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The association between perceived and observed ability to use everyday technology in working age people with ABI

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Abstract

Everyday technology (ET), including computers and automated telephone services, is increasingly required for everyday functioning. However, people with acquired brain injury (ABI) may have difficulty with ET use. To design interventions to support ET use, further knowledge of how to assess dimensions of such use is needed. This study investigated the relationship between the perceived difficulty of ET use (self-reported using the Short version of the Everyday Technology Use Questionnaire, S-ETUQ) and observed ability to use ET (observed using the Management of Everyday Technology Assessment, META) in a sample of people with ABI (n=81). Data were analysed using a Rasch measurement model, and person measures of perceived difficulty and observed ability to use ET were identified and correlated. The person measures had a correlation of .49 ($p < .001$). In groups of different severity levels after ABI, significant associations were found in the moderate (.36) and severe (.47) disability groups. In the good recovery group, only a non-significant correlation was found (.21). This indicates that the S-ETUQ and the META measures different but complementary dimensions of ET use. Hence, the assessments are proposed to be used together in clinical practice to more fully understand the ability of people with ABI to use ET.

Keywords: ADL, IADL, assessment

Today's age of the information and communication society implies an increased dependence on everyday technology (ET) (1-3), including devices such as computers and cell phones as well as telephone- and computer-related services (4). The use of ET can be necessary for all areas of everyday functioning, at home, in the workplace and in society, which places new demands on peoples' ability to use technology. Recently, we found that the ability to use ET can be decreased after acquired brain injury (ABI) (5-8) and that this decrease can be related to the severity of the disability (9, 10). People with severe or moderate severity of disability both perceive and demonstrate significantly more difficulties using ET than those experiencing a good recovery from ABI or control participants (9, 10). In addition, among people with ABI who are of working age, difficulties using ET are related to limitations in performing activities of daily living, leisure and work (11). Therefore, based on the increased use of ET in society and the difficulties in managing ET for people with ABI, it can be argued that clients' ability to use ET needs to be considered when designing rehabilitation strategies following an ABI. However, previous research examining working-age people has focused only to a limited extent on evaluating the ability to use ET. One possible reason for this is that the ability to use ET may be considered a subtle aspect of the performance of activities of daily living that is taken for granted and, therefore, is rarely evaluated in practice and research.

In applying client-centred occupation-based interventions (12), the importance of using both self-reports and observations has been emphasised to fully understand clients' problems as they serve different and complementary purposes. Similar to other abilities, the ability to use ET can be evaluated by self-report and by observation, for example, using performance-based evaluations conducted by professionals. Recently, assessments that measure perceived (13) and observed ability to use ET (14) have been developed and validated for use in individuals

with ABI (9, 10). The short version of the Everyday Technology Use Questionnaire (S-ETUQ) measures perceived difficulties in ET use (13, 15), and the Management of Everyday Technology Assessment (META) measures the observed ability to use ET (14). The S-ETUQ and the META assess two different dimensions of ET use. The S-ETUQ captures the perceived difficulties in the technological landscape in general while the META assesses the observed ability in the use of some ETs relevant to the person. To our knowledge, previous studies have not explored in what way the evaluations of these two dimensions of ET use yields complementary information when examining the ability to use ET in working-age people with ABI.

The agreement between perceived and observed ability in people with ABI has been used as a way to examine self-awareness (16-19). The level of self-awareness is considered important for the rehabilitation process and its outcome after ABI (20, 21). Commonly, clients have problems describing their difficulties with activities of daily living in a valid way. They often underreport their difficulties, in comparison to professionals or relatives, due to impairments related to cognition and language (18, 22-24). However, it is important to consider that reports from professionals and relatives may also have their weaknesses. Self-awareness has been found to be influenced by the severity of the disability. Those with severe brain injuries or those more impaired are generally less accurate when compared to those with moderate and mild brain injury or less impaired (22, 25), even though self-awareness can be highly variable among people with brain injuries (22, 26). As the ability to use ET can be considered as a subtle but essential part of the performance of most occupations of today and the self-awareness varies in the group, new knowledge is needed about in what way different modes of data collection, capturing different dimensions of ET use, can provide complementary information. From a professional perspective, it is important to know to what extent

evaluation of the ability to use ET based on perception versus observation yields different or similar results for different groups of individuals with ABI. Thus, to support professionals in designing and evaluating interventions to support ET use, further knowledge is needed regarding the extent to which the perceived ability to use ET is related to the observed ability, and whether this relationship is related to the severity of disability in individuals with ABI. Therefore, the aim of this study was to describe the relationship between the perceived difficulty (self-reported with the S-ETUQ) and the observed ability (performance-based evaluation using the META) of using everyday technology (ET) in people of working age with ABI and to explore if this relationship was associated with the severity of disability.

