actual task performance [20], for example stroke survivors with high levels of driving self efficacy are more likely to pass a driving test compared with those with lower self efficacy [21]. Self efficacy judgements are thought to be specific to the behaviours and situations in which they occur [19, 22] and can be measured by asking individuals how confident they feel that they will be able to manage specific behaviours. The link between higher levels of technology self efficacy and higher levels of technology use has been demonstrated by several researchers [23-27].

Relevant assessment tools

Scales to measure specific aspects of technology self efficacy have been developed and validated. Compeau and Higgins [23] developed and validated a 10 item computer self efficacy scale designed principally for professionals in the workplace. Respondents were asked to rate their level of confidence using a new software package in a range of conditions (for example; if they only had the instruction manuals for reference, if someone showed them how to do it first, if they had used similar products before to do the same job). The scale was validated with professionals (n=1,020) including accountants, financial analysts and researchers in Canada. They found that people with higher computer self efficacy used computers more, experienced more enjoyment from computer use and had less computer anxiety. Torkzadeh [26] developed and validated a 17 item Internet self efficacy scale. Items included surfing the World Wide Web, encrypting/decrypting email messages and managing files.

Neither of the self efficacy scales described above appear directly transferable to a clinical setting in their current format as their terminology refers specifically to use of a computer or the internet for work purposes. To our knowledge, these scales have not been validated in a clinical population.

Although not designed to measure self efficacy, the “Everyday Technology Use Questionnaire” (ETUQ) has been developed to measure perceived competence in using everyday types of technology in a community environment [28]. The questionnaire consists of 86 items (for example iron, electric toothbrush, e-mail, dishwasher) which are grouped into; household activities, activities in the home, personal care, power tools, accessibility, data and telecommunications, economy and shopping and transportation. Participants are asked firstly whether the specified technology is relevant to them and secondly whether they have difficulty using it. A carer or proxy supports the individual to complete the questionnaire where significant cognitive impairment is present. The ETUQ was developed by employing Rasch analysis (a mathematical technique for converting qualitative responses to a continuous scale) [29] and demonstrated good internal validity. However, the ETUQ measures perceived competence using relevant technologies which is likely to be based on past experience and thus is highly dependent on past exposure to technologies. In contrast, perceived self efficacy is not based simply on knowing what to do, but relates to judgements of how well one can execute actions required to deal with prospective/future scenarios. These judgements are based not only on previous exposure but previous experiences of mastery, vicarious experience and encouragement from others [19]. Furthermore, the ETUQ has not been validated through comparison to actual performance in technology use.

Thus, further work is required to develop tools which are able to predict which clients have the highest chance of success in adopting technologies (for example using environmental control units, or utilising online shopping and banking education tools) and measurement of self efficacy in this context appears to be of value. Assessment of the likelihood of technology acceptance will be valuable in prioritising both the client and therapist's time and resources. In addition, identification of those people who are less inclined to successfully adopt technology may also assist in proactively designing interventions that will maximise success [18]. Furthermore, as it is likely that studies involving eHealth technologies will increase, there is a need for reliable and valid tools that are able to evaluate technology interventions in research trials and clinical practice.

In summary, previous studies indicate that technology self efficacy is an important predictor of successful technology uptake and is likely to be applicable to a clinical population comprising of older people or people with a disability. However at present there is a lack of suitable assessment tools and we aimed to adapt an existing tool for use with a clinical population.

This study used a modified version of the computer self efficacy scale produced by Compeau and Higgins [23]. The scale was modified in order to make it applicable to a population of older people or people with disabilities, and to include the use of a broader range of everyday technology items. Modifications were made to both the wording of the scale items and the administration of the tool as described in detail below. The scale was pilot tested with a small group of rehabilitation clients to ensure that the tool was easy to understand and use. The scale was then administered to a larger group of clients participating in a rehabilitation program to determine the reliability and construct validity of the tool.

Construct validity was assessed by exploring the following hypotheses:

Hypothesis 1: Participants with higher levels of technology self efficacy would be more frequent users of everyday technologies. The positive relationship between technology self efficacy and use of technologies has been demonstrated in previous studies [23-27].

