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Application of Mean and Standard Deviation in Questionnaire Surveys

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ABSTRACT

A simple method using the descriptive statistics involving mean and standard deviation can be applied in questionnaire surveys. By focusing on the reliability and validity assessment, items should have roughly equivalent means and standard deviations within a Likert scale with the rule of thumb of 2:1 (ratio of the maximum standard deviation to the minimum standard deviation). A comprehensive study on the reliability and validity of the questionnaire to assess computer and internet usages is presented to illustrate how to perform a simple evaluation of the item-level descriptive statistics (mean, standard deviation and frequencies), the multitrait/multi-item correlation matrix (Pearson correlation and Biserial correlation) and reliability coefficients and inter-scale correlations (Cronbrach's alpha and Hoyt's method). This method is thus applicable in any research that employs a questionnaire.

Keywords: Likert scales, mean, reliability, standard deviation, validity.

INTRODUCTION

Simple descriptive statistics involving mean and variance can be used for construct validation in a questionnaire. Item mean and item standard deviation were applied to test whether the items in each hypothesized grouping contain approximately the same proportion of information about the construct being measured. It is also used to examine whether the items have roughly equal standard deviations, such that they contribute equally to the total scale score. In other words, items should have roughly equivalent means and standard deviations within a Likert scale, respectively. Likert scale is a subjective scoring system that allows respondents to quantify how much they agree with the point of view in the item, i.e. 1 represents never, 2 represents seldom and 3 represents often (Trochim & Donnelly, 2007). A rule of thumb is that the ratio of the maximum standard deviation to the minimum standard deviation should be about 2:1 (Julious, 2005). The bundling of items within scales and scales within measures goes wrong when some items are not correctly bundled. This method is very simply but yet it is not commonly use by mathematicians, researchers and teachers. Therefore, the objective of this paper is to discuss the application of mean and standard deviation in the research that uses questionnaire by focusing on the reliability and validity assessment.

Variables must be measured before they can be related to one another in a questionnaire. For statements of relationship to have any meaning, each measurement must, in some sense, validly measure what it is supposed to measure. In other words, items should tend to measure something in common when they are grouped into a same scale in the questionnaire. This is assessed by the item-scale correlations. The items scores are then summed to estimate a scale score. A Pearson product-moment correlation coefficient is used to describe this type of relationship (Brown & Benedetti, 1977; Snedecor & Cochran, 1989). On the other hand, a point biserial correlation coefficient is used when the association between an item with dichotomous score and scale with continuous score is measured; or when strength of the relationship between a single item and the hypothesized scale that includes the item is measured (Armitage & Colton, 2005).

Internal consistency is the extent to which items within a scale are correlated with each other in a questionnaire (Brazier, Harper, Jones, O'Cathain, Thomas, Usherwood & Westlake, 1992). In reliability analysis, the Cronbach's alpha is a widely used method based on correlations between items, and reliability coefficients for each scale calculated by a 2-way analysis of variance (ANOVA). In fact, it is based on the average correlation of items within a test if the items are standardized and based on the average covariance among the items if the items are not standardized (Cronbach, 1951). Besides Cronbach's alpha coefficient, the Hoyt's method is used for items with dichotomous score. The rest of the paper is organized as follows. In the second section, the item-level descriptive statistics are discussed. The multitrait/multi-item correlation matrix is described in the third section while the fourth section discusses the reliability coefficients and inter-scale correlations. An illustrative example is presented in Section Five by using data consisting of information about the extent of computer and internet usage of the citizens of Penang, Malaysia in 2006. The conclusion of our study is in the final section.

ITEM-LEVEL DESCRIPTIVE STATISTICS

Essentially, simple item-level descriptive statistics can be used for construct validation in a questionnaire. The good rule of thumb to follow is that the items should have roughly equivalent means within a Likert scale. Other than examining the item means, item standard deviations also are examined. The rule of thumb is the maximum standard deviation to minimum standard deviation should be about 2:1 (Julious, 2005). If the item does not fulfill the rule, the item needs to be standardized so that it does not differ greatly within a scale.

