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Research Article

Functional Assessment of Currently Employed Technology Scale (FACETS): Reliability and Validity

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Abstract:

Introduction: Health protocols have not included technology as a specific area of assessment or treatment. The Functional Assessment of Currently Employed Technology Scale (FACETS) was designed to do so. FACETS is a 10 item questionnaire assessing 5 functional domains. The current study was conducted to establish validity & reliability for FACETS.

Methods: Using 423 pre-existing deidentified FACETS forms from clinical records, analyses were conducted including Cronbach's alpha coefficient, McDonald's omega, confidence intervals for alpha and omega, multiple group factor analysis, Fleming's index of scale fit, and differential item (domain) function (DIF).

Results: Internal consistency and factor validity for the 10 FACETS items and intra-domain correlations were high. Fleming's factor scale fit index indicated excellent fit. All but one domain contains sufficient unique information to produce differential item functioning.

Discussion and Conclusions: FACETS demonstrated high internal consistency reliability, strong general factor validity, and strong factor validity for the five domains.

Keywords: Functional Assessment of Currently Employed Technology Scale, FACETS, reliability, validity, internal consistency, domains

Introduction

Protocols for health professionals have not included technology per se as a specific area of assessment or treatment [1]. Most of the research exploring acceptance and utilization of new technologies has come from the information technology sector [2-14]. Several instruments have been developed that assess a person's perception of their own proficiency with various technologies [15-21]. The studies and models described above assess factors determining a person's decision to use specific technologies, or self-perceived proficiency in using specific technologies, but none of them functionally assesses the frequency with which the person employs commonplace current information technologies in a way that informs individualized treatment planning, and directs choice of media for communicating with a specific patient to facilitate better treatment outcomes and higher satisfaction ratings by patients and providers of care. The Functional Assessment of Currently Employed Technology Scale (FACETS, Appendix 1) was designed specifically to meet those previously unaddressed needs.

The FACETS questionnaire consists of 10 questions, two in each of 5 functional domains: Home, Social, E-commerce, Health Care, and Technical. Each question has 6 optional answers that characterize the respondent's frequency employing a specific type of information technology. The scores for the two questions in each functional domain are added to produce a subtotal for that domain. The five domain subtotal scores are then added to produce an overall total score.

Higher scores suggest more frequent utilization of technologies across domains. There are no foreseen risks or benefits associated with completing FACETS. The current study was conducted to establish validity & reliability for FACETS.

Methods

423 completed FACETS forms were randomly selected using pre-existing deidentified records originally collected for clinical purposes. Respondents varied in age, ethnicity, socio-economic status, household income, and educational level. No control group was applicable. The Santa Barbara Cottage Health Hospital Review Board granted a waiver for the current data.

Statistical Analysis

The distribution of FACETS scores was markedly non-normally distributed. Consequently, nonparametric statistical tests were used when possible. Cronbach's alpha coefficient was used to assess internal consistency. Additionally, calculated McDonald's omega [22] was calculated. Confidence

intervals for alpha and omega were found using bootstrap resampling (5,000 iterations). Item statistics were also derived including the alpha if each item was removed with corrected item total correlations. To address the factor validity of the five domains, multiple group factor analysis, a quasi-confirmatory method, was used [23, 24]. This method uses a weighting matrix to pre-define the factors, in this case the five domains. The weights used the item standard deviations to simulate actually summing the items to construct the domains. An oblique extraction allowed the domains to remain correlated. Fleming's index of scale fit is reported [25]. Differential item (domain) function (DIF) was assessed using partial correlations. Each domain was correlated with age while controlling for the sum of the other domains. Statistical analyses were performed using STATA 15MP and R.

Results

A description of the sample is shown in Table 1. The mean age in the sample was 54.58 (sd = 18.42). The youngest respondent was 18 years of age while the oldest was 95 years old. The sample was predominantly female and had an income between $50,000 and $100,000. The most frequently cited education was a Bachelor's degree. Over 90% had home access to a computer and to the internet.

