An Initial Development and Validation of Tablet Computer Familiarity Questionnaire

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Abstract: In the past few years, the advances of the tablet computer have captured the imagination of the educators all around the world. The determination of the tablet computer familiarity is an important issue. There were some computer familiarity questionnaires or scales developed in the past studies; however, the questionnaire of tablet computer familiarity was not concerned yet. The purpose of this study was to develop a tablet computer familiarity questionnaire. 409 college students took part in this study. According to the item analysis and the exploratory factor analysis (EFA), there were 32 items under 5 factors in the questionnaire. The Cronbach's alpha coefficient of the questionnaire was 0.916 and the Pearson's correlation coefficient was acceptable. In other words, the reliability was suitable. Further discussion would be given regarding to the questionnaire.
Keywords: Tablet Computer, Familiarity, Questionnaire

1 Introduction

In the past few years, tablet computers (such as Apple iPad, and Microsoft Surface) became one of the most important mobile devices in our daily life, was widely used in the teaching and learning all around the world. Tablet computer has come to be viewed as not just a new category of mobile devices, but indeed a new technology in its own right-one that blends feature of laptops, smartphones, and earlier tablet computers with always-connected Internet, and thousands of apps with which to personalize the experience.

Many policymakers, and the school leaders regarded the tablet computer as an ideal teaching and learning devices and encouraged the teachers and students to apply the tablet computer into the class. Thus, nowadays, many educational institution

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and K-12 school have been using tablets as a cost-effective alternative to the notebook when carrying out the one-to-one technology-enhanced learning[1]. However, some studies indicated that the tablet computer would be the potential issue of the technology in the class and had a negative effect on the performance[2][3] of the teachers and students who were unfamiliar with it. So we should determine the tablet computer familiarity of the teachers and students.

There is not any questionnaire that has been particularly developed to measure tablet computer familiarity and for which validity and reliability have been proven. However, there were some computer familiarity questionnaires or scales developed in the past studies. With the widespread use of the computer in the language examinations (such as TOEFL, GRE), many researchers[4][5] have developed the questionnaires of computer familiarity and studied the relationship between computer familiarity and performance on computer-based TOEFL test tasks[6][7]. In their research, they developed the computer familiarity from four aspects: access, attitudes, experience or use, and related technology. There were 23 items include access or where use computers, self-assessment of attitude and ability, use of and experience with computers, and use of and experience with related technology. Goldberg and Pedulla [8] studied the performance differences according to test mode and computer familiarity on a practice graduate exam. The computer familiarity questionnaire was 31 items dealing with the participants' familiarity with specific computer hardware and software and the frequency with which they used various computer skills. Researchers [9] developed a Computer Aversion, Attitudes, and Familiarity Index (CAAFI). There were 10 items of the computer familiarity aspect. Yu[10] developed the computer familiarity questionnaire (CFQ) with five categories and 33 items. The five categories included assess/availability to computers, attitude to and ability of using computers, with computer-related technology, use of and experience with computers, problem solving when encountering difficulties. In summary, the computer familiarity questionnaire mainly included six aspects: access/availability to table computers, attitude to tablet computers, ability of using tablet computers, use of and experience with tablet computers, with tablet computer-related technology and problem solving when encountering difficulties.

As we know, the tablet computer has many characteristics that are different from the computer and will affect learning and reading performance. For example, the interactivity (multi-touch) and flexibility (easy to get the content) of the tablets will change the paradigm of reading and learning[11]. With significantly larger screen and richer gestured-based interfaces than their smartphone predecessors, the new tablet computers are ideal tools for sharing and getting content, videos, images, and presentations because they are easy for anyone to use, visually compelling, and highly portable. Therefore, it may be not suitable to use the computer familiarity questionnaire or scale directly to determine the tablet computer familiarity. So this study is to develop a tablet computer familiarity questionnaire, and confirm the validity and reliability in order to specify a tablet computer familiarity.

2 Methods

2.1 Participants

The participants of this research consisted of 409 students (287 females and 122 males) in different specialties, and they were all sophomore or junior students from 20 to 23 years olds (M = 22.25) in Beijing Normal University. Since all the students obtained education for twelve years, they do not have any trouble in reading. 135 participants were included in the item analysis, 150 participants were for the exploratory factor analysis, and 124 participants were for test-retest.

