STUDENTS' PERCEPTION OF PAPERLESS ENGLISH CLASSROOM: A CASE STUDY OF A JAPANESE IT UNIVERSTIY CAMPUS

by **Kentaro Ochi**
Keisen University, Tokyo, Japan
k-ochi @ keisen.ac.jp

Abstract

This exploratory study analyzed students' perception of a paperless English classroom to identify participants who successfully used the paperless environment. The participants (n = 179) were tasked to answer a questionnaire. Results only showed a significant difference in the amount of time the participants used their PCs to work on their assignments; however, PCs' prior use was not a factor. The transition from a traditional paper-based classroom to a paperless one cannot be taken for granted. Sufficient instruction on how the digital materials can be accessed is necessary for some learners to embrace a paperless classroom.

Keywords: paperless classroom; technology; student learning

1. Introduction

Going paperless has been a growing global trend. More specifically in Japan, the government has been promoting a paperless society in the form of offering cashless payments (Ministry of Economy, Trade and Industry, 2018) and online tax filing (National Tax Agency, n.d.; Nikkei, 2014). In education, 2020 brought a sudden change in the way classes are taught all over the world. What was still considered relatively uncommon when the data was collected for the current paper in early January 2020 suddenly became the norm, with most universities being held online in Japan (eLearning Strategy Research Institute, 2020). Class materials inevitably became digital, at least in terms of distribution. Currently, schools and teachers are delivering digital materials in many forms. Whether this will continue in the future is still unclear, but the delivery of online classes will most likely accelerate. Therefore, it is essential to understand how learners perceive the use of digital materials in the classroom.

The shift from using textbooks, worksheets, and notebooks in the paper format to having everything done digitally is a significant change. Even though computers have been around since current university students were born, many Japanese students claim that they are not confident in their computer skills (NEC Personal Computers, Ltd., 2017). In this study, responses to a questionnaire were analyzed to explore if the students' lack of confidence in

computer skills affected the perception of those who participated in an in-person English class utilizing only digital materials. The following research questions were formulated for this study:

1. What are the underlying dimensions of 'students' perception of the paperless classroom?
2. What homogeneous groups can be identified from the factors derived in Research Question 1?
3. If demographic differences between the two groups can be identified, what are they?

2. Literature review

2.1. Paperless Classroom

Several studies have explored the academic outcomes of digitalizing classroom materials. Chuang (2014) explored student motivation in a paperless classroom in a Taiwanese science and engineering class in high school by implementing a technology-supported class to enhance students' collaboration and found that students experienced motivation to learn and became more active in class.

Juhaňák, Zounek, Záleská, Bárta, and Vlčková (2019) studied the relationship between the age children first used a computer at and their perceived competence and autonomy in using information and communication technology (ICT). Their findings showed that the earlier a child started using a PC, the higher was their level of ICT competence and autonomy. However, the relationship was not linear, and the authors suggested the pre-school period as a critical period for digital technology acquisition. Moreover, the use of ICT for school purposes did not result in ICT competence or autonomy.

In a large-scale study on 18,344 college students, Kuh and Hu (2001) found that computers and other information technologies benefit students. Specifically, they were "associated with greater levels of educational effort with the effects of C&IT [computers and other information technologies] on gains being largely mediated through the other educational efforts students put forth" (p. 230).

Arney, Jones and Wolf (2012) conducted an entirely paperless software course that was traditionally paper-intensive by having students submit assignments electronically and found that students' satisfaction was higher when using the electronic system. Students reported that their work was more manageable than in paper submissions. Furthermore, it was found that 86% of students preferred to receive feedback electronically.

Enriquez (2010) found that using a tablet computer to create an environment in which technology enhances the interaction between instructors and learners and among learners

improved learning outcomes for the learners. There was a statistical difference in homework and test scores between the classes that used tablet computers and those that did not. The student survey also showed an "overwhelmingly positive student perception of the effects of this classroom environment on their learning experience" (p. 2).

Meishar-Tal and Shonfeld (2019) examined learner preferences for using electronic materials for reading and writing. They found that the reading preference depended on the context of the activities performed. Students preferred to read shorter texts on computers and longer ones on paper. For writing, students responded that they preferred typing over writing in most contexts. Moreover, they reported a gender gap where "boys prefer to read and write on the computer significantly more than girls" (p. 9). They also found a difference between academically weak and strong students; stronger students seemed to prefer computers, although the result does not seem causal.