This discrepancy can also occur when items do not have roughly symmetrical distribution for all of the response choice and it still might be desirable to include the item in the scale for purposes of content validity. In such cases, the item can be weighted by using factor analysis (Ware, Kosinski & Keller, 1994). In addition to examining item means and standard deviations, the response value frequencies of individual items is assessed to determine if all of the items are chosen or not, and whether the items are symmetrically distributed in the hypothesized scale.

MULTITRAIT/MULTI-ITEM CORRELATION MATRIX

The multitrait/multi-item correlation matrix is used to examine the relationship of each item to its hypothesized scale, as well as the item's correlations with other scales. Each row in the matrix contains correlations between the score for one item and all scale scores. Each column contains correlations between the score for one scale and all items (items hypothesized to be part of that scale and those which are not). The multitrait item-scale correlation matrix examines the item internal consistency (items are substantially linearly related to the total scale score) and the equality of item-scale correlations (items in a scale contributing roughly equal proportion of information to the total score of its hypothesized scale).

For the Pearson correlation coefficient (r), item internal consistency is considered substantial and satisfactory if an item correlates to 0.4 and above with its hypothesized scale (Ware, Brook, Davies-Avery, Williams, Stewart, Rogers, Donald & Johnston, 1980). Point biserial correlation coefficient

($\rho_{biserial}$) is used to estimate the value of the Pearson correlation when the association between item with dichotomous score and scale with continuous score is measured (Armitage & Colton, 2005). Point biserial correlation coefficient is defined as follows (Sheskin, 2007):

$$\rho_{biserial} = \frac{(M_1 - M_2)}{\sigma} \times \frac{p_1 p_2}{z} \tag{1}$$

where

M_1, M_2 = means of the 2 groups,
p_1, p_2 = proportions of the 2 groups from the total,
σ = standard deviation for the scale with continuous score, and
z = ordinate of the normal curve at the point of dichotomy.

These coefficients have a range of possible values from -1 to +1. The value indicates the strength of the relationship, while the sign (- or +) indicates the direction. The equality of item-scale correlations is the guide line to determine rejecting or not rejecting an item into a scale. Low or negative correlation coefficients are often an indicator of a flawed item being included into a hypothesized scale.

RELIABILITY COEFFICIENTS AND INTER-SCALE CORRELATIONS

Correlations among all scales are computed and compared with reliability estimates to evaluate how distinct each scale is from other scales in the same matrix. A reliability coefficient illustrates a correlation between a scale and itself. The reliability of scales scores has been estimated using the internal consistency method, i.e. Cronbach's alpha coefficient and Hoyt's method (for item with dichotomous score). Cronbach's alpha coefficient is defined as follows (Cronbach, 1951):

$$R_{tt} = \frac{kR_{ii}}{1 + (k-1)R_{ii}} \tag{2}$$

where

R_{tt} = internal-consistency reliability of a score,
k = number of items, and
R_{ii} = average of all inter-item correlations within a scale.

and $0 \le R_{tt} \le 1$. The Cronbrach's alpha coefficient of a scale should be above 0.70 to indicate a strong correlation between a scale and itself (Nunnally & Bernstein, 1994). However, the caution is that Cronbrach's alpha coefficient is quite sensitive to the number of items in the scale. It is common to find a low value with short scales (e.g. scale with fewer than ten items) (Briggs & Cheek, 1986).

The Cronbrach's alpha coefficient is used for items with Likert scale, whereas, for items with dichotomous scoring, i.e. yes or no; relevant or irrelevant, Hoyt's method is used. Hoyt (1941) developed an approach to the estimation of reliability which also yields results identical to those obtained from the Cronbrach's alpha coefficient. Hoyt's method was based on ANOVA, treating person and items as sources of variation. Hoyt (1941) defined the reliability estimate $\hat{\rho}_{tt}$, using ANOVA notation as

$$\hat{\rho}_{tt} = \frac{MS_{person} - MS_{residual}}{MS_{person}} \tag{3}$$

where

MS_{person} = the mean square term for persons taken from the ANOVA summary table
$MS_{residual}$ = the mean square term for residual taken from the residual variance in the ANOVA summary table

Hoyt's method can be computed easily because ANOVA is a general statistical procedure that is available in all statistical packages.

