Technology Proficiency Self-Assessment (TPSA): Reliability and Validity

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Introduction

The Technology Acceptance Model (TAM) discussed by Davis (1989) identifies two variables that have been defined to be components to user acceptance: perceived usefulness and perceived ease of use. Davis (1989) states that "perceived ease of use and perceived usefulness function as a basic determinant of user behavior" (pg. 320). As users modify their behavior to accept technology, how does it affect their comfort levels when using it? This study examined a technology proficiency assessment for its reliability and validity. In addition, the same assessment was submitted to a participant group to collect data and evaluate how they rate their own technology aptitude.

The instrument used in this study was the Technology Proficiency Self-Assessment (TPSA) (Appendix A). The purpose of the TPSA is to allow participants to self-assess their comfort levels with using technology. The TPSA consists of nine demographic questions and 20 Likert-scale questions. The Likert-scale questions pertained specifically to comfort levels when performing technology tasks.

To disseminate the TPSA, the assessment was imported into Google forms and made available as an electronic survey. The Google form was sent via email-link to a participant group. The form was available for approximately one week. When the form closed, 50 participants between the ages of 29 and 71 had submitted and completed the assessment. At that time the data was exported into an Excel spreadsheet and coded (Appendix B). It was noted that 14 participants were female and 36 were male. Fifty-six indicated that they lived in the state of Texas, US, and 4 indicated that they lived in other US states. When asked about their level of teaching, 33 responded that they were employed as a teacher or administrator, 4 indicated "other", and 13 indicated that they

"don't teach".

Reliability

The data was collected and responses were imported for analysis into IBM's statistical software SPSS. To determine the reliability and consistency of the survey's 20 Likert-scale questions, the first analysis calculated in SPSS was Cronbach's Alpha. According to DeVellis (2012), Chronbach's Alpha has been "widely used" and is strongly linked to the definition of reliability when analyzing internal consistency among aggregated survey questions.

Cronbach's Alpha was calculated using the Reliability Analysis feature in SPSS. *Item, Scale*, and *Scale if Item Deleted* were also calculated during this process. According to DeVellis (2012) and the commonly accepted rule to describe internal consistency using Cronbach's Alpha: .7 or greater is respectable, .8 or greater is very good, and anything greater than .9 is considered excellent. A Cronbach's Alpha score of .941 (Table 1) was revealed for this assessment, indicating excellent reliability.

Table 1

Reliability Statistics

Cronbach's Alpha	N of Items
.941	20

Examination of the *Scale if Item Deleted* table (Table 2) shows that Cronbach's Alpha would remain high even if individual questions were deleted from the assessment. This is a good indicator that the questions are reliable as a group.

Table 2

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
pro1	84.021	189.085	.568	.940
pro2	84.333	180.908	.794	.937
pro3	84.750	178.234	.542	.941
pro4	84.083	187.014	.653	.939
pro5	84.125	185.431	.685	.939
pro6	84.063	187.507	.637	.940
pro7	84.104	186.563	.632	.939
pro8	85.146	171.234	.590	.942
pro9	84.167	183.376	.744	.938
pro10	84.188	183.177	.746	.938
pro11	84.813	176.283	.577	.941
pro12	84.583	170.972	.821	.935
pro13	84.438	180.507	.623	.939
pro14	84.396	177.478	.778	.936
pro15	84.729	179.266	.616	.939
pro16	84.604	176.712	.748	.937
pro17	84.750	173.426	.774	.936
pro18	84.646	174.276	.768	.936
pro19	84.979	175.510	.664	.938
pro20	84.896	175.968	.638	.939

A factor analysis indicated three specific self-assessment factors of relevance (Appendix C). The *principle components analysis* indications that these three factors account for 77% of the variance (Table 3) among the intercorrelations of the 20 question variables.

Table 3

Variance Explained			
Component	Initial Eigenvalues	Extraction Sums of Squared Loadings	Rotation Sums of Squared Loadings

	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	10.696	53.479	53.479	10.696	53.479	53.479	6.875
2	3.455	17.274	70.752	3.455	17.274	70.752	5.348
3	1.272	6.360	77.113	1.272	6.360	77.113	3.199

Factor one pointed predominantly to web use and sending emails. This factor includes seven questions with component ratings scores ranging from .81 to .96. Questions in factor one had the highest level of principle components. Factor two includes five questions with component scores ranging from .70 to .84. This factor connected with technology use while planning, organizing, and collaborating. Factor three indicated principle components scores from .51 to .69. This factor was linked to naming conventions and creating presentations.