Hulse (2019) found that using a learning management system (LSM) called *Google Classroom* was well received by the participants studying English in Japan. They found that the LMS assisted their learning by making submissions easier and answered they had few problems despite using the platform for the first time.

Not all studies were in favor of using digital materials. A meta-analysis of 48 studies found that "the impact of digital technologies on learning consistently identifies positive benefits" (Higgins et al., 2012, p. 3). However, the educational outcome was insignificant, and the causal link could not be determined. It was more likely that innovative and effective teachers used digital materials. Their findings showed that what is essential is not what materials were used but how they were implemented.

Runnels and Rutson-Griffiths (2013) caution that the materials need to be modified for a paperless classroom so that they are not merely an electronic version of the paper material. Students need to be able to edit the content on the electronic device to take advantage of electronic material fully.

Finally, in a survey conducted by Ji, Michaels and Waterman (2014), it was found that half of the participants read materials distributed electronically online, whereas one-third printed the document. However, over 80% of the students reported that they could study and learn more if the materials were provided on paper, consistent with previous studies (Daniel & Woody, 2013; Precel et al., 2009; Spencer, 2006). There was a divergence between the students' actions versus their perceived notion of learning advantage. The authors suggest that for the students the low cost of digital materials outweighs the paper's learning advantage.

2.2. Learning Management Systems

Digital materials can be distributed in many ways, including email and other communication platforms. An LMS is among the most popular. An LMS is "a server-based software program that interfaces with a database containing information about users, courses and content" (Pina, 2010, p. 1). These systems can distribute class materials, assess learners' work, and facilitate communication with and among learners online. Other terms are used to describe similar applications, such as course management systems and learning content management systems. Watson and Watson (2007) argue that three terms describe different systems, and a distinction needs to be made. However, according to Pina (2010), these terms are often used interchangeably in journals; thus, this paper will also use the term 'LMS' for the online learning platform. Below is an introduction of the LMS that the researcher used for the study.

2.2.1. *Google Classroom*

Google Classroom is a free LMS service provided by Alphabet Inc.'s Google with G Suite for Education. According to Google (n.d.), it "makes teaching more productive and meaningful by streamlining assignments, boosting collaboration, and fostering communication" (para. 1). The program is designed to integrate well with other Google online products such as *Google Docs, Google Slides, Google Forms,* and *Google Drive*. Assignments and quizzes can be composed, distributed, and assessed on one platform. Student grades can also be kept with functions to set grading categories. It also includes grading features that allow teachers to use matrix grading and a plagiarism checking function called originality reports. The shared setting for materials using Google products distributed through *Google Classroom* is set so that the teacher and the learners can access the same content, enabling users to see the work being done in real-time. Therefore, it is possible to provide feedback while the learners are working on various tasks in class. It is one of the more popular platforms, with more than 100 million active users as of March 2020 (De Vynck & Bergen, 2020).

3. Methodology

3.1. Participants

The participants (n = 179) were students in the six classes taught by the researcher. They were first-year students majoring in information technology at a private university located in Tokyo who completed two semesters of paperless classrooms. A random sampling of participants did not take place because of practical limitations. The current research is a case study, which

provides context-dependent knowledge. Although a particular finding may not easily be generalized, it provides a "nuanced view of reality" (Flyvbjerg, 2006, p. 223), and in mass, results in expert knowledge.

One thing to note relating to the participants is that the department makes it compulsory for all students to learn to program and bring a laptop to school every day. The department policy states that paperless lessons should be administered. Thus, for English lessons, *Google Classroom* is used to manage, distribute, and grade student work. Compared to the average university student in Japan, it is expected that the amount of computer usage would be significantly higher.

3.2. Questionnaire

The questionnaire was administered in late January 2020, which is the end of the school year. The instrument was in Japanese and consisted of 26 questions about the participants' perceptions of the paperless classroom and nine demographic questions (see Appendix A for the translated material). The researcher designed a new questionnaire to ask questions concerning the specific environment the participants were in (i.e., Japanese university students, digital material in every class, learning English). The 25 questions asking the participants' perception used a five-point Likert-scale with one open-ended question, and the nine demographic questions were open-response items. The five-point Likert-scale ranged from 1 "strongly disagree" to 5 "strongly agree." The questionnaire appears to have good internal consistency, a = .89. Exploratory factor analysis (EFA) was used to identify the underlying construct of the participants' perceptions. EFA is used to identify the minimum number of common factors when the researcher does not have a clear hypothesis (Ferguson & Cox, 1993).