Hypothesis 2: Younger participants would have higher levels of technology self efficacy than older participants. Previous studies have shown that older people have lower levels of technology acceptance than younger people [4-6, 10].

Methods

This study reports on the modification of the scale items from the computer self efficacy scale and testing of reliability (internal consistency) and construct validity of the tool in this population.

Scale construction

The Computer Self Efficacy Scale was modified to make it specifically applicable to older people and people with disabilities and the utilisation of a range of different everyday technologies. The Computer Self Efficacy Scale requires respondents to first answer whether they feel they would be able to use a computer software package in a particular circumstance (yes or no), and then rate their confidence on a scale of 1-10. This was simplified by omitting the first part of the question, (whether they feel they would be able to use the technology in a particular circumstance), and just asking the person to rate their confidence in the given circumstances.

Wording of the questions was altered to ensure applicability to everyday technology use. For example the original statement of, “I could complete the job using the software package if I had never used a package like it before”, was modified to, “I could use the new technology if I had never used a product like it before”. The modified questions were presented in a questionnaire format and completed individually by a small pilot group of patients participating in rehabilitation (n=5) on the rehabilitation ward at one of the study sites to ensure that the questions were understandable. The pilot group met the same inclusion criteria used for the larger study described in detail below.

[Refer to the appendix for full version of the modified Computer Self Efficacy Scale (mCSES].

Testing of reliability and validity

Setting and subjects

Participants were recruited from the Repatriation General Hospital, Griffiths Rehabilitation Hospital, and St Margaret’s Rehabilitation Hospital in Adelaide, South Australia. The study was approved by the sites’ associated research ethics committees. Data was collected between October 2009 and January 2010. Eligible participants were participating in an inpatient rehabilitation program for stroke or any other medical condition requiring inpatient rehabilitation (see Table 1 for full description of participant diagnoses). Participants were assessed by the treating team as being able to communicate effectively and without significant cognitive impairment (as determined by a Mini Mental State Examination score of $\geq 24/30$) [30]. The eligibility criteria did not specify an age range in order to gain a representative sample of clinical rehabilitation patients. Key contact people at each hospital monitored admissions and notified the researchers of anyone that met the inclusion criteria. The research occupational therapist (KL) then approached the potential participant to provide verbal and written information about the study and gain consent. Once written consent for study participation had been obtained, the questionnaire was completed by the participant in the presence of the research occupational therapist on the rehabilitation ward. The questionnaire comprised the self efficacy scale, questions about the participant's frequency of use of everyday technologies (refer to table 2 for details on how this was measured) and sociodemographic details. Sociodemographic details requested were: age (in years), gender, living situation (alone or with others), diagnosis for which the person was receiving rehabilitation, household income and level of education (refer to table 1). The research occupational therapist asked the participant subsequent questions about their ability to manage everyday tasks in order to ascertain their Modified Rankin Scale score.

Analysis

All analyses were conducted using SPSS Statistical software. Descriptive statistics (means, standard deviations and frequencies) were used to summarise participant's characteristics as well as their frequency of use of everyday technologies. Distribution of responses for individual scale items on the mCSES and the total score were reviewed prior to further analysis. Facets of reliability and validity were examined; specifically, internal reliability to determine the homogeneity of scale items, and construct validity to determine the relationship of the scale with relevant constructs [31].

Internal reliability was checked using the Cronbach's alpha coefficient [32] where a coefficient of more than 0.7 was determined to be acceptable [31]. Scale items were reviewed to determine whether omission of an item resulted in a higher coefficient.

In order to confirm the hypotheses and explore relationships with other sociodemographics, scores on the scale were correlated with frequency of use of technology (using ordinal categories as shown in table 2), age, income and level of education using Spearman's rho and with gender using Pearson's product-moment correlation coefficient [31]. A p level of 0.05 was interpreted as significant.

Factor analysis, using principal components analysis with direct oblimin rotation [33] was used to examine the predominant factors within the scale. Direct oblimin rotation was chosen due to it's capacity to allow factors to be correlated [34]. Bartlett's test of sphericity [35] and the Kaiser-Meyer-Olkin measure of sampling adequacy [36] were conducted to determine the appropriateness of using principal components analysis. Visual inspection of the scree plot and review of eigenvalues (assuming that factors with eigenvalues of more than one are important [37]) were used to identify important factors within the scale [33].