It was noted that there were two questions (pro2 and pro11) that overlapped between factors two and three (Table 4). Scores for both questions equally fell into factor two (planning, organizing, and collaborating) and factor three (naming conventions and creating presentations), receiving a score of .59 and .51. The questions were closely examined and determined to belong in the third factor category. To establish reliability, a Cronbach's Alpha was calculated with and without the two questions. Because the question's scores were somewhat low (.59 and .51), my initial impression was that the Cronbach's score would be higher if the two questions were excluded. To my surprise Cronbach's Alpha actually went up when the questions were included. It was also noted that when any of the other items were deleted from factor three, Cronbach's Alpha decreased much less as a whole if the two questions were kept in the factor set. It appears that the two questions actually strengthen factor three. Because of this finding, I chose to

keep the questions in factor three. In doing so, it changed the final Cronbach's score for the third factor from .79 to .82.

Table 4

Rotated Component Matrix[a]

	Component		
	1	2	3
pro6	.966		.168
pro4	.949		.254
pro1	.931		.169
pro7	.888		.320
pro5	.849	.264	.143
pro10	.816	.367	.162
pro9	.813	.342	.194
pro20	.267	.847	
pro15		.845	.211
pro18	.460	.720	.117
pro8		.719	.331
pro19	.154	.707	.301
pro17	.170	.684	.512
pro16	.475	.678	.122
pro11	-.114	.592	.591
pro12	.322	.582	.572
pro2	.421	.513	.513
pro14	.434	.351	.697
pro13	.478	.101	.682
pro3	.256	.170	.675

After reviewing the data in the rotated component matrix (Table 4) and formulating the factor commonalities, a reliability analysis was run for each factor. Factor one, the "web and email" factor, showed a Cronbach's Alpha of .97. Factor two, the "planning, organizing, and collaborating" factor, revealed a Cronbach's Alpha of .86. Factor three, the "naming conventions and creating presentations" factor revealed a

Cronbach's Alpha of .82. All three Cronbach's scores were within the "acceptable" to "excellent" range indicating that each demonstrated internal consistency.

Validity

Dr. Margaret Merlyn Ropp (1999) developed the TPSA instrument. It has been used in other studies and is a validated instrument. The instrument can be found on the Institute for the Integration of Technology into Teaching and Learning (IITTL) website (http://www.iittl.unt.edu/IITTL/).

One-Way Analysis Variance (ANOVA) test comparing gender to the three factors found that males and females responded similarly in all three factors. Both, on average, chose a 4 or above as their response on the TPSA Likert scale. In addition, none of the factors indicated a significant p level. Effect size (Cohen's d) was minutely meaningful. A 0.36 was calculated for the "web and email" factor, 0.27 for "teaching, learning, and collaboration", and 0.36 for "naming conventions and creating presentations" (Table 5). This indicates a small magnitude in the differences between genders.

Table 5

Descriptives (Gender)

		N	Mean	Std. Deviation	Sig. Between Groups	Effect Size/Cohen's d
Web_eMail	Male	14	4.9694	.11454	.334	0.36
	Female	36	4.7857	.69609		
	Total	50	4.8371	.59710		
Planning_Organizing_Colaborating	Male	14	4.3373	.60485	.440	0.27
	Female	36	4.1019	1.06321		
	Total	50	4.1678	.95703		
NamingConventions_Creating	Male	14	4.6786	.55840	294	0.36
	Female	36	4.4028	.90490		

Presentations	Total	50	4.4800	.82660	.

Next, I ran a One-Way ANOVA to see if the "highest degree received" might contribute to discrimination. The p level for "web use and email" and "naming conventions and creating presentations" was not significant. However, the p for "planning, organizing, and collaborating" was educationally significant indicating a p = .015 (Table 6). The mean score for participants with a High School and BA/BS degree was lower than the mean for participants with degrees in the other categories. Both were about one standard deviation lower than the mean response for the rest of the degrees earned. This might suggest that the participants who have a High School or BA/BS degree have less confidence in using technology that relates to "planning, organizing, and collaborating". One explanation could be that there are higher expectations for graduate students, requiring them to use technology more often to plan, organize, and collaborate. Critchley (1988) explains that "as part of the more independent functioning required in graduate school, students need to be able to set realistic goals and time frames for themselves in completing the many expectations they encounter. You must be able to meet deadlines and due dates while producing quality work" (pg.4). The planning organizing, and collaboration expectations of this group would most probably increase to meet these needs. In addition, increased expectations such as "institutional ownership", an unstated expectation that students who are truly committed will spend more time in their departments, may also contribute to developing stronger planning, organization, and collaboration skills with technology (Brus, 2006). This does not explain, however, why participants who chose the "other" category also had a higher mean than the High School and BA/BS graduates. The assessment did not ask participants to indicate what degree