AN EXAMPLE

The questionnaire was created to examine the extent of computer and internet usage of the citizens of Penang (Malaysia) in the year 2006. In the following example, the discussion is focused on this group of respondents. Data collection was carried out via face-to-face interviews by enumerators for all the household members. At completion, 4340 individuals had been surveyed. Amongst them, 272 respondents were simultaneously computer and internet users who used online monetary transactions. The computer and internet usage questionnaire have 10 scales with their respective items. The 10 scales include place used computer, main activities for computer usage, place used internet, awareness about Information and Communication Technology (ICT), type of computer skills, online activities including e-communication, e-entertainment, e-learning, non-monetary e-transactions, and monetary e-transactions. This questionnaire may be obtained on request from the second author. This study presents the results on the reliability and validity of the questionnaire to assess computer and internet usages. The software Predictive Analytics SoftWare (PASW); formerly Statistical Package for the Social Sciences (SPSS) and Statistical Analysis Software (SAS) are used throughout the study.

Table 1 indicates that all items have roughly equivalent means and standard deviations within a Likert scale (ratio of maximum standard deviation to minimum standard deviation of around 2:1), respectively, except items PLA04, PLA05, PUI04 and PUI05. Item PLA04 (Mean=.03, SD=.173) and item PLA05 (Mean=.00, SD=.000) have lower mean values compared to other items in scale PLA. Their standard deviation is about 3 times and 5 times lower than the maximum standard deviation for scale PLA, respectively. This has violated the 2:1 rule. Item PUI04 (Mean=.00, SD=.061) and PUI05 (Mean=.01, SD=.121) in scale PUI, follow in a similar vein. In addition to means and standard deviations, the response values frequencies were examined in order to determine whether all response choices were used. For computer users who do not own computer(s), the results showed that only 2 respondents responded to using computers at e-community centres (PLA04) and no one responded to using a computer at school (PLA05). Among the respondents who used the Internet, only one respondent accessed the internet at an e-community centre (PUI04) and 4 respondents accessed the Internet at school (PUI05). These 4 items are eliminated because it is not desirable to include them in their corresponding scale.

The test of item internal consistency is assessed by evaluating the correlation between an item and the score of hypothesized scale. From Table 2, all items correlates to 0.4 and above with their hypothesized scale, except item PLA01 ($\rho_{biserial}$= .200) and MAI02 ($\rho_{biserial}$=.338). Items PLA01 and MAI02 have the highest correlation coefficient amongst all the items in their hypothesized scale. Other than these 2 items, all the items in a scale contribute roughly equal proportion of information to the total score of their hypothesized scale. This can be seen by looking at the items correlation coefficients in the same hypothesized scale, which do not differ much from each other.

Item PLA01 ($\rho_{biserial}$= .200) has a low correlation coefficient which means that the respondent who does not own any computers seldom use a computer in their work place. However, they chose to use the computer at cyber cafés ($\rho_{biserial}$= .708) and perhaps their friends' house ($\rho_{biserial}$= .571). On the other hand, a low correlation coefficient for item MAI02 ($\rho_{biserial}$=.338) suggests that the main activities of respondents is not office automation but related to education activities ($\rho_{biserial}$= .710), game/entertainment/multimedia activities ($\rho_{biserial}$= .627) and other application (i.e. programming) ($\rho_{biserial}$= .606). It is noted that item SKI03 (r = .436) does not have the highest correlation coefficient with its hypothesized scale compared to other scales. This might be due to the definition of "Other applications" being too broad and not suitable to put into a scale named skill.

From the reliability coefficients presented in Table 3, all the correlations between the two scales is less than their respective reliability coefficients, except for MAI (Main Activities) and PUI (Place Used Internet). This is consistent with the findings in Table 2 that items of MAI and PUI might not categorize into suitable scales. For variable with Cronbrach's alpha and Hoyt's coefficients of a scale above 0.70, there is an evidence of unique reliable variance measured by each scale. In a similar vein, the evaluation of inter-scale correlations indicates that each scale is measuring a distinct concept.