2.2 Development Process of the Questionnaire

The Development of Item Pool

We performed an initial literature review about computer familiarity and how computer familiarity influence reading or language exam[5]. By brainstorming, we adapted the items about the computer familiarity and developed the item pool included 46 items in six aspects: access/availability to table computers (6 items), attitude to tablet computers (10 items), ability of using tablet computers (12 items), use of and experience with tablet computers (7 items), with tablet computer-related technology (5 items) and problem solving when encountering difficulties (6 items). A five-point Likert type questionnaire method was used to each item's options, and they were organized and graded as "Strongly agree" (5), "Agree" (4), "Neutral" (3), "Disagree" (2), "Strongly disagree" (1).

Experts Review

First draft questionnaire was prepared to form and examined by three experts. Two are experts in the field of education technology who affirmed the validity of items and the questionnaire form's structure, and one is a linguistic expert who asserted the expression of the questionnaire form was articulate.

Procedure and Data Analysis

Firstly, the first draft questionnaire was examined online by 135 participants. An item analysis was conducted with the aim of determining how well the items discriminate between individuals with high familiarity and individuals with low familiarity. In this version, 46 items were demonstrated in random order and we carried out items validity analysis on the data collected. From the result, we

removed 7 items which could not discriminate differences between individuals. There were 39 items left in the questionnaire with 31 positively formed items and 8 negatively formed items.

Secondly, the revised questionnaire was examined online by 150 participants. The exploratory factor analysis was carried out on the data collected in order to examine the structure of the questionnaire form. Initially, the principal component analysis was conducted to determine the number of factors and the factor structure. In addition, the Promax method was used to do factor rotation in the subsequent analyses, because it is most appropriate method for correlated factors. We removed 7 items.

Thirdly, the final adapted questionnaire was applied to 150 participants in order to implement the reliability. We tested the internal consistency level of the questionnaire. Four weeks later, 124 of the 150 participants completed the retest. The Cronbach's alpha reliability coefficient was calculated to test the internal consistency level. Test-retest reliability coefficient which showed the consistency of the measure from one time to another was calculated, as well.

3 Results

3.1 Item Analysis

With the purpose of determining how well the item discrimination of the items in the questionnaire was, the item analysis was conducted on the data collected with 135 participants. The sample *t* test was carried out to observe the differentiation between the lowest 27% of groups and the highest 27% of the groups after sorting raw scores obtained from the item forms the highest to the lowest. From results, there were 7 items in the questionnaire no significantly discriminated the individuals belongs to the lower and higher groups. So, there were 39 items left in the tablet computer familiarity questionnaire.

3.2 Exploratory Factor Analysis

In this session, firstly, we performed KMO and Bartlett test analyses. The KMO coefficient was .857 the χ^2 from the Bartlett was 3076.460 (p <.001). It suggested that the data was appropriate for the factor analysis. So the principal component analysis was carried out in the subsequent analysis. It can be concluded from the scree plot of the factors' eigenvalues that the questionnaire had a five-factor structure, which the total variance explained was 52.300%. Furthermore, we rotated

the factors by Promax to calculate the factor loads. As a result, there were 7 items (Item 6, 8, 15, 17, 27, 30 and 33) in the questionnaire should be removed because these items cannot meet the requirement that the factor load value should be higher than .40 and the differences of between the factors load values should not be lower than 0.10.

Then, we found that the revised questionnaire with the 32 remaining items had a five-factor structure accounting for 45.381% of the total variance after rotated, and the factor load values ranged from 0.418 to 0.897. Since the value of the variance between 40% and 60% was claimed to be sufficient for social science studies, this questionnaire was within the acceptable limits. The contents of the remaining items in the factors were examined and the five factors were named based on the literature review and the aspects of tablet computer familiarity we came up with before. The factors' names can be showed as follows: ability of using tablet computers (F1), use of and experience with tablet computers (F2), availability to tablet computers (F3), use tablet computers for entertainment (F4) and problem solving when encountering difficulties (F5). The results of factor analysis could be shown in Table 1. Compared with the aspects of tablet computer familiarity we came up with before, the aspect named "computer related technologies" was removed and a new aspect named "use tablet computers for entertainment "was added, we think this difference may be caused by the unique product feature of tablet computer and we will discuss it more in the later discussion.