Methods

In this cross-sectional study, the relationship between person measures of self-reported difficulty with the use of ET collected with the S-ETUQ (15) and person measures of the observed ability to use ET assessed with the META (14) among people with ABI was investigated. The person measures were generated by Rasch analyses and were based on data collected for two different studies of the same sample of participants, collected on the same occasion (9, 10).

Instruments

The *Short version of the Everyday Technology Use Questionnaire, S-ETUQ*, was used to evaluate the participants' perceived difficulties with ET use. The S-ETUQ comprises 33 items, i.e., ETs, (e.g., coffee machine, radio and cell phone), most of which are relevant to a majority of people. The S-ETUQ includes a variety of items because it emphasises the evaluation of perceived difficulty. Therefore, the items on the S-ETUQ range from very difficult to very easy, and cover both newly developed and well-known ETs (15). The S-

ETUQ is administered in a 10-20 minute face-to-face interview. The level of perceived difficulty in the use of those ETs that are relevant for each person is registered on a six-step scale (27). A non-relevant ET could be one that the participant does not use anymore or has never been interested in using even if it is accessible. The psychometric properties of the S-ETUQ have been evaluated in a sample of older adults with and without cognitive impairment and were found to be acceptable (13, 15).

The Management of Everyday Technology Assessment, META, was used to assess each participant's observed ability to use his or her own relevant and sufficiently challenging ET. The META consists of 10 skill items that assess observable performance skills while using ETs, such as “*to identify services and functioning*”, “*to identify information and respond adequately*” and “*to turn a button or knob in the correct direction*”. To administer the META, a person is observed while using an ET and scored on the performance skill items using a three-category rating scale based on the difficulty in managing each item. The scoring is described in detail in the manual (28). In earlier studies, the META demonstrated acceptable psychometric properties in different populations (10, 14).

The severity of disability after ABI was assessed with *GOS-E* (29). Through a structured interview, the *GOS-E* assesses the general functioning of a person who has suffered a head injury and separates individuals into three main outcome categories: severe disability, moderate disability, and good recovery. The *GOS-E* has been found to be reliable (29, 30), and valid (30, 31) for use in individuals with head injuries.

Selection of participants

The participants in the study comprised a sample of individuals with ABI, selected from a database of clients in a rehabilitation medicine clinic in the northern part of Sweden. All clients in the database who met the inclusion criteria during the time period 2003-2010 were included as potential participants. Inclusion criterion for all participants were (a) having a diagnosis of ABI, (b) being of working age (18-64 years old), (c) living in one of the two municipalities where the study was performed and (d) being able to express themselves verbally. Participants were excluded if they had any other disease which could cause impairments, such as dementia. The inclusion of participants is further described elsewhere (9, 10). Of the clients from the database who fulfilled the criteria for inclusion (n=215), 81 agreed to participate in the study (see Table 1). The participants were divided into three groups according to The Glasgow Functional Outcome Scale-Extended, GOS-E (26); persons with severe disability (n=19), persons with moderate disability (n=38), and persons with good recovery after ABI (n=24). Approval was obtained from the Regional board of Research Ethics at Umeå University, Sweden, before data collection was initiated (Journal no. 2010-235-31).

Insert Table 1 about here

Data collection process

Three registered occupational therapists (OTs) who were trained in administering and scoring the ETUQ and META in a valid manner collected the data (32). The three OTs were all experienced in the rehabilitation of persons with ABI. After written consent was obtained from the participant, data collection was performed in each participant's home or another place chosen by the participant. The data collection was structured as follows: (1) the participants were asked questions to collect socio-demographic characteristics, (2) the S-

ETUQ interview was conducted, (3) the META observations were performed to assess the use of a minimum of three ETs, and (4) the GOS-E was completed.

