

Danish University Colleges

Validation of a tool measuring everyday technology use in three countries

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Publication date:
2018

Document Version
Other version

[Link to publication](#)

Citation for published version (APA):

Walsh, R., Lee, J., Kaptain, R. J., Helle, T., Malinowsky, C., Nygård, L., & Kottorp, A. (2018). *Validation of a tool measuring everyday technology use in three countries*. Poster session presented at Annual Conference, Progress in Rehabilitation Research (ACMR), Dallas, Texas, United States.

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Introduction

The rapid increasing use of technology is changing many activities for people both within the home and community internationally. Today the use of everyday technology (ET) enables people to manage everyday activities in ways that were not possible a few years ago (1). Both health care and community-based activities are also moving towards a higher level of technology use (e.g., e-health applications). But the use of technology also comes at a cost; new skills and habits are required, and costs are associated with new technology, which together creates challenges and changes in everyday life for a diverse population (2). In order to study technology use more in-depth, valid measures of technology use that are functioning for various people and contexts are crucial.

Aim

To investigate evidence of validity and precision of the Everyday Technology Use Questionnaire (ETUQ) among older adults with and without functional limitations in urban contexts from the United States, Denmark, and Sweden.

Samples, instrument and analysis

A cross-sectional design including three samples from Denmark (n=100), United States (n=114) and Sweden (n=77) from both urban and rural areas were included in the analysis. The samples varied in clinical characteristics; the Danish sample consisted of people with Chronic Obstructive Pulmonary Disease (COPD); the Swedish sample consisted of people with Mild Cognitive Impairment (MCI) and Mild Dementia; and the US sample consisted of a mixed sample of people with various functional limitations. All samples targeted primarily older people (55 years or older).

The Everyday Technology Use Questionnaire (ETUQ) is a semi-structured, interview-based self-report assessment of perceived difficulties in using a variety of everyday technologies used in home and community.

We applied a two-faceted Rasch rating scale model and addressed aspects of validity and precision including rating scale functioning, item and person goodness-of-fit, person separation, and differential item functioning.

Results

The findings from the Rasch analysis revealed that the ETUQ demonstrated overall acceptable psychometric properties in relation to rating scale functioning, item and person goodness-of-fit, precision. The findings also revealed that even though 14 items out of 90 demonstrated misfit, the remained inclusion of these items did not bias the generated person measures. The precision of the person measures was adequate, supporting that the ETUQ may be preferable to use for group comparisons rather than monitoring individual changes. Finally, the ETUQ items did not demonstrate any bias in relation to country, further supporting evidence of fairness in testing.

Table 1: Summary of the outcomes from a Rasch analysis of the Everyday Technology Use Questionnaire (ETUQ) in a mixed sample of older people with and without functional limitations from Denmark, United States and Sweden (n=277).

Aspect of validity/precision measured	Statistical approach and criteria	Findings
Rating scale functioning	a) ≥10 observations per category b) Average measures for each item step category on each item should advance monotonically c) Outfit mean square (MnSq) values < 2.0 for step category calibrations	Two of the scale steps (Always using the ET together with someone and Does not use the ET) were disordered, so the scale steps were collapsed in the following analyses. After collapsing scale steps, all rating scale functioning criteria were met.
Internal scale validity (Item goodness-of-fit statistics)	A sample-size adjusted criterion for item goodness-of-fit requiring infit MnSq values between 0.7 and 1.3 logits	In the first iteration, eight items did not demonstrate acceptable goodness-of-fit to the model. After removing these items, an iterative process continued until all remaining items met the set criteria (MnSq value range 0.73 – 1.29). In total, 14 items out of 90 (15.6%) were removed from the analysis.
Person response validity (Person goodness-of-fit statistics)	A criterion for person goodness-of-fit requiring infit MnSq values lower than 1.4 associated with a z value lower than 2.0, with an expectation that 5.0% or less should demonstrate misfit. Pearson correlation coefficient	Five participants (1.8%) did not demonstrate acceptable goodness-of-fit to the Rasch model. The relationship between the measures from the ETUQ 90 item version and the valid ETUQ 76 item version was $r=0.95$, indicating that the ETs demonstrating misfit did not bias the person measures.
Precision (Person separation)	Person-separation index > 1.5 was required to ensure that the scale could differentiate participants in at least two different levels of everyday technology use. Cronbach-Alpha coefficient Maximum scores n (%)	Person separation index = 1.66 Cr-A = 0.96 15 (5.4%)
Differential Item Functioning (DIF)	The magnitude of DIF was evaluated using the Mantel-Haenszel statistics for polytomous scales using log-odds estimators as reported from the WINSTEPS program, (1% alpha with Bonferroni correction).	None of the ETUQ items displayed systematic DIF in relation to country.

For more demographic information of the US subsample see Walsh et al. (2018). *Activity Engagement and Everyday Technology Use among Older Adults in an Urban Area. American Journal of Occupational Therapy, XXX.*

Take-home message

- 1 • Everyday technology (ET) is an important aspect to consider in everyday functioning among people w/wo functional limitations
- 2 • The ETUQ is a standardized OT assessment for evaluation of ET availability and use with evidence of validity and precision
- 3 • The ETUQ can be used also in international projects comparing everyday technology availability and use with no evidence of systematic bias in relation to country

Acknowledgements

We thank the participants as well as each University for their ongoing support of this project. We also want to acknowledge the data collectors in various countries for their valuable contribution.

Evaluation of ET use