Table 1 Factor analysis results of the questionnaire as per factors

Statement	F1	F2	F3	F4	F5
2. I think tablet computer is easy to use.	0.437				
3. It is difficult to edit text by tablet computer.	0.418				
9. I do not know how to navigate information by tablet computer.	0.753				
11. I always try to get out by myself when in trouble with tablet computer.	0.571				
14. I am skilled at using tablet computer to get in touch with my friends.	0.642				
18. I'd like to try new apps on tablet computer.	0.460				
24. I do not know how to use tablet computer to watch videos.	0.595				
28. I am skilled with listen to music by tablet computer.	0.659				
32. I know how to download apps by tablet computer.	0.597				
35. I know how to uninstall apps on tablet computer.	0.769				
36. I know how to set up tablet computer into existing network.	0.780				
37. I know how to update the OS and apps on tablet computer.	0.673				
38. I know how to import files into tablet computer.	0.630				
39. I know how to set up personalized settings for tablet computer.	0.855				
1. I usually use tablet computer.		0.719			
4. I always browse the Web on tablet computer.		0.818			
5. I always use e-Reader to read (such as Amazon Kindle).		0.546			
10. I usually use tablet computer to read e-Book.		0.552			

13. I prefer tablet computer to computer.		0.564			
22. I already have a tablet computer.		0.672			
25. I often use tablet computer to listen to music.		0.897			
29. I rarely use tablet computers to watch videos.		0.516			
31. I do not like listening to music by tablet computers.		0.601			
34. I like logging in QQ and microblog on tablet computer.		0.450			
19. I am a tablet computer gaming master.			0.789		
20. I always use tablet computer to play games.			0.773		
23. I prefer to use tablet computer to play games.			0.507		
7. I can get a tablet computer anytime I need.				0.543	
12. I would buy a tablet computer anytime I need.				0.455	
16. I always refer to help docs when being stuck with an app.					0.555
21. I always surf the internet to find out solutions when stuck.					0.427
26. I always try to restart the tablet computer when it crashes.					0.480
Eigenvalue	10.588	3.300	1.524	1.245	1.042
Explained variance	27.148	8.461	3.908	3.193	2.671

3.3 Internal Consistency Reliability

In order to test the internal consistency level of the questionnaire, Cronbach's alpha coefficients were calculated. It was found that the Cronbach's alpha coefficient regarding all of the 32 items in the questionnaire form was 0.916. And the Cronbach's alpha coefficients related to the factors that constituting the questionnaire ranged between 0.543 and 0.900 and can be presented in the Table 2. The internal consistency level is acceptable because it is higher than 0.7.

Table 2 The result of Internal Consistency Reliability analysis

Factor	Number of items	Cronbach's alpha
F1	14	0.900
F2	10	0.869
F3	3	0.758
F4	2	0.653
F5	3	0.543
Total	32	0.916

3.4 Stability Level

We carried out test-retest to calculate the stability level of the questionnaire. The revised questionnaire with 32 items was re-applied to 124 participants after four weeks. The correlations between the scores after each application were tested using the Pearson's correlation coefficient. The results are summarized in Table 3.

Table 3 Test-retest results of the items in the questionnaire

Item	r	Item	r	Item	r	Item	r

1	0.761**	11	0.437**	21	0.468**	31	0.455**
2	0.396**	12	0.593**	22	0.863**	32	0.290**
3	0.607**	13	0.539**	23	0.454**	34	0.579**
4	0.693**	14	0.569**	24	0.456**	35	0.275**
5	0.539**	16	0.331**	25	0.621**	36	0.533**
7	0.654**	18	0.319**	26	0.425**	37	0.596**
9	0.306**	19	0.681**	28	0.566**	38	0.561**
10	0.579**	20	0.575**	29	0.523**	39	0.504**

**p<.001

As shown in Table 3, each item's correlation coefficients varied between 0.275 and 0.863 and each correlation was significant and positive. That is to say that there was a highly positive correlation between the two applications. So it can be said that the questionnaire can make stable measurements.

