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Student uses and preferences of technology in the Japanese STEM classroom – PCs and smartphones

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Abstract

This paper examines student preferences in regards to smartphone usage vs PC usage for academic work both in class and out of class. This research examines the context where students have access to both smartphones and PCs in class, and which one students prefer for which activities. 235 first and second year Science and Technology majors at a university from Japan responded to a survey designed to investigate their preferences in relation to computer vs smartphone usage for academic purposes. This paper will first review pertinent literature on the topic. Then, the results of the survey will be discussed. The results of the survey found no strong preference for either, however they did indicate a slight preference for smartphones in class and out of class in regards to perceived usefulness, but students still slightly prefer to use the classroom PC for tasks that could be done on either technology. Furthermore, students reported their belief that smartphones will be important in their future careers. However, results indicated that they still also recognise the importance of PCs and the ability to use them well. Finally, though students reported using their smartphones in class for non-classwork, most reported that they felt this does not stop them from studying well, and can self-regulate effectively. In concluding this paper, the authors will discuss the implications of the survey results and offer suggestions for teachers who wish to utilize smartphones alongside PCs in their classrooms.

Keywords: Smartphone usage, student preferences, technology, ICT

INTRODUCTION

1.1 *Background*

Computers have become an integral part of life, work, and study. Indeed, Ravizza, Uitvlugt and Fenn [1] explain how some institutions either recommend or require students to have their own laptop computer for study or in class. Other institutions, such as the one in this study, supply students with laptop computers in the classroom for certain classes. The usefulness of computers and skills with computers for students is generally agreed upon and often regarded as essential for their future professional lives. However, a new trend has begun to encroach upon areas that were once the sole domain of the PC in both work and study. The smartphone revolution has delivered a new more portable and lightweight computer. And, with this ubiquitous spread of the smartphone it is little wonder they have begun to impact upon the classroom. However, with this new technological revolution opinions are mixed about the usefulness of it in the classroom. Are they just a distraction, or a tool to employ for more student engagement and learning? This is further impacted by a generational conflict that arises between teachers, who have been adult adopters (or not) of smartphone technology, and students who have known smartphones for most if not all of their lives. Existing research has focused on how students use their smartphones in and out of class, the effects of non-class focused use of smartphones in class, and how

some teachers have utilized smartphones for classwork. However, this pilot study seeks to find out when students have access to both a computer and a smartphone, which do students prefer, and which do they choose for different tasks? Furthermore, do they still see usefulness in PC skills when they can do so much work from their smartphones, and what do they think of class policies regarding smartphones that are dictated by teachers and/or institutions. Below is a review of pertinent literature regarding students and smartphones, followed by the results of a survey to gather student opinions, with a final discussion on the implications of this study and how best to employ smartphones in class if teachers wish to utilize this potentially pedagogical enhancing technology.

1.2 Literature review

The pedagogical benefits of allowing and/or employing smartphone use in classrooms has begun to be reported upon. Amongst this research they report that students use their smartphones as dictionaries, a means to take memos or make reminders, record homework and class or lecture contents, access learning management systems or university portals, download class materials, and as a device to record the audio of classes and lectures ([2], [3], [4], [5]). Essentially, they report that smartphones can act in lieu of PCs when they are absent from the classroom, allowing students to use the Internet for research and work related to class. Anshari, Almunawar, Shahrill, Wicaksono and Huda [3] further report that students utilize their smartphones for academic work outside of class also, and as a means to communicate with fellow class members and teachers about classwork. Thus, research indicates that smartphones are capable of enhancing student learning and study.

Further research has begun to look at how smartphones can heighten student enjoyment and engagement in classes when thoughtful use of them is employed by teachers. Indeed, Robb and Shellenbarger [6] found that nursing students positively evaluated these areas in classes where activities specifically using smartphones were utilized. Furthermore, Menkhoff and Bengtsson [7] reported that students in Singapore positively evaluated activities and courses that explicitly had them use their phones. These activities were not only based in the classroom, but allowed students to travel outside the classroom during class time, whilst also maintaining contact with the teacher and task focus. Thus, adding a new dimension and possibilities to 'in class' work. Menkhoff and Bengtsson [7] assert that phones can not only act as a conduit to students' creativity and be fun to use, but are also pedagogically meaningful when employed thoughtfully by instructors.

The importance of smartphones as something more than just a tool for entertainment and communication has also been discussed. Indeed, Anshari et al. [3] state students will continue to use and access their smartphones in their future professional lives, and thus usage for academic purposes is reflective of their future careers. Therefore, it is argued that teachers and institutions should be more flexible about allowing use in the classroom. Indeed, it has become a fact of working life that smartphones are utilized when away from the PC. Furthermore, smartphones have become an important part of identity creation for young people ([8], [9]). Mohtar et al. [9] discuss how smartphones have become essential to Malaysian undergraduate students and their identity. They explain that smartphone use has become a way for young people to express their social status and express their identity through communication channels often accessed through smartphones.