CONCLUSION

There have been reports in the literature where the common reliability and validity method have been used for the analysis of questionnaires related to health surveys (Kröz, Büssing, Laue, Reif, Feder, Schad, Girke, Matthes, 2009; Okamura, Nojiri & Osuga, 2009; Ware & Gandek, 1998a, 1998b). However, there are no comprehensive studies on the reliability and validity of questionnaires to assess computer and internet usages. In this respect, a case study employing real world data is presented to illustrate how to perform a simple evaluation of the item-level descriptive statistics (mean, standard deviation and frequencies), the multitrait/multi-item correlation matrix (Pearson correlation and biserial correlation) and reliability coefficients and inter-scale correlations (Cronbrach's alpha and Hoyt's method). These findings have shown that an uncomplicated method using the descriptive statistics involving mean and standard deviation can be utilised in questionnaire surveys for construct validation. By focusing on the reliability and validity assessment, items should have roughly equivalent means and standard deviations within a Likert scale with a straightforward rule of thumb of 2:1 (ratio of the maximum standard deviation to minimum standard deviation). Thus, we would highly encouraged teachers, researchers and mathematicians to apply this simple, easy and convenient method in any research that uses questionnaires.

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Table 1. Item descriptive statistics for computer users and internet users who used monetary transactions.

Item		QUESTIONS				Response Values Frequencies	
Original	**Label**		**N**	**Mean**	**SD**	**0**	**1**
Scale = Place Used Computer							
b8ai	PLA01	Work place	66	.89	.310	7	59
b8aii	PLA02	Cyber café	66	.36	.485	42	24
b8aiii	PLA03	Friends' house	66	.05	.210	63	3
b8aiv	PLA04	E-community centre	66	.03	.173	64	2
b8av	PLA05	School	66	.00	.000	66	0
Scale= Main Activities							
b9ai	MAI01	Education	272	.43	.496	155	117
b9bi	MAI02	Office automation	272	.75	.436	69	203
b9ci	MAI03	Other application (i.e. programming)	272	.31	.464	187	85
b9di	MAI04	Game/Entertainment/Multimedia	272	.45	.498	150	122
Scale = Place Used Internet							
c12ai	PUI01	Home	272	.69	.464	85	187
c12bi	PUI02	Cyber cafe	272	.18	.388	222	50
c12ci	PUI03	Work place	272	.65	.478	95	177
c12di	PUI04	E-community centre	272	.00	.061	271	1
c12ei	PUI05	School	272	.01	.121	268	4
Scale = Awareness							
e18i	AWE01	MSC	272	.89	.318	31	241
e18ii	AWE02	Penang Cyber City	272	.51	.501	133	139
e18iii	AWE03	E-Community Center	272	.41	.493	160	112
e18iv	AWE04	PC Fair	272	.83	.379	47	225
e18v	AWE05	K-ICT Mater Plan	272	.24	.429	206	66
e18vi	AWE06	WIFI/Hotspot	272	.62	.487	104	168
e18vii	AWE07	Penang Government Portal	272	.31	.464	187	85
e18viii	AWE08	MYICMS 886 (Malaysian Information, Communication and Multimedia Services 886)	272	.18	.385	223	49

Note: All items used a binary scale with (0=Not relevant and 2=Relevant)

Table 1. (Cont.)