Results

A total of 88 participants consented to the study and completed the scale. Participant profiles are summarised in table 1. Participants had a range of diagnoses; the most common being stroke (n=44) and falls (n=12). The majority were female (68%) and had moderate disability (65%) as defined by the Modified Rankin Scale [38].

[Insert table 1]

Participants frequency of use of everyday technologies is presented in table 2. It can be seen that the most frequently used technologies were the television remote control and microwave and the least frequently used were searching for information on the internet and sending emails.

[Insert table 2].

Reliability Assessment

The mean total score on the scale was 57 out of 100 (SD 24.2). Items from the mCSES were normally distributed. The standardized alpha was 0.94 which indicates a high level of internal consistency [32]. Removal of items from the scale would not have increased the alpha coefficient.

Principal Components Analysis

Inspection of the correlation matrix and results of the Kaiser-Meyer-Oklin value test and Bartlett's Test of Sphericity revealed that the mCSES was suitable for factor analysis [35, 36]. Principal components analysis showed that there were two factors with eigenvalues exceeding one. Inspection of the scree plot reveals that there is one predominant factor; this factor (explaining 66% of the variance) consisted of items in which the person was using the technology alone. The second (explaining 10% of the variance) consisted of items in which the person was using the technology with others. The factors were correlated (0.62) suggesting that the scale is measuring one main factor with two dimensions.

[Insert table 3]

Construct validity assessment

Correlation coefficients are presented in the correlation matrix (table 4).

Hypothesis 1: As hypothesised, total scores on the scale were correlated with frequency of use of some technologies (Use of automatic teller machines (Spearman's $r = -0.276$; $P<0.01$) and recording a television program

(Spearman's r= -0.244; P<0.05)) however were not significantly correlated with frequency of use of other items.

Hypothesis 2: Total scores on the scale were negatively correlated with age as predicted (Spearman's r= -0.320; P < 0.01).

Scores on the mCSES were not significantly correlated with income, level of education or gender.

[Insert table 4]

Discussion

Previous studies have established a relationship between self efficacy and technology use and have identified issues in regards to technology acceptance in older and disabled people [4-8]. This study contributes to the field by proposing a tool that can be used to measure technology self efficacy in this population and by demonstrating the tool's internal consistency and construct validity. The modified Computer Self Efficacy Scale was well understood by participants and appears to be a promising way of measuring everyday technology self efficacy in older people and people with a disability however further research is required to determine the validity of the scale in predicting successful use of new technologies.

Study hypotheses that were formed based on findings from previous studies were confirmed. Firstly, participants with higher levels of technology self efficacy reported more frequent technology use for some technology items. This correlation supports the role of self efficacy in predicting technology acceptance in this population. It is unclear why this correlation was significant for some technology items and not others. It may be that these two activities (recording a television program and using an automatic teller machine) are important in determining those people that are more accepting of everyday technologies. Secondly, older people reported lower levels of technology self-efficacy relative to younger people. This was despite younger people also experiencing limitations in physical and cognitive function. A possible explanation for this finding is that younger people have experienced greater performance accomplishments and vicarious experience than older people [19].

Social cognitive theory proposes that possible strategies for increasing self efficacy include the use of mastery, modelling and encouragement [19]. These strategies should be used by health professionals to facilitate competent use of everyday technologies in this population. For example, a therapist working with a client towards the goal of independent on-line grocery shopping should first demonstrate the task (modelling), and then provide gradually diminishing support for the client to successfully manage this successfully and independently (mastery). Therapists could also draw on family members to support and reinforce use of the new technology (encouragement). It is interesting that two constructs were evident in the scale: using the technology alone and using the technology with the support of others. This finding reinforces the important role that therapists and family members can play in facilitating technology acceptance in this population.

An advantage of the mCSES scale is that because the items within the scale are generic it is more likely to be applicable over a longer period of time. Furthermore, while the current phrasing refers to the use of everyday technologies, small changes to the introductory instructions may mean that the scale is applicable to eHealth technologies.