4 Discussions and Conclusion

In this study, we developed the item pool with 46 items from the literature. According to the results of the item analysis, it was determined that seven items were removed from the item pool, the other 39 items in the questionnaire had high discrimination power. The construct validity was calculated by the principal component analysis. It was showed that all the items gathered into five factors, and each item had been under their factors. The questionnaire's internal consistency coefficients calculated and it was found that the questionnaire could make reliable measurements. Furthermore, the test-retest process, which was carried out after an interval of four weeks, indicated that the questionnaire scores were stable.

The tablet computer familiarity questionnaire had a five-factor structure: (1) Ability of using tablet computers, (2) Use of and experience with tablet computers, (3) Availability to tablet computers, (4) Use tablet computers for entertainment and (5) Problem solving when encountering difficulties. Now, we can define tablet computer familiarity as not only the ability of, use of and experience with, and availability to tablet computer, but also the use of the tablet computer for entertainment and problem solving when encountering difficulties.

Comparing to what we presume according to literature review, the aspect of the attitude to the tablet computer was adapted, some items on attitude to the tablet computer were gather into the other factors (such as Factor 2: Use of and experience with tablet computer), and the others were removed from the questionnaire. It is deserved for further discussion. The experience of the tablet computer is highly related with the attitude; the discrimination to the questionnaire is low. Use tablet computers for entertainment was gather into a new aspect in the questionnaire. As we know, the tablet computer is a kind of consumer devices. It is always used for entertainment. Although it is easy to use for everyone, it needs highly skill for playing games on tablet computer. All the items of the tablet

computer-related technology were removed. It is thought that tablet computer has come to be viewed as not just a new category of mobile devices, but indeed a new technology in its own right-one. In the future, we will do the confirmatory factor analysis (CFA) to confirm the factor structures of the questionnaire.

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References

[1] L. Johnson, S. Adams Becker, and M. Cummins, "The NMC Horizon Report: 2012 Higher Education Edition," The New Media Consortium, Austin, Texas, USA, 2012.

[2] C. Gong, G. Chen, W. Cheng, X. Yang, and R. Huang, "Potential Issues on Initiatively Utilizing E-Textbooks in K-12 Classrooms," in *Advanced Learning Technologies (ICALT), 2013 IEEE 13th International Conference on*, 2013, pp. 314–318.

[3] W. Cheng, X. Zheng, and G. Chen, "Which is the Best for Reading: Paper, Computer or Tablet PC?," in *Advanced Learning Technologies (ICALT), 2014 IEEE 14th International Conference on*, 2014.

[4] I. S. Kirsch, J. Jamieson, C. Taylor, and D. Eignor, *Computer familiarity among TOEFL examinees*. Educational Testing Service Princeton, NJ, 1998.

[5] D. R. Eignor, C. Taylor, I. Kirsch, and J. Jamieson, *Development of a scale for assessing the level of computer familiarity of TOEFL examinees*. Educational Testing Service, 1998.

[6] C. Taylor, J. Jamieson, D. Eignor, and I. Kirsch, *The relationship between computer familiarity and performance on computer-based TOEFL test tasks*. Educational Testing Service Princeton, NJ, 1998.

[7] C. Taylor, I. Kirsch, J. Jamieson, and D. Eignor, "Examining the Relationship Between Computer Familiarity and Performance on Computer-Based Language Tasks," *Language Learning*, vol. 49, no. 2, pp. 219–274, Jun. 1999.

[8] A. L. Goldberg and J. J. Pedulla, "Performance differences according to test mode and computer familiarity on a practice graduate record exam," *Educational and Psychological Measurement*, vol. 62, no. 6, pp. 1053–1067, 2002.

[9] S. E. Schulenberg and A. M. A. Melton, "The Computer Aversion, Attitudes, and Familiarity Index (CAAFI): A validity study," *Computers in Human Behavior*, vol. 24, no. 6, pp. 2620–2638, Sep. 2008.

[10] G. Yu, "Effects of Presentation Mode and Computer Familiarity on Summarization of Extended Texts," *Language Assessment Quarterly*, vol. 7, no. 2, pp. 119–136, 2010.

[11] S. J. Margolin, C. Driscoll, M. J. Toland, and J. L. Kegler, "E-readers, Computer Screens, or Paper: Does Reading Comprehension Change Across Media Platforms?," *Applied Cognitive Psychology*, vol. 27, no. 4, pp. 512–519, 2013.

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