Preparatory data analysis

A Rasch measurement model (33) was applied to analyse data in a preparatory step. The Rasch model is based on modern test theory that intends to prevent problems (related to clinical test theory) by convert raw item scores (ordinal data) into equal interval measures. The Rasch model is advantageous as the generated measures, e.g. person ability measures, can take in account several facets, e.g. item difficulty, rater severity, thereby making the data from the participants comparable. The ordinal data from the S-ETUQ interviews and the META observations were analysed using (33), the Rasch Winsteps (34) and Facets software programs (35), respectively. The reason for choosing different software programs was that the two assessments have different numbers of facets (e.g., items, persons, raters, tasks) that need to be adjusted for in the models. The Rasch measurement models use logistic transformations to convert raw score data from the S-ETUQ and META into abstract intervals, with equal scaling in units called log-odds probability units, or logits (33). In the Rasch analyses, person measures in logits for the perceived difficulty in ET use (S-ETUQ) and observed ability in ET use (META) were generated for each person separately. The person measures of perceived difficulty in ET use were based on the persons' responses to the specific ETs assessed by S-ETUQ and the person measures of the observed ability in ET use were based the ratings of the specific ETs and the META performance skills assessed by the META. Higher numbers, in logits, indicate less perceived difficulty or higher observed ability with ET use in the sample, and lower numbers indicate greater perceived difficulty and lower observed ability. The person measures generated from the S-ETUQ and META were displayed in the Winsteps and

Facets outputs. These analyses have been described in detail elsewhere (9, 10). For the primary data analyses in this study, comparisons were made between the S-ETUQ and META person measures. Before the analyses, the normality of the S-ETUQ and META measures were tested using both graphical and statistical methods. Histograms and values for skewness and kurtosis demonstrated that the S-ETUQ and META person measures were not normally distributed.

Primary data analysis

Due to the non-normal distribution of the variables, the person measures from the S-ETUQ and the META analyses were compared using a Spearman correlation in SPSS (36). To determine the strength of the association between the person measures, the guidelines from social sciences by Cohen were applied: 0.1-0.3= small, 0.3-0.5 =medium, and 0.5-1.0 = large (37). A p-value of less than 0.05 was used to determine the level of significance for the correlation. Correlation analyses were performed in the whole sample, and in the three groups with different levels of severity after ABI. Finally, the correlation between the S-ETUQ and the META person measures was plotted to visualise the proportion of the sample that perceives the use of ET as more or less difficult compared to their observed level of ability.

Results

The person measures generated by the Rasch analyses for the S-ETUQ and the META are presented for the total sample as well as group-wise in Table 2. A medium-strength relationship was found between the person measures of perceived and observed difficulty in the total sample of participants with ABI, with a Spearman correlation of .49 ($p < 0.001$; see Table 2). The results of the correlation analyses between the perceived difficulty and the observed ability in the three groups of different severity levels after ABI demonstrated

significant medium positive associations in the moderate and severe disability groups. In the good recovery group only a small non-significant correlation was found (Table 2).

Figure 1 shows that, in this sample, several participants seem to perceive difficulties in ET use almost at the same level as the occupational therapists assessed their ability. However, there are some participants who perceive less difficulty than the ability observed by the rater and vice versa

Insert Figure 1 about here

Insert Table 2 about here

Discussion

This study describe the relationship between two dimensions of ET use, the self-reported difficulty in ET use and the observed ability to use ET in people of working age with ABI. The results demonstrated a medium-strength relationship between the self-reported person measures of perceived difficulty in ET use (based on the S-ETUQ) and the person measures of observed ability to use ET (based on the META). Consequently, there are differences in the results between the two dimensions in ET use in persons with ABI that need to be considered. In agreement with earlier suggestions, we propose that information regarding perceived difficulties in combination with observation of actual ability will offer an understanding of a client's strengths and limitations in occupational performance and of their own perception and awareness of their ability (12, 38-42). However, even if the use of both self-reports and observations is underscored in guidelines for client-centred occupation-based intervention processes (12) as well as in research of the group (39), there can exist a discrepancy to clinical practice. As previous research of agreement between self-reports and observations in individuals with ABI foremost had focused on tasks in daily life without specifically considering the aspect of managing ET, this study adds more knowledge about the importance

of also considering both dimensions of ET use in this aspect of performance. Thus, with the intention of identifying individuals who will require interventions that support ET use and determining the best way to design, provide and evaluate them, the use of the S-ETUQ and META together is suggested.