4. Results

4.1. Demographic data

The demographic data showed (see Appendix B Demographic Data) an imbalance in the male-female ratio. Of the 179 participants, 148 identified themselves as male, and 30 identified themselves as female (one chose not to answer this question). The imbalance may have contributed to the outcome of the questionnaire.

The average number of years participants had used computers before starting university was 3.62. However, the range was extensive, with some having never used a computer before entering university, while others had 15 years of experience. Also, the amount

of time for which participants used their computer outside the school for their university assignments varied from 10 to 300 minutes per day, with an average of 74.43 minutes (see Figure 1). Similar results were found with the computer usage for non-assignment reasons (e.g., watching *YouTube*, talking to friends, playing games) with an average of 81.31 minutes per day (See Figure 1) with a range of 0 to 420 minutes.

The participants reported having used smartphones on average for 5.74 years. There was high variance in the amount of time smartphones were used, with an average of 81.31 minutes per day for working on an assignment. A notable difference was that participants used smartphones predominantly for non-assignment reasons, averaging 199.11 minutes, as shown in Figure 1.

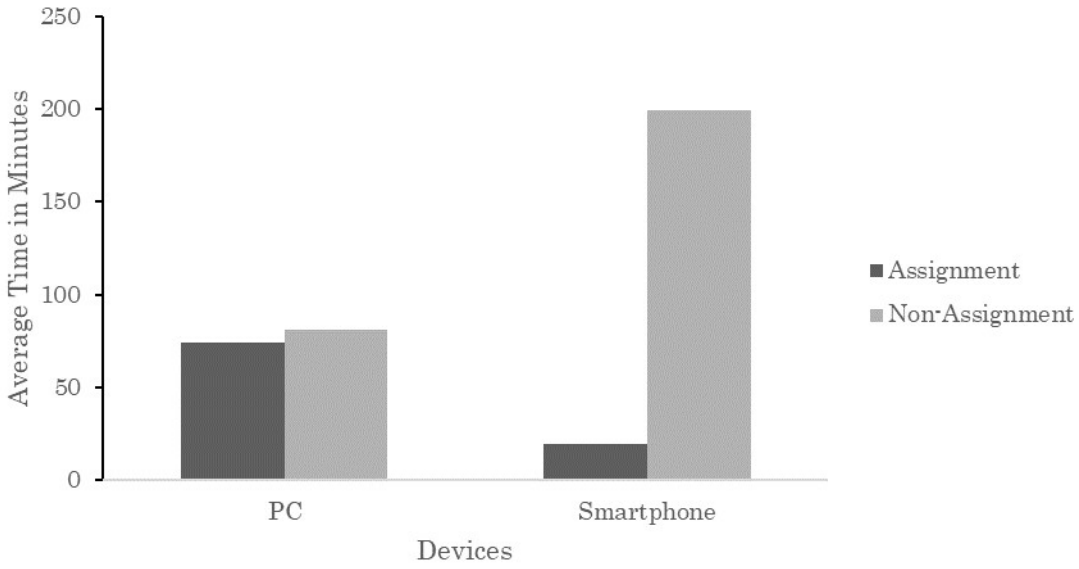

Figure 1. Average time participants spent on their devices

4.2. Perception questions

The 25-item student perception questionnaire item was subjected to exploratory factor analysis. The Kaiser-Meyer-Olkin value was .856, which indicates that the sample is adequate for analysis. Bartlett's test of sphericity was significant (χ^2 (231)= 1884.763, $p < .01$), indicating that the variables were related and adequate for analysis. Three items were omitted due to low factor loading. Table 1 presents the results of the factor analysis. Four factors were identified, which explained 58.61% of the variance.