Limitations

Limitations of the study must be acknowledged. Firstly, while the sample size was adequate, it is modest and a larger sample size may have provided more conclusive results [34]. Secondly, the study population was heterogeneous in regards to age and diagnosis. However, it is likely to be representative of the population participating in inpatient rehabilitation programs. Thirdly, there is ongoing debate as to the best approach to exploratory factor analysis and most appropriate rotation method. Principal components analysis was used in this study because of it's frequency of use and support in the literature [33].

Further research

More research is required to determine whether use of this tool correctly selects those patients most likely to master new technologies and whether the tool can be applied to the use of eHealth technologies. Furthermore, research is required to determine whether the scale is sensitive to change following interventions to increase technology self efficacy.

Conclusion

In conclusion, the role of technology in society is increasing as it is becoming more affordable and accessible and it is likely to become used more frequently to help older people and people with disabilities manage their daily activities. Teaching people to use these technologies requires an investment of time and resources and it is useful to identify those people that are more likely to be successful and adopt technologies into their lives. Recognising the powerful role that technologies may have in increasing independence and quality of life for older people or people with disabilities this tool provides clinicians with a first step to addressing the issue with clients.

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Appendices: The modified Computer Self Efficacy Scale

Imagine that you have been given a new technology for some aspect of daily living (for example new alarm clock/cordless phone/answering machine). It doesn't matter specifically what this technology does, only that it is intended to make your life easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar technology under a variety of conditions. For each of the conditions, please rate your confidence about using the new technology on the scale of 1 – 10. I could use the new technology…

1. If there was no one around to tell me what to do as I go

1 2 3 4 5 6 7 8 9 10

Not at all confident → Completely Confident

2. If I had never used a product like it before

1 2 3 4 5 6 7 8 9 10

Not at all confident → Completely Confident

3. If I had only the product manuals for reference

1 2 3 4 5 6 7 8 9 10

Not at all confident → Completely Confident

4. If I had seen someone else using it before trying it myself

1	2	3	4	5	6	7	8	9	10

Not at all confident → Completely Confident

5. If I could call someone for help if I got stuck

1	2	3	4	5	6	7	8	9	10

Not at all confident → Completely Confident

6. If someone else had helped me get started

1	2	3	4	5	6	7	8	9	10

Not at all confident → Completely Confident

7. If I had a lot of time to complete the job for which the product was provided

1	2	3	4	5	6	7	8	9	10

Not at all confident → Completely Confident

8. If I had just the built-in help facility for assistance

1	2	3	4	5	6	7	8	9	10

Not at all confident → Completely Confident

9. If someone showed me how to do it first

1	2	3	4	5	6	7	8	9	10

Not at all confident ⟶ Completely Confident

10. If I had used similar products before this one to do the same job

1	2	3	4	5	6	7	8	9	10

Not at all confident ⟶ Completely Confident

Adapted from Compeau & Higgins 1995

REFERENCES

1. The Productivity Commission. Caring for Older Australians. Productivity Commission Issues Paper. Canberra: May 2010.
2. van Hoof J et al. Environmental interventions and the design of homes for older adults with dementia: An overview. Am J Alzheimers Dis Other Demen 2010;25:202-232.
3. Demiris G. E-health: Current status and future trends in the EU and the US. The Netherlands: IOS Press; 2004.
4. Koopman-Boyden P, Reid S. Internet/email usage and well-being among 65-84 year olds in New Zealand: Policy implications. Educ Gerontol 2009;35:990-1007.

5. Melenhorst A, Rogers W, Bouwhuis D. Older adults' motivated choice for technological innovation: Evidence for benefit-driven selectivity. Psychol Aging 2006;21:190-195.
6. Morris A, Goodman J, Brading H. Internet use and non-use: views of older people. Universal Access in the Information Society 2007;6:43-57.
7. World Internet Project 2010. Available from http://www.worldinternetproject.net/. Accessed 2010 December 15.
8. Ziefle M, Wilkowska W. Technology acceptability for medical assistance. 4th Conference on Pervasive Computing Technologies for Healthcare; 2010; Munich, Germany.
9. Arning K, Ziefle M. Different perspectives on technology acceptance: The role of technology type and age. In: Holzinger A, Miesenberger K, editors. Human-Computer Interaction for eInclusion. Berlin: Springer; 2009. p 20-41.
10. Venkatesh V et al. User acceptance of information technology: Toward a unified view. MIS Quarterly 2003;27:425-478.
11. Davis F. User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. Int J Man-Machine Studies 1993;38:475-487.
12. King W, He J. A meta-analysis of the technology acceptance model. Information and Management 2006;43:740-755.
13. Ma Q, Liu L. The technology acceptance model: A meta-analysis of empirical findings. Journal of Organizational and End User Computing 2004;16:59-72.
14. Turner P, Turner S, Van de Walle G. How older people account for their experiences with interactive technology. Behav Inf Technol 2007;26:287-296.