However, along with said benefits of employing smartphones in class, and the importance they play in the lives of young people, it has also been acknowledged that unpoliced smartphone usage in the classroom can act as a distraction to learning. Gokcearslan, Mumcu, Haslaman, and Cevik [8] discuss how students can 'cyberloaf' in class by continuing non-class smartphone usage in the classroom. Indeed, it has been found that unstructured use of information technologies in class, including PCs, can lead to diminished GPAs due to its effect on the learning processes of students [10]. Interestingly, in this study of 1,839 American college students, Junco [10] found that it was Facebook and text messaging that created a significant difference in regards to a negative impact on student learning. However, other uses such as emailing, searching for content unrelated to class, and talking on the phone were found not to have the same significant implications. Junco [10] theorizes this may have to do with the way students attend to the different activities, some being for social purposes, and others being for gathering information. Likewise, Dietz and Henrich [11] in their simulated lecture with 99 participants found that students who were instructed to text during the lecture performed worse on a test about the lecture contents. Achieving poorer results has also been found true for non-academic uses of PCs in class [1]. Furthermore, Anshari et al. [3] found that the increase in smartphone use amongst students from Brunei negatively impacted hands on skills and the quality of face-to-face interaction.

On the other hand, Beasley, McCain, Millard, Pasley and Western [4], in their survey of 194 students at a liberal arts college in the Midwest of America, found that though most students reported smartphones can act as a distraction and affect their ability to learn they report being able to self-regulate their use when required. Moreover, the students reported that though they are distracted at times to use their smartphones for non-academic purposes, they found these distractions brief respites that helped them maintain focus with heavy workloads or boring content. Furthermore, students reported that they are not distracted by their smartphones when studying for important tests, studying in groups, and during class time. Additionally, students also disclosed that they are not tempted to cheat or use their phones in a dishonest way.

However, when it comes to smartphone use in class a generational conflict between teachers and students can arise ([10], [12], [13]). Whereas students have grown up in a digital online world, many teachers grew up in a world adapting to the use of technology in education. This is particularly pertinent when it comes to teachers' perceived usefulness of PCs versus that of the prevalent modern-day smartphone. With PCs having been much longer established in daily life, whilst modern day smartphones having only been in existence since 2007 [14]. Therefore, this may lead teachers to believe in the inherent usefulness of PC technology above that of smartphones due to familiarity with said technology, and implicate upon the belief in the liability that smartphones have upon student learning. Furthermore, it may impact upon teachers' confidence in using the varied features of smartphones in an educational setting. Indeed, Menkhoff and Bengtsson [7], report that in their course when implementing mobile learning activities students sometimes pointed out more compatible software or applications for the activities.

In relation to the location of this particular study, Thorton and Houser [15] found that even before the prevalence of the modern-day smartphone, Japanese students were prevalent users of the available mobile technology at the time of their study of 333 female Japanese university students. Japanese mobile phones at the time had good quality email and video technology. In fact, Japan were the first mass adopters of smartphone like technology, with 40 million subscribers by 2001 to an NTT DoCoMo developed mobile Internet service called i-mode, which was a precursor to the modern-day smartphone [14]. In their study, Thorton and Houser [15] found that 99% of students used their mobile phones to send emails, but only 43% reported using a PC to do the same. Of the 99% of students that reported using their mobile phones for emailing, 66% stated that they email their peers about classes, and 44% reported that they use their phones for studying. Further to their survey, the researchers found that a focus group of 44 students who were prompted to study vocabulary via an email to their mobile phones three times a week learned more vocabulary than students verbally prompted once a week in class to study throughout the week. Furthermore, 71% of the participants reported preferring the mobile learning method, and 99% reported they felt the mobile learning method was an important method for learning. This study also found that even at the time of the study, 2005, students already desired more educational and academic functions through their mobile devices.

Thus, research into smartphones in the classroom for classwork and non-classwork inform us about the implications of such uses, and the innate importance that smartphones have in students' lives. However, much of it espouses how students use their smartphones in an academic setting, and in particular how useful they can be in-lieu of a computer, or how they act as a distraction. With this in mind this study sets out to find which students prefer to use when they have access to both computers and their smartphones, and how they utilize both in such a situation. It further aims to help expand on the literature about how smartphones can be purposefully utilized in class to enhance student engagement and learning.

1. METHODOLOGY

2.1 *Participants*

A total of 235 university students studying STEM subjects at a university in Japan responded to a survey constructed to measure their preferences and uses of PCs and smartphones for academic purposes. All respondents were studying compulsory English subjects focused on communication or academic writing. Students were either taking first year or second year subjects. 156 (66.4%) of the respondents identified as male, 73 (31.1%) identified as female, with the remaining 6 (2