The correlations between the person measures of perceived difficulty (S-ETUQ) and observed ability (META) in the three groups separately is a somewhat unexpected result. A higher correlation could be expected in the group of individuals with good recovery than in the groups with moderate or severe disability because individuals who are less impaired after ABI often have a higher self-awareness of their difficulties in daily activities (22, 25). However, in this study, only a small, non-significant correlation between self-reported difficulty and observed ability in ET use was found in the good recovery group. One reason for this might be that because individuals with good recovery often have a high ability to use ET (10), they likely have only minor difficulties with ET use, and these difficulties might be less recognisable than the major difficulties that are more common among persons with more severe disabilities (10). It may be easier to cope with minor difficulties such as needing a bit more time than usual or hesitating occasionally during performance than to handle more major and obvious difficulties such as not finding the required button, function or command. Additionally, minor difficulties might not even be perceived as difficulties if they can easily be compensated for and the outcome of the ET use works as expected. These findings indicate that the severity of disability after ABI is not associated with the level of correlation between self-reports of difficulty with ET use and observations of the ability to use ET. Self-reported difficulty does not always seem to predict the observed ability and vice versa, specifically for those with good recovery after ABI. This implies that to evaluate one dimension of ET use cannot be preferred before the other in regard to severity of the disability. Thus, evaluation of

one type of ET use cannot replace another. However, in applying a client-centered occupation-based intervention process, the reason for including a participant's self-reported ability in addition to a rater's assessment of the participant's observed quality in performance is to provide the rater with as much information as possible and not to obtain the same information in the self-report and the observation (39). Therefore, the ability to use ET should be assessed on an individual basis, and an observation using the META is an important complement to a self-report with the S-ETUQ. Interviews with the S-ETUQ can evaluate the ETs that are relevant for the client and whether difficulties are perceived and to what extent, while the observations with the META could identify important actions in the management of ET that are required to support the ability. Consequently, the combination of the two assessments may give valuable information to occupational therapists about the (observed) quality of their clients' occupational performance when managing of ET as well as their own perception of the ability. The results of this study could, as well, be seen as a further validation of the agreement between the instruments.

As mentioned earlier, the client's self-awareness of his or her ability influences the outcome of rehabilitation. Individuals with ABI are often found to under-report their difficulties compared to assessments by professionals or reports from significant others (18, 22-24). On the other hand, it is important to realise that reports from significant others or professional assessments and observations also have limitations when attempting to generate valid and reliable estimations (such as the impact of rater severity, intra- and inter-rater reliability and evidence of unidimensionality). In this study, it is shown (in Figure 1) that many of the participants seem to perceive difficulties in ET use that are approximately the same level as the occupational therapists assessed their ability. However, it is also clear that some individuals under-report difficulties and others over-report them. If an individual self-report

no or few difficulties but the OT observe such, it will be important to discuss the reason to this discrepancy with the client to increase the self- awareness of disability. On the other hand, if the OT do not observe difficulties but the client report such it will be important to explore the clients concerns to be able to support future use of ET.

Aside from the under- or over-report of difficulties, the differences between self-reported difficulty and observed ability may occur for other reasons. First, the S-ETUQ and the META assess two slightly different dimensions; the perceived difficulty versus the observed ability to use ET. Secondly, the person measure generated from the S-ETUQ is dependent on the participant's perceived difficulty using 33 different ETs, compared to the person measure from the META assessments, which originates from observing the use of three challenging ETs that the participant has chosen him- or herself. In addition, it is possible that the ETs that an individual perceives as difficult to use are not represented in the S-ETUQ, and this could have caused artificially high person measures for observed ability in some cases. Third, the S-ETUQ captures the general use of ETs while the META captures the use of the ETs during one specific occasion. If a person's performance fluctuates, which is observed among persons with traumatic brain injury (43), it might be challenging to assess the person's ability in a valid way in only one observation session. When the results of the evaluations with the S-ETUQ and the META are divergent or contradictive, the above mentioned reasons and approaches can support professionals in defining the clients' problems when designing interventions facilitating occupational performance. Future research will be valuable in exploring in what way the assessments add to the prediction of different outcomes of rehabilitation interventions of people with ABI and in assessing the use of both assessments in evaluating interventions designed to reduce problems with ET use.