Table 1. *Rotated Factor Loading*

Items	Factor				Construct
	1	2	3	4	
Q6.	**0.84**	-0.05	0.11	-0.24	
Q8.	**0.79**	-0.18	0.14	0.07	
Q3.	**0.78**	-0.06	0.05	-0.14	
Q7.	**0.70**	0.02	-0.21	0.23	
Q9.	**0.70**	-0.12	-0.03	0.30	
Q1.	**0.64**	0.03	0.02	0.01	Skills
Q4.	**0.63**	0.06	0.03	-0.21	
Q5.	**0.63**	0.23	-0.05	-0.15	
Q11.	**0.63**	-0.13	0.29	0.00	
Q2.	**0.49**	0.23	0.00	-0.02	
Q12.	**0.46**	0.06	-0.26	0.39	
Q22.	-0.12	**0.69**	-0.04	0.00	
Q24.	0.14	**0.62**	0.08	0.11	
Q25.	0.22	**0.59**	-0.04	-0.02	
Q19.	-0.14	**0.58**	-0.10	-0.02	Tools
Q21.	-0.04	**0.57**	0.17	0.03	
Q23.	0.10	**0.55**	0.19	0.07	
Q20	-0.01	**0.43**	-0.02	-0.06	
Q14.	0.07	0.01	**0.74**	0.13	
Q13.	0.10	0.07	**0.72**	0.07	Vocabulary
Q16.	-0.19	0.08	0.06	**0.72**	
Q15.	-0.12	-0.10	0.28	**0.67**	Notes

Notes. Extraction method; maximum likelihood; Rotation method; Promax with Kaiser Normalization

Factor 1 comprised 11 items reported on a 5-point Likert scale that explained 33.5% of the variance with factor loadings from .84 to .46. The questions consisting of mainly items that dealt with reading and writing skills were labeled “Skills.” Factor 2 comprised seven items that explained 11.3% of the variance with factor loadings from .69 to .43. Questions associated with Factor 2 focused on the use and function of digital tools and were thus labeled “Tools.” The third factor comprised two items that explained 7.6% of the variance with factor loadings of .74 and .72. These two items concerned vocabulary learning and were thus labeled “Vocabulary.” The final factor was also comprised of two items, which explained 6.2% of the variance with factor loadings of .72 and .67. Factor 4 was labeled “Notes” as it comprised two questions

asking students' perceptions of how they took notes digitally.

Based on the factor analysis, factor scores were estimated for skills (M = 3.06, SD = 0.83), tools (M = 4.27, SD = 0.52), vocabulary (M = 2.77, SD = 1.00), and notes (M = 2.25, SD = 1.06). These scores were used to conduct Ward's clustering method for analysis, which resulted in two clusters. The first cluster and second cluster consisted of 116 and 63 participants, respectively. The Kolmogorov-Smirnov test of normality showed that the data were not normally distributed. The Mann-Whitney test was conducted using the two clusters as the independent variable and the four factors as a dependent variable to compare the median. There was a significant difference in the participants' perception of all four factors (Skills: U = 1077, p <.001; Tools: U = 1020, p <.001; Vocabulary: U = 1193, p <.001; Notes: U = 2965, p = .037). The mean rank and the sum of ranks for each factor are listed in

Table 2. The first cluster had a higher mean rank for all four factors. Compared to the second cluster, these participants rated their use of digital materials in the paperless classroom higher. This cluster was named the "No Struggle" group. The second cluster, which had a lower mean rank, was classified as the "Struggle" group. These were participants who felt less comfortable using digital tools for learning.

Table 2. Mean rank and sum of ranks for each factor

	Cluster	*n*	Mean Rank	Sum of Ranks
Skills	No Struggle	116	112.22	13017
	Struggle	63	49.10	3093
Tools	No Struggle	116	112.71	13074
	Struggle	63	48.19	3036
Vocabulary	No Struggle	116	111.22	12901
	Struggle	63	50.94	3209
Notes	No Struggle	116	95.94	11129
	Struggle	63	79.06	4981

The Mann-Whitney test was conducted using the two clusters as the independent variable and the demographic questionnaire item as the dependent variable to compare the median. The mean rank and sum of ranks for each question are listed in Table 3. Only the question "PC for assignment use" differed significantly (U = 2717, p = .017). The mean rank indicates that the No Struggle group used the computer more for assignments than the Struggle group.