15. Venkatesh V. Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model. Information systems research 2000;11:342-365.
16. Bandura A. Self-efficacy mechanism in human agency. Am Psychol 1982;37:122-147.
17. Bandura A. Social foundations of thought and action: a social cognitive theory Englewood Cliffs: NJ: Prentice-Hall; 1986.
18. Gist M. Self-efficacy: implications for organisational behaviour and human resource management. Acad Manage Rev 1987;2:472-486.
19. Bandura A. Self-Efficacy: The Exercise of Control. New York: W.H. Freeman and Company; 1997.
20. Locke E, Frederick E, Lee C, Bobko P. Effect of self efficacy, goals and task strategies on task performance. Journal of Applied Psychology 1984;69:241-251.
21. George S, Clark M, Crotty M. Development of the Adelaide Driving Self Efficacy Scale. Clin Rehabil 2007;21:56-61.
22. Maibach E, Murphy D. Self-efficacy in health promotion research and practice: conceptualisation and measurement. Health Education Research Theory and Practice 1995;10:37-50.
23. Compeau D, Higgins C. Computer self efficacy: development of a measure and initial test. MIS Quarterly 1995;19:189-211.
24. Czaja S, Charness N, Fisk A, Hertzog C, Nair S, Rogers W, Sharit J. Factors predicting the use of technology: Findings from the center for research and education on aging and technology enhancement (CREATE). Psychol Aging 2006;21:333-352.

25. Eastin M, LaRose R. Internet self-efficacy and the psychology of the digital divide. J Comput Mediat Commun 2000;6:DOI: 10.1111/j.1083-6101.2000.tb00110.

26. Torkzadeh G, Van Dyke T. Development and validation of an internet self efficacy scale. Behav Inf Technol 2001;20:275-280.

27. Wilkowska W, Ziefle M. Which factors form older adults' acceptance of mobile information and communication technologies? In Holzinger A, Miesenberger K, editors. Human-Computer Interaction for eInclusion. Berlin: Springer; 2009. p. 81-101.

28. Rosenberg L, Nygard L, Kottorp A. Everyday technology use questionnaire: psychometric evaluation of a new assessment of competence in technology use. OTJR: Occupation, Participation and Health 2009;29:52-62.

29. Tesio L. Measuring behaviours and perceptions: Rasch analysis as a tool for rehabilitation research. J Rehabil Med 2003;35:105-115.

30. Folstein M, Folstein S, McHugh P. Mini mental state: A practical guide for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189-198.

31. DeVellis R. Scale Development Theory and Applications. London: SAGE Publications; 2003.

32. Streiner D. Starting at the beginning: An introduction to coefficient alpha and internal consistency. J Pers Assess 2003;80:99-103.

33. Henson R, Roberts J. Use of exploratory factor analysis in published research. Educ Psychol Meas 2006;66:393-416.

34. Garson GD. Factor Analysis. In Statnotes: Topics in Multivariate Analysis [online] 2010. Available from

http://faculty.chass.ncsu.edu/garson/PA765/statnote.htm. Accessed 2010 December 15.

35. Bartlett M. A note on the multiplying factors for various chis square approximations. J R Stat Soc 1954;16:296-298.

36. Kaiser H. An index of factorial simplicity. Psychometrika 1974;39:31-36.

37. Kaiser H. The application of electronic computers to factor analysis. Educ Psychol Meas 1960;20:141-151.

38. van Swieten J, Koudstaal P, Visser M, Schouten H, van Gijn J. Interobserver agreement for the assessment of handicap in stroke patients. Stroke 1988;19:604-607.