level they had completed if they choose “other”. It would be interesting to include this question and compare responses in future studies.

Table 6

Descriptives (Highest degree received)					
		N	Mean	Std. Deviation	Sig. Between Groups
Web_eMail	High School	3	4.9048	.16496	.523
	BA/BS	14	4.6020	1.08099	
	MA/MS	22	4.9610	.12610	
	EdD/PhD	2	5.0000	.00000	
	Other	9	4.8413	.29833	
	Total	50	4.8371	.59710	
Planning_Organizing_Colaborating	High School	3	3.7407	1.40692	.015
	BA/BS	14	3.5238	1.16243	
	MA/MS	22	4.5657	.62564	
	EdD/PhD	2	4.7500	.35355	
	Other	9	4.2099	.74834	
	Total	50	4.1678	.95703	
NamingConventions_CreatingPresentations	High School	3	4.1667	.87797	.092
	BA/BS	14	4.1071	1.23924	
	MA/MS	22	4.7955	.38294	
	EdD/PhD	2	5.0000	.00000	
	Other	9	4.2778	.66667	
	Total	50	4.4800	.82660	

The significance number in the ANOVA prompted me to group the levels of “highest degree received” and look more closely at the effect size of each grouping. The effect size for the High School and MA/MS group and the High School and EdD/PhD group did indicate an educationally meaningful number. Because of the small sample size, however, this should be considered more interesting than anything significant. Of

worth is the effect size for the BA/BS and MA/MS group. The comparison between these two groups returned an effect size of 1.11617 and appears to be educationally significant (Table 7).

Table 7

	Cohen's d
Between degree groups High School & MA/MS	0.75773
Between degree groups High School & EdD/PhD	0.98394
Between degree groups BA/BS & MA/MS	1.11617
Between degree groups BA/BS & EdD/PhD	-1.4272
Between degree groups BA/BS & Other	-0.7018
Between degree groups MA/MS & EdD/PhD	-0.3626
Between degree groups MA/MS & Other	0.51585

Because I expected that graduate level degrees are related to higher levels of planning, organizing, and collaborating with technology, I ran a 1-tailed correlation analysis (Appendix D) in addition to the ANOVA using the three factors and the variables "age", "years of experience", and "highest degree received". A correlation with a significance level of .039 was indicated between "highest degree received" and "planning, organizing, and collaboration". This confirms the findings of the ANOVA and the relationship between the two.

Summary

The analyses performed on the TPSA confirm that it is a reliable and valid instrument. A Cronbach's Alpha score of .941 verifies internal consistency and reliability. Although there was a significant finding in the relationship between the highest degree completed and "planning, organizing, and collaborating" with technology, there is still a discrepancy

and some question regarding the “other” category. Further investigation is needed to provide clarification on the choice of “other” and how replies correlate with the other submitted responses for this question.

References

Brus, C. P. (2006). *Seeking balance in graduate school: A realistic expectation or a dangerous dilemma?*. New Directions for Student Services, 2006: 31–45. doi: 10.1002/ss.214.

Critchley, Deane L, RN, CS,PhD., F.A.A.N. (1988). What to expect as a graduate student. *Journal of Psychosocial Nursing & Mental Health Services, 26*(11), S4-S5. Retrieved from http://search.proquest.com/docview/1026707550?accountid=7113

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DeVellis, Robert. F. (2012). *Scale Development Theory and Applications*, 3rd edition. Thousand Oaks, CA: SAGE Publications.