Item		QUESTIONS				Response Values Frequencies		
Original	**Label**		**N**	**Mean**	**SD**	**1**	**2**	**3**
Scale = Skill								
b9aii	SKI01	Education	117	1.62	.598	7	59	51
b9bii	SKI02	Office automation	204	1.61	.564	8	108	88
b9cii	SKI03	Other application (i.e. programming)	86	1.65	.628	7	42	37
b9dii	SKI04	Game/Entertainment/Multimedia	123	1.64	.667	12	56	54
Scale = E- Communication								
c13ai	COM01	E- Communication: E-mail	271	1.23	.509	220	40	11
c13aii	COM02	E- Communication: Chat/Instant messaging	272	2.01	.901	108	52	112
c13aiii	COM03	E- Communication: Internet sms	272	2.29	.867	74	46	152
c13aiv	COM04	E- Communication: Discussion group	272	2.39	.835	62	41	169
c13av	COM05	E- Communication: Video conferencing/Web camp	272	2.29	.893	80	33	159
c13avi	COM06	E- Communication: Internet Telephony	271	2.32	.884	76	32	163
Scale = E- Entertainment								
c13bi	ENT01	E- Entertainment: Download and/or upload digital photos	272	2.05	.843	90	79	103
c13bii	ENT02	E- Entertainment: Audio streaming/download/upload music	272	2.05	.853	92	74	106
c13biii	ENT03	E- Entertainment: Download/play online games	272	2.33	.824	62	59	151
c13biv	ENT04	E- Entertainment: Video streaming/download/upload video	272	2.18	.861	80	62	130
c13bv	ENT05	E- Entertainment: Contest/competition	272	2.66	.640	25	42	205
c13bvi	ENT06	E- Entertainment: Sport/Artist	272	2.35	.788	53	70	149
Scale = Learning								
c13ci	LEA01	Learning: E-learning or online education	272	2.26	.852	72	56	144
c13cii	LEA02	Learning: Childen education content	272	2.60	.717	37	35	200
c13ciii	LEA03	Learning: Assignment	272	2.32	.866	72	41	159
Scale = Non-monetary E-Transactions								
c13di	NMT01	Non-monetary E-Transactions: News/information	272	1.50	.759	180	48	44
c13dii	NMT02	Non-monetary E-Transactions: Information retrieval/search (e.g. Google)	272	1.38	.692	203	36	33
c13diii	NMT03	Non-monetary E-Transactions: Download application software	272	2.06	.846	89	77	106
c13div	NMT04	Non-monetary E-Transactions: Upload&Download from office server	272	2.31	.842	67	54	151
c13dv	NMT05	Non-monetary E-Transactions: Job search/Job applications	272	2.41	.778	49	62	161
c13dvi	NMT05	Non-monetary E-Transactions: Library Services	272	2.56	.700	33	53	186
c13dvii	NMT07	Non-monetary E-Transactions: Creating personal home page/Blogging	272	2.64	.683	32	33	207
c13dviii	NMT08	Non-monetary E-Transactions: Complaint	272	2.76	.557	17	32	223
Scale = Monetary E-Transactions								
c13ei	MET01	Monetary E-Transactions: Government Related Transactions	272	2.24	.880	80	46	146
c13eii	MET02	Monetary E-Transactions: Banking/Finance	272	1.69	.798	142	73	57
c13eiii	MET03	Monetary E-Transactions: Shopping	271	2.33	.860	70	42	159
c13eiv	MET04	Monetary E-Transactions: Investments/Security	272	2.56	.747	42	37	193
c13ev	MET05	Monetary E-Transactions: Utility Payments	272	2.11	.892	94	53	125
c13evi	MET06	Monetary E-Transactions: Gambling	272	2.78	.583	23	13	236
c13evii	MET07	Monetary E-Transactions: Business	272	2.24	.880	50	36	186

Note: All items used a 3-point Likert scale with (1=Never, 2=Seldom and 3=Often). Abbreviations: PLA=Place used computer; MAI=Main Activities; NOI=Not used internet; AWE=Awareness; SKI=Skill; COM=E-Communication; ENT=E-Entertainment; LEA=Learning; NMT=Non-Monetary E-Transactions; MET=Monetary E-Transactions.

Table 2. Item-scale correlations for computer users and internet users who used monetary transactions.