Table 1: Sample Demographics

Trait	Number of Respondents	% of Sample
Gender		
Male	40.9	173
Female	59.1	250
Race/Ethnicity		
Hispanic	11.99	50
African American	1.2	5
Asian	2.64	11
Other	84.17	351
Income		
<$25,000	1.9	8
<$50,000	16.9	71
<$100,000	36.67	154
<$150,000	23.33	98
>$150,000	21.19	89
Education		
N/A	0.96	4
High School	19.14	80
Some college	23.21	97
AA	1.91	8
Bachelor's	43.06	180
Post graduate	11.72	49
Access to computer		
Yes	92.79	
No	7.21	30
Access to High-speed Internet		
Yes	93.49	388
No	6.51	27

Internal consistency for the 10 items was high, Cronbach's alpha = 0.95 (95% CI: 0.94 – 0.96). Similarly, omega was 0.95 (95% CI: 0.94 – 0.96). These high internal consistency values suggest a strong general factor underlying the FACETS score. Alpha is not increased by removing any item and all of the corrected item total correlations are moderate to high, indicating some item redundancy between the items and the large general factor. Item statistics appear in Table 2.

Table 2: Data by Item, SD, Alpha and Corrected Item Total Correlations if Item Removed

Item Number	Mean	SD	Alpha if Item Removed	Corrected Item Total Correlation
1	4.32	1.50	0.95	0.73
2	4.19	1.54	0.95	0.75
3	4.35	1.63	0.95	0.68
4	4.07	1.77	0.95	0.69
5	3.11	2.17	0.94	0.89
6	3.13	2.16	0.94	0.87
7	2.63	2.14	0.94	0.86
8	2.58	2.13	0.94	0.85
9	3.14	2.21	0.94	0.80
10	2.74	2.03	0.95	0.79

Table 3 shows the factor structure of the five domain scores.

Table 3: Factor Structure for Five Domain Scores

Item Number	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
1	0.99	0.83	0.55	0.50	0.52
2	0.99	0.80	0.60	0.54	0.55
3	0.82	0.97	0.55	0.47	0.45
4	0.79	0.97	0.56	0.53	0.42
5	0.58	0.57	0.99	0.87	0.75
6	0.58	0.56	0.99	0.85	0.74
7	0.53	0.51	0.87	1.00	0.76
8	0.53	0.51	0.85	1.00	0.75
9	0.55	0.46	0.75	0.75	0.99
10	0.52	0.43	0.74	0.75	0.99

All of the items were correlated with all of the domains due to the large general factor. However, the domain specific correlations were near 1.0. Communalities were all 0.95 or higher. The domain intercorrelations ranged from 0.51 (Domain 2 and 4) to 0.83 (Domain 1 and 2). The factor solution accounted for 97.87% of the total variance and the root mean squared residual was less than 0.01, indicating good fit. Fleming's factor scale fit index was 0.99 overall and greater than 0.97 for each domain, also indicating excellent fit. Differential item (domain) functioning (DIF) was also investigated regarding age of the respondent. Partial correlations were calculated between age and each domain, controlling for the sum of the remaining domains. If the relationship of age was constant across all domains, controlling for the remaining domains should make the partial correlation go to near zero. Only Domain 1 did not show DIF (partial $r = 0.06$, $p > 0.21$). Domains 2, 3, 4, and 5 all showed differential correlations with the partial correlations ranging from -0.17 (Domain 2) to -0.35 (Domain 3; p's < 0.001). These analyses were repeated using partial Spearman correlations with nearly identical results. The partial Spearman correlations ranged from -0.23 (Domain 2) to -0.50 (Domain 3; p's < 0.001). Thus, while there is a strong general factor, all but one domain contain sufficient unique information to produce differential item functioning.

Discussion and Conclusions

There are two main findings to this study. One finding is both the large alpha and omega coefficients indicate very high internal consistency reliability for FACETS. The other finding is that FACETS demonstrated strong factor validity for the five domains, in addition to the strong general factor. This finding suggests that both the overall score (summing all of the items) and the five individual domain scores can offer meaningful values.