Methodological considerations

First, the sample of persons with ABI was rather small, particularly when divided into the three groups based on severity level. There is a potential risk that these participants are not representative of other working-age individuals with ABI. Additionally, as the three groups were rather small, it is possible that they may have biased the results. The differences in sociodemographic variables (Table 1) between them may have caused some of the differences between the three groups even though they are non-significant. However, it has been found that sex, age, educational level and living conditions do not contribute to the variance in the observed ability to use ET, assessed with the META, in this sample with ABI (10) or in older adults with and without cognitive impairment (44). Future studies should include more participants and adopt more rigorous sampling procedures so that they may compare more similar groups of participants with ABI. In addition, one inclusion criteria was that the individual had to be able to express themselves verbally. This meant that persons who had minor difficulties expressing themselves were included while persons with a more severe aphasia were excluded from participation. In future studies the option to use significant others as a support in the S-ETUQ interviews could be applied to also include persons with severe aphasia. A methodological strength of the study is that the S-ETUQ and META data were collected for the same sample of participants with ABI on the same occasion and by the same occupational therapist. In addition, the occupational therapists who collected the data did not know beforehand which ETs would be more or less difficult in the Rasch-based measures of difficulty level, which could minimise the risk for rater bias in supporting clients in the interviews with the S-ETUQ and in the selection and observation of ETs in the META. Finally, as mentioned earlier, the S-ETUQ and the META assess two slightly different constructs, and this may have influenced the results. The S-ETUQ captures the general perceived difficulty for ETs while the META assesses the observed ability to use a number of

relevant and challenging ETs. This could have caused some of the differences between the two modes of data collection.

In conclusion, the present study has shown that two different dimensions in assessing ET use in working-age people with ABI, self-report in face-to-face interviews (S-ETUQ) and structured assessments using observations (META), seem to have a medium-strength relationship. Many participants perceive difficulties at the approximately same level as the OT assessed their ability. However, many under- or over- report their difficulties and the association between the assessments in the group with good recovery was not significant. Therefore, it is proposed that the instruments should be used together in clinical practice. In case of divergent or contradictory results of the S-ETUQ and the META, the discussion reveals how the combined use of the assessments can guide OTs in clarifying the reasons to this. i.e., to the different results of the two assessments and in the design of subsequent interventions supporting ET use.

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Table 1. Sociodemographic characteristics of the participants (n=81).

Group	Good recovery	Moderate disability	Severe disability	Total	Comparison between groups
n	24	38	19	81	
Sex, n (%)					
Men	12 (50)	27 (71)	8 (42)	47 (58)	Pearson chi ² ns
Women	12	11	11	34	
Age, years					
Mean (SD)	53.79 (10.6)	54.95 (9.2)	58 (7.3)	55.32 (9.25)	ANOVA ns
range	23-64	25-65	37-64	23-65	
Education, n (%)					
Elementary School	2 (8)	5 (13)	5 (26.5)	12 (15)	Pearson chi ² ns
High School	13 (54)	20 (53)	9 (47)	42 (52)	
University	9 (38)	13 (34)	5 (26.5)	27 (33)	
Living conditions n (%)					
Cohabiting	20 (83)	22 (58)	14 (73)	56 (69)	Pearson chi ² ns
Single	4	16	5	25	

Table 2. Groupwise S-ETUQ and META person measures and the correlations between the person measures of perceived and observed levels of difficulty using ET.