Item			Item-Scale Correlations A									
Original	**Label**	**QUESTIONS**	**PLA**	**MAI**	**NOI**	**AWE**	**SKI**	**COM**	**ENT**	**LEA**	**NMT**	**MET**
Scale = Place Used Computer												
b8ai	PLA01	Work place	.200	.172	.126	.061	.096	.046	.098	.095	.091	.029
b8aii	PLA02	Cyber café	.708	.104	.594	.096	.247	.334	.366	.130	.019	.131
b8aiii	PLA03	Friends' house	.571	.096	.123	-.149	.206	.054	.117	.038	.034	-.043
Scale= Main Activities												
b9ai	MAI01	Education	.188	.710	.119	.249	.628	.176	.288	.477	.249	.051
b9bi	MAI02	Office automation	-.103	.338	.219	.114	.180	.054	-.067	.040	.066	.105
b9ci	MAI03	Other application (i.e. programming)	-.017	.606	.085	.257	.572	.189	.221	.094	.288	.120
b9di	MAI04	Game/Entertainment/Multimedia	.364	.627	.243	.231	.531	.191	.367	.177	.152	.126
Scale =Place Used Internet												
c12ai	PUI01	Home	.108	.027	.416	.096	.142	.206	.206	.077	.108	.315
c12bi	PUI02	Cyber cafe	.684	.175	.444	.121	.193	.167	.270	.120	.061	.016
c12ci	PUI03	Work place	.026	.205	.532	.139	.095	.150	.056	.103	.093	.101
Scale = Awareness												
e18i	AWE01	MSC	-.160	.107	-.053	.443	.139	.092	.118	.112	.157	.102
e18ii	AWE02	Penang Cyber City	.130	.281	.255	.683	.279	.223	.243	.191	.144	.258
e18iii	AWE03	E-Community Center	.035	.178	.103	.631	.206	.102	.164	.318	.233	.077
e18iv	AWE04	PC Fair	.067	.188	.150	.457	.231	.214	.173	.065	.101	.178
e18v	AWE05	K-ICT Mater Plan	.054	.166	.188	.686	.230	.196	.193	.281	.222	.197
e18vi	AWE06	WIFI/Hotspot	-.029	.329	.187	.609	.341	.308	.334	.285	.187	.268
e18vii	AWE07	Penang Government Portal	.123	.300	.162	.720	.327	.178	.243	.234	.203	.196
e18viii	AWE08	MYICMS 886	.079	.264	.223	.698	.338	.416	.387	.188	.251	.280
Scale = Skill												
b9aii	SKI01	Education	.321	.039	.179	.341	.551	.460	.529	.433	.511	.309
b9bii	SKI02	Office automation	.049	.092	.127	.194	.452	.358	.270	.083	.150	.299
b9cii	SKI03	Other application (i.e. programming)	.463	-.108	.278	.396	.436	.506	.446	.235	.444	.390
b9dii	SKI04	Game/Entertainment/Multimedia	.478	.092	.186	.333	.529	.444	.481	.156	.287	.274

Table 2. (Cont.)