Additional analyses indicated that domains demonstrated differential item functioning with regard to dependent variables. While this can cause some issues for instruments thought to have a general factor, it adds weight to the validity of the domains. The DIF also supports the need for considering the domains separately, and further confirms the validity of the five domain factor solution.

This study has several strengths as well as limitations. The strengths include a large sample size to generate accurate estimates for the internal consistency coefficients and the factor solution. Another strength was the broad ranges for age, education, and income. However, this was also a convenience sample in a clinical setting, which may limit the generalizability to the general public.

Overall, the high internal consistency reliability and strong factor validity suggest that FACETS has value for determining not only an individual's overall frequency of IT use, but also for determining in which technology domains the individual has greater or lesser frequency of IT use. FACETS also appears effective for determining differences between groups, not only in general frequency of IT use, but within specific IT usage domains. FACETS has demonstrated value in a clinical setting, but further research is recommended using FACETS with a general population. Longitudinal studies using FACETS may also be of value for understanding age, gender, and other differences over time.

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Appendix 1:

Functional Assessment of Currently Employed Technology Scale (FACETS)

Age: _____ ◯Male/◯ Female ◯Hispanic ◯ African American ◯Asian ◯Other

Household Income: ◯< $25,000 ◯< $50,000 ◯< $100,000 ◯< $150,000 ◯>$150,000

Degree: ◯N/A ◯High School ◯Some college ◯ AA ◯Bachelor's ◯Post graduate

Access to a computer at home? ◯Yes/ ◯No **Access to internet at home?** ◯Yes/ ◯No

Instructions: Check the response that most accurately completes each statement.

A.	Home Domain						
1.	I send email...	○ **Never**	○ **A few times a year**	○ **A few times a month**	○ **Once a week**	○ **A few times a week**	○ **Daily**
2.	I find, open & close files in my computer...	○ **Never**	○ **A few times a year**	○ **A few times a month**	○ **Once a week**	○ **A few times a week**	○ **Daily**
	Home Domain Subtotal						
B.	Social Domain						
3.	I send text messages using a smart phone…	○ **Never**	○ **A few times a year**	○ **A few times a month**	○ **Once a week**	○ **A few times a week**	○ **Daily**
4.	I post on social media (e.g., facebook, twitter)…	○ **Never**	○ **A few times a year**	○ **A few times a month**	○ **Once a week**	○ **A few times a week**	○ **Daily**
	Social Domain Subtotal						
C.	E-Commerce Domain						
5.	I manage my banking and credit card accounts online…	○ **Never**	○ **Tried, but it didn't work**	○ **Got help but didn't work**	○ **Only with help**	○ **Can but prefer not to**	○ **Prefer to**
6.	I pay bills and make purchases via the internet…	○ **Never**	○ **Tried, but it didn't work**	○ **Got help but didn't work**	○ **Only with help**	○ **Can but prefer not to**	○ **Prefer to**
	E-Commerce Domain Subtotal						
D.	Health Care Domain						
7.	I communicate with my doctor or clinic online…	○ **Never**	○ **Tried, but it didn't work**	○ **Got help but didn't work**	○ **Only with help**	○ **Can but prefer not to**	○ **Prefer to**
8.	I communicate with my health insurance company online…	○ **Never**	○ **Tried, but it didn't work**	○ **Got help but didn't work**	○ **Only with help**	○ **Can but prefer not to**	○ **Prefer to**
	Health Care Domain Subtotal						
E.	Technical Domain						
9.	I have installed components (monitors, speakers, mice)…	○ **Never**	○ **Tried, but it didn't work**	○ **Got help but didn't work**	○ **Only with help**	○ **Myself, with difficulty**	○ **Myself easily**
10.	I have reset a modem or router in my home…	○ **Never**	○ **Tried, but it didn't work**	○ **Got help but didn't work**	○ **Only with help**	○ **Myself, with difficulty**	○ **Myself easily**
	Technical Domain Subtotal						
	Total FACETS Score						