Table 3. Mean rank and sum of ranks for the demographic data

	Cluster	*n*	Mean Rank	Sum of Ranks
Gender	No Struggle	116	88.43	10169.5
	Struggle	63	91.45	5761.5
Age	No Struggle	116	87.35	9783
	Struggle	63	87.77	5442
PC use history	No Struggle	116	88.55	9918
	Struggle	63	84.15	5133
PC for Assignment use	No Struggle	116	93.96	10617
	Struggle	63	75.54	4608
PC for non-assignment use	No Struggle	116	87.76	9829.5
	Struggle	63	85.6	5221.5
Smartphone use history	No Struggle	116	89.57	10032
	Struggle	63	85.21	5368
Smartphone for assignment use	No Struggle	116	85.95	9712
	Struggle	63	90.38	5513
Smartphone for non-assignment use	No Struggle	116	87.3	9864.5
	Struggle	63	87.88	5360.5

The open-ended question which asked the participants to comment on anything relevant to the paperless classroom yielded 47 responses. They were coded into three categories: (a) positive, (b) negative, or (c) other. Twenty-five responses were positive, 17 were negative, and five were other. A chi-square test was performed to examine the relationship between the cluster and their answers. The relationship between these variables was not significant. The majority of positive responses dealt with convenience, such as not carrying around textbooks, writing by hand, and organizing materials. Negative responses varied. There were remarks on learning style preference, such as writing by hand and writing notes in the margin. Others included inconvenience, such as the need for a computer for all aspects of the class.

5. Discussion

The main objective of this study was to understand the students' perceptions of the paperless classroom. In response to Research Question one, the data from 179 participants suggest four factors as the paperless classroom's underlying perceptual dimensions: skills, tools, vocabulary, and notes. The participants differentiated the use of digital materials for vocabulary learning and note-taking from other English skills such as reading and writing.

The first factor involved the use of digital materials for language skills. The questionnaire result showed that participants, in general, viewed the use of digital materials to be positive. However, similar to the concerns raised by Runnels and Rutson-Griffiths (2013) and Ji, Michaels, and Waterman (2014), responses in the open-ended questionnaire included mentions of preference for paper, especially for reading materials. Some commented that it was easier to read using paper and prefer to use paper and pencil to write.

The second factor concerned the use and function of tools such as computers and smartphones. Participants saw digital materials as a tool to facilitate more collaboration among students and teachers, and it also made it logistically more convenient, as was seen in previous findings (Arney et al., 2012; Enriquez, 2010; Ji et al., 2014). The positive feedback in the open-ended questionnaire echoes this notion with mentions of convenience.

The third and fourth factors had fewer related items on the survey, and the responses to the questionnaire scored lower on the Likert-scale than the other two factors. This suggests that participants' overall perception was not as favorable when using paperless materials for these two factors as the first two factors. The third factor was vocabulary and was categorized independently from other language learning skills. One participant's response in the open-ended questionnaire stated that the lack of handwriting made it more challenging to retain the vocabulary words they learned.

The fourth factor was notes. Like the third factor, some participants raised concerns about not taking notes during class and when reading. In terms of reading material, they wished to make notes in the margins and mark off chunks of sentences using slashes in the text. These actions can be performed on a computer with different applications, but it is unclear whether the participants knew but preferred paper or did not know that it was possible.

Research Question Two asked if there were homogeneous groups that could be identified from the data. Two distinct groups were identified from the four factors. The transition to paperless was not as seamless as was hoped for some participants. Based on the cluster analysis using the factor score, there was a clear divide among participants, with those who reported favorably on the paperless classroom and those who did not. There was a significant difference in the mean rank between the two clusters for all four factors. So the problem was not the particular way digital materials were used, but digital materials in general.

Finally, to answer research question three, demographic data were used to compare the two groups. Unlike the findings by Meishar-Tal and Shonfeld (2019), gender did not play a role in digital materials' preference. Findings by Juhaňák et al. (2019) also did not apply to these participants because computer usage history was not a factor. Prior engagement with a

computer would suggest more familiarity with computers, but that did not translate to a preference for a paperless classroom. Likewise, having a smartphone was not a factor. Time spent on smartphones for non-assignment purposes far exceeded the time participants spent completing assignments on other electronic devices. This is in line with the general trend of young Japanese shifting away from computers to smartphones (Maita, 2020; Ministry of Internal Affairs and Communications, n.d.).

The only demographic data that showed a significant difference between the Struggle and No Struggle groups was the amount of time they spent on a computer for assignment purposes. This could be interpreted to mean that the learners would feel more comfortable by increasing their time working on assignments on a computer. However, Juhaňák et al. (2019) suggested ICT for school purposes did not result in ICT competence or autonomy. Hence, a more likely explanation is that learners who prefer digital materials are those who can work on assignments on computers longer.