Item Original	Label	QUESTIONS	PLA	MAI	NOI	AWE	SKI	COM	ENT	LEA	NMT	MET
Scale = E-Communication												
c13ai	COM01	E-mail	.200	.019	.168	.109	.075	.425	.251	.135	.277	.238
c13aii	COM02	Chat/Instant messaging	.251	.310	.272	.312	.353	.748	.478	.188	.229	.293
c13aiii	COM03	Internet sms	.386	.226	.259	.225	.332	.788	.530	.149	.306	.351
c13aiv	COM04	Discussion group	.265	.236	.335	.300	.321	.840	.505	.143	.296	.397
c13av	COM05	Video conferencing/Web camp	.189	.185	.322	.300	.289	.849	.509	.250	.253	.345
c13avi	COM06	Internet Telephony	.120	.208	.353	.287	.282	.827	.480	.218	.210	.362
Scale = E- Entertainment												
c13bi	ENT01	Download and/or upload digital photos	.361	.317	.253	.328	.343	.436	.764	.182	.267	.229
c13bii	ENT02	Audio streaming/download/upload music	.379	.313	.310	.288	.346	.518	.825	.273	.393	.182
c13biii	ENT03	Download/play online games	.348	.293	.314	.292	.367	.476	.807	.314	.305	.303
c13biv	ENT04	Video streaming/download/upload video	.312	.274	.264	.259	.372	.473	.849	.331	.363	.304
c13bv	ENT05	Contest/competition	.333	.236	.289	.339	.363	.544	.682	.217	.294	.482
c13bvi	ENT06	Sport/Artist	.243	.240	.266	.240	.326	.408	.664	.234	.330	.316
Scale = Learning												
c13ci	LEA01	E-learning or online education	.194	.339	.256	.303	.345	.262	.345	.868	.463	.140
c13cii	LEA02	Children education content	.144	.136	.084	.246	.168	.119	.174	.735	.316	.126
c13ciii	LEA03	Assignment	.140	.365	.168	.300	.374	.169	.294	.835	.447	-.017
Scale = Non-monetary E-Transactions												
c13di	NMT01	News/information	-.037	.185	.110	.136	.203	.090	.194	.308	.610	.072
c13dii	NMT02	Information retrieval/search (e.g. Google)	.050	.140	.114	.153	.181	.132	.169	.277	.549	.036
c13diii	NMT03	Download application software	.034	.219	.161	.215	.296	.316	.303	.324	.743	.163
c13div	NMT04	Upload&Download from office server	.044	.191	.204	.213	.291	.287	.312	.281	.726	.209
c13dv	NMT05	Job search/Job applications	.287	.291	.111	.103	.298	.142	.235	.354	.615	.022
c13dvi	NMT05	Library Services	-.161	.171	.093	.259	.257	.213	.272	.423	.682	.218
c13dvii	NMT07	Creating personal home page/Blogging	.114	.218	.021	.238	.330	.318	.392	.374	.617	.217
c13dviii	NMT08	Complaint	.119	.292	.145	.247	.344	.186	.305	.250	.525	.261
Scale = Monetary E-Transactions												
c13ei	MET01	Government Related Transactions	-.065	.149	.186	.152	.140	.134	.127	.065	.115	.645
c13eii	MET02	Banking/Finance	-.086	-.100	.079	.133	.051	.138	.090	.111	.084	.496
c13eiii	MET03	Shopping	.261	.100	.162	.221	.272	.433	.329	.119	.187	.593
c13eiv	MET04	Investments/Security	.003	.129	.262	.218	.235	.317	.298	.058	.157	.740
c13ev	MET05	Utility Payments	.116	.167	.235	.242	.239	.150	.154	.053	.220	.629
c13evi	MET06	Gambling	.000	.212	.278	.233	.327	.459	.446	-.013	.109	.704
c13evii	MET07	Business	.047	.139	.280	.216	.223	.390	.334	.014	.126	.685

Note: columns PLA–MET are Item-Scale Correlations A.

Abbreviations: PLA=Place used computer; MAI=Main Activities; NOI=Not used internet; AWE=Awareness; SKI=Skill; COM=E-Communication; ENT=E-Entertainment; LEA=Learning; NMT=Non-Monetary E-Transactions; MET=Monetary E-Transactions.

Table 3: Reliability coefficients and inter-scale correlations.

Scale	PLA	MAI	PUI	AWE	SKI	COM	ENT	LEA	NMT	MET
PLA	(1.000)	.235	.672	.065	.360	.357	.442	.192	.085	.121
MAI		(0.331)	.288	.373	.892	.268	.365	.353	.330	.174
PUI			(0.000)	.255	.300	.376	.367	.213	.191	.325
AWE				(0.771)	.425	.347	.376	.349	.302	.315
SKI					(0.901)	.370	.460	.373	.427	.322
COM						(0.855)	.615	.229	.333	.437
ENT							(0.860)	.338	.425	.383
LEA								(0.746)	.507	.098
NMT									(0.790)	.228
MET										(0.751)

Scale internal consistency reliability (Cronbach's alpha coefficient) is presented in the diagonal. Hoyt's Method is applied for item with dichotomous score.
Abbreviations: PLA=Place used computer; MAI=Main Activities; PUI=Place used internet; AWE=Awareness; SKI=Skill; COM=E-Communication; ENT=E-Entertainment; LEA=Learning; NMT=Non-Monetary E-Transactions; MET=Monetary E-Transactions.