Group	Good recovery (n=24)	Moderate disability (n=38)	Severe disability (n=19)	Total (n=81)
S-ETUQ person measure, in logits mean (SD) Range	61.38 (9.4) 52.14-79.32	54.66 (5.33) 48.14-76.13	48.97 (3.78) 43.56-55.57	55.32 (7.9) 43.56-79.32
META person measure, in logits mean (SD) Range	2.86 (1.6) .46-5.1	1.73 (1.24) -.16-5.14	1.02 (0.88) -.79-2.67	1.9 (1.45) -.79-5.14
Spearman correlation S-ETUQ/ META person measures	.21 (p=.333)	.36 (p=.027)	.47 (p=.043)	.49 (p<0,001)

Note: A high S-ETUQ person measure indicates less perceived difficulty using ET. A high META person measure indicates a high observed ability to use ET.

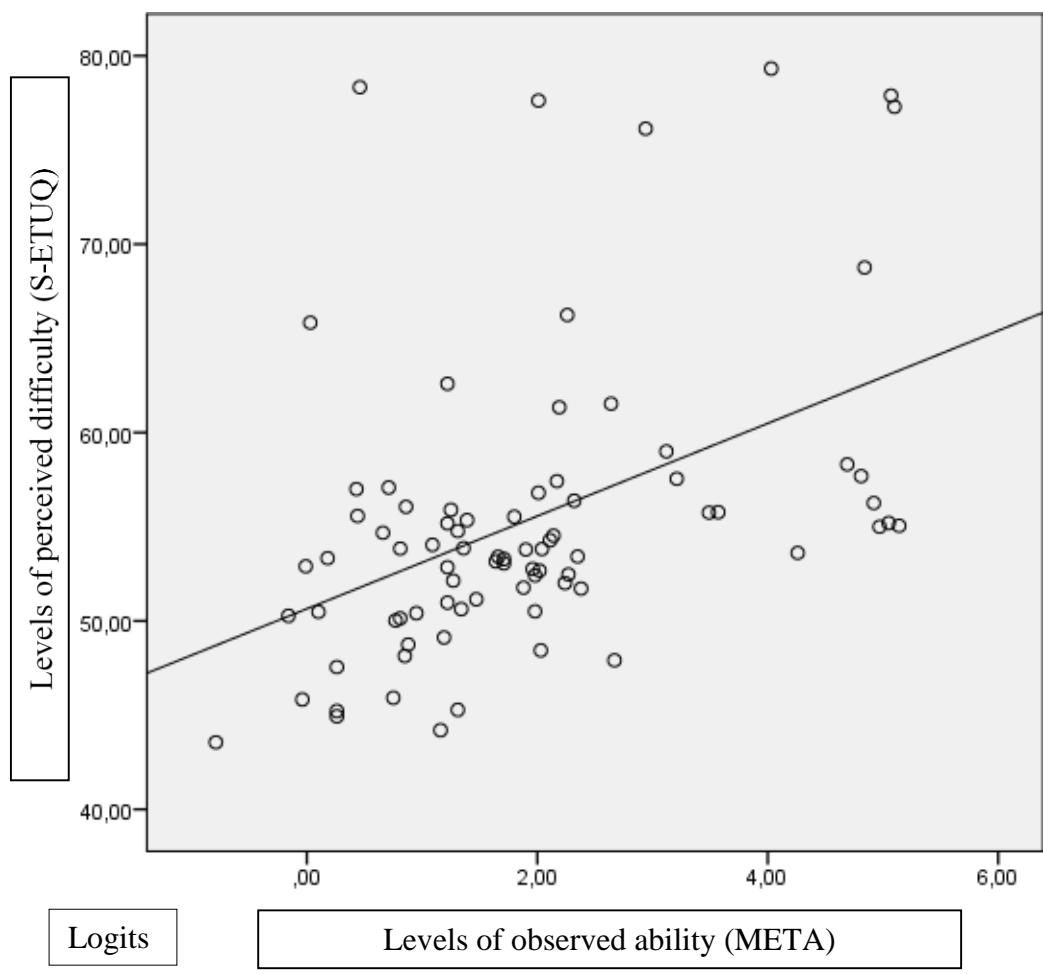


Figure 1. Plot showing the person measures of perceived levels of difficulty (S-ETUQ) correlated with the person measures of observed ability level (META), in logits. A high S-ETUQ measure represents a lower level of perceived difficulty. A high META measure represents a higher level of observed ability