6. Conclusion

The current research showed that four factors can be associated with a paperless classroom for this set of learners. The participants viewed learning how to read and write using digital materials as different from learning vocabulary and taking notes. The Clustering analysis revealed that the amount of time spent on assignments using a computer was a factor that differentiated the learners who were struggling with digital materials from those who were not. Namely, those who spent more time on assignments using their computer were often classified as non-strugglers. Other factors, such as a prior history of PC usage or PC usage for non-assignment reasons, did not show a significant difference between the two groups. This suggests that the ease of using digital materials was not a product of familiarity with the use of a computer in general.

The results suggest that, in terms of the practical application of using digital materials to implement a paperless classroom, we cannot assume a smooth transition from paper to paperless simply because the students are familiar with the use of computers, especially for vocabulary learning and note-taking. Instead, we need to show learners how to use digital materials to enhance their learning (i.e., using annotation on a pdf, flashcard apps for vocabulary learning, and podcasts for listening). Introducing how they can use different applications and web resources may be essential even for those who have been using computers for a long time.

The limitations of the study need to be discussed. First, the scale of the study was

small; it only included students from one university, which is by no means a representative sample of learners in general. Second, the data used in the study were obtained from a self-report questionnaire. The data do not necessarily reflect the actual actions of the participants. Finally, the data do not answer what can be done to make the paperless classroom experience better for the students.

Future research should explore ways adept users of digital materials are using computers and other electronic devices. It is also essential to find empirical evidence of the learning advantages of going paperless. As Ji, Michaels, and Waterman (2014) pointed out, lowering the cost, both socially and financially, should not be the only reason for implementing paperless classrooms. A comparison study of using paper versus paperless is warranted.

Even before the COVID-19 pandemic, going paperless has been the trend in our societies, including schools. It is both financially and ecologically cost-effective. However, we need to keep in mind that the shift from paper to paperless is not smooth even for the 'digital natives' (Prensky, 2001).

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Appendix A. Questionnaire Items

Perception Questions

	M	*SD*
1. My motivation towards the learning materials improved because it was distributed digitally.	3.34	1.07
2. My motivation toward class/homework improved by being able to submit it digitally.	3.63	1.21
3. I had more opportunities to be in contact with English because the classwork was given digitally.	3.16	1.12
4. I had more opportunities to be in contact with English because the homework was given digitally.	3.07	1.20
5. I was able to be in contact with more English because it was dealt with digitally.	3.82	1.08
6. I had more opportunity to read English because I read it digitally.	3.12	1.21
7. I had more opportunities to write English because I wrote it digitally.	3.03	1.36
8. I was able to read English more because it was given to me digitally.	2.87	1.14
9. I was able to write more by writing digitally.	2.89	1.29
10. I became faster at reading because I read digitally.	3.35	1.15
11. My reading comprehension improved because I read digitally.	2.67	0.95
12. My English writing speed improved because I wrote digitally.	2.86	1.25
13. I learned more vocabulary by studying them digitally.	2.82	1.14
14. my vocabulary learning speed improved by learning them digitally.	2.72	1.10
15. I think the amount of note I take increased by taking them digitally.	1.98	1.12
16. my note-taking speed increased by taking them digitally.	2.53	1.31
17. I was able to ask questions easier by doing the work digitally.	3.39	1.20
18. it made it easier for me to get feedback from teachers by doing the work digitally.	4.41	0.91
19. It made it easier to use online tools like the dictionary by doing the work digitally.	4.69	0.72
20. It made it easier to submit work because it was digital.	4.18	1.15
21. It made it easier to manage submitted work because it was done digitally.	4.37	1.01
22. It made it easier to collaborate by doing the work digitally.	4.75	0.72
23. I was able to answer more questions by collaborating digitally.	4.08	1.06
24. My productivity increased by taking the class digitally.	3.92	0.96
25. My efficiency improved by taking the class digitally.	4.18	0.91

Appendix B. Demographic Data

	M	*SD*	Min	Max
Age	19.21	1.67	18	23
PC use history in years	3.62	3.79	0	15
PC use outside school a day in minutes (for assignments)	74.43	47.84	10	300
PC use outside school a day in minutes (non-assignments)	81.31	95.00	0	420
Smartphone use in years	5.74	1.71	1	10
Smartphone use outside school a day in minutes (for assignments)	19.61	28.52	0	180
Smartphone use outside school a day in minutes (non-assignments)	199.11	120.75	5	720