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Appendix A

Edit this form

Technology Proficiency Self-Assessment

* Required

Gender *
- ◯ Male
- ◯ Female

Age *

Use the Group and ID assigned to you. If there is no assigned ID, use the last 4 digits of your Social Security Number. *

Years of teaching experience *

Highest degree received: *
- ◯ High School
- ◯ BA/BS
- ◯ MA/MS
- ◯ EdD/PhD
- ◯ Other

Level taught: *
- ◯ Pre-K - Grade 2
- ◯ Grades 3 - 5
- ◯ Grades 6 - 8
- ◯ High School
- ◯ Pre-Service
- ◯ Higher Education
- ◯ Administrator
- ◯ Other
- ◯ Don't teach

Location *
- ◯ Texas
- ◯ Other US state

◯ Outside US

Do you have a computer at home? *
◯ No
◯ Yes

Do you have access to the World Wide Web at home? *
◯ No
◯ Yes

Section Instructions: Select one level of agreement for each statement to indicate how you feel.

1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly Agree

I feel confident that I could...

1. send an e-mail to a friend. *

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

2. subscribe to a discussion list. *

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

3. create a "nickname" or an "alias" to send e-mail to several people at once. *

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

4. send a document as an attachment to an e-mail message. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

5. keep copies of outgoing messages that I send to others. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

6. use an internet search engine (e.g., Google) to find Web pages related to my subject matter interests. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

7. search for and find the Smithsonian Institution Web site. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

8, create my own World Wide Web home page. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

9. keep track of Web sites I have visited so that I can return to them later. (An example is using bookmarks.) *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

10. find primary sources of information on the Internet that I can use in my teaching. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

11. use a spreadsheet to create a pie chart of the proportions of the different colors of M&Ms in a bag. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

12. create a newsletter with graphics and text in 3 columns.

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

13. save documents in formats so that others can read them if they have different word processing programs (eg., saving Word, RTF, or text). *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

14. use the computer to create a slideshow presentation. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

15. create a database of information about important authors in a subject matter field. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

16. write an essay describing how I would use technology in my classroom. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

17. create a lesson or unit that incorporates subject matter software as an integral part. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

18. use technology to collaborate with other interns, teachers, or students who are distant from my classroom. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

19. describe 5 software programs that I would use in my teaching. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

20. write a plan with a budget to buy technology for my classroom. *

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

Thank you for your time.

TPSA created by and used with permission of Dr. Margaret Merlyn Ropp, Assistant Professor of Technology Education, University of New Mexico. For additional information or for permission to use the TPSA in other studies, see http://www.unm.edu/~megropp/ TPSA v 1.1 8/1999

Submit

Never submit passwords through Google Forms.

Appendix B

Code Sheet

1. Gender: (gender)
1 = Male
2 = Female

2. Age: ____ (age)

3. Enter group number or last 4 of social:_____ (ID)

4. Years of teaching experience: ____ (yrsExp)

5. Highest degree received: (degree)
1. High School
2. BA/BS
3. MA/MS
4. EdD/PhD
5. Other

6. Level taught: (levTaught)
1. Pre-K-Grade2
2. Grades 3-5
3. Grades 6-8
4. High School
5. Pre-service
6. Higher Education
7. Administrator
8. Other
9. Don't teach

7. Location: (loc)
1. Texas
2. Other US state
3. Outside US

8. Do you have a computer at home? (homeComputer)
1. No
2. Yes

9. Do you have access to the World Wide Web at home? (www)
1. No
2. Yes

The following items are a likert rating from strongly disagree to strongly agree (1 – 5)

10. send e-mail to a friend. (prof1)

11. subscribe to a discussion list. (prof2)

12. create a "nickname" or an "alias" to send e-mail to several people at once. (prof3)

13. send a document as an attachment to an e-mail message. (prof4)

14. keep copies of outgoing messages that I send to others. (prof5)

15. use an Internet search engine (e.g., Google) to find Web pages related to my subject matter interests. (prof6)

16. search for and find the Smithsonian Institution Web site. (prof7)

17. create my own World Wide Web home page. (prof8)

18. keep track of Web sites I have visited so that I can return to them later. (An example is using bookmarks.)(prof9)

19. find primary sources of information on the Internet that I can use in my teaching. (prof10)

20. use a spreadsheet to create a pie chart of the proportions of the different colors of M&Ms in a bag. (prof11)

21. create a newsletter with graphics and text in 3 columns. (prof12)

22. save documents in formats so that others can read them if they have different word processing programs (eg., saving Word, RTF, or text). (prof13)

23. use the computer to create a slideshow presentation. (prof14)

24. create a database of information about important authors in a subject matter field. (prof15)

25. write an essay describing how I would use technology in my classroom. (prof16)

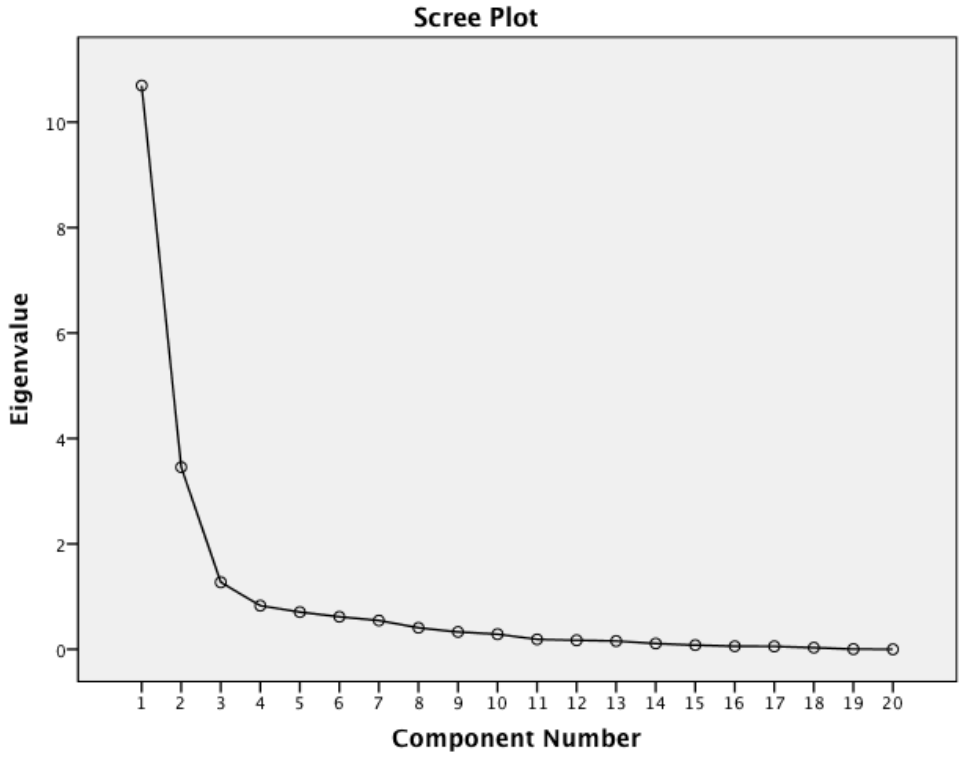
26. create a lesson or unit that incorporates subject matter software as an integral part. (prof17)

27. use technology to collaborate with other interns, teachers, or students who are distant from my classroom. (prof18)

28. describe 5 software programs that I would use in my teaching. (prof19)

29. write a plan with a budget to buy technology for my classroom. (prof20)

Appendix C



Appendix D

Correlations							
		Web_eMail	Planning_Organizing_Collaborating	NamingConventions_CreatingPresentations	age	yrexp	degree
Web_eMail	Pearson Correlation	1	.469**	.665**	.153	.060	.098
	Sig. (1-tailed)		.000	.000	.145	.339	.249
	N	50	50	50	50	50	50

Planning_Organizing_Collaborating	Pearson Correlation	.469**	1	.682**	-.067	.092	.252*
	Sig. (1-tailed)	.000		.000	.322	.262	.039
	N	50	50	50	50	50	50
NamingConventions_CreatingPresentations	Pearson Correlation	.665**	.682**	1	.029	.201	.097
	Sig. (1-tailed)	.000	.000		.420	.081	.251
	N	50	50	50	50	50	50
age	Pearson Correlation	.153	-.067	.029	1	.448**	-.278*
	Sig. (1-tailed)	.145	.322	.420		.001	.025
	N	50	50	50	50	50	50
yrexp	Pearson Correlation	.060	.092	.201	.448**	1	.134
	Sig. (1-tailed)	.339	.262	.081	.001		.176
	N	50	50	50	50	50	50
degree	Pearson Correlation	.098	.252*	.097	-.278*	.134	1
	Sig. (1-tailed)	.249	.039	.251	.025	.176	
	N	50	50	50	50	50	50
**. Correlation is significant at the 0.01 level (1-tailed).							
*. Correlation is significant at the 0.05 level (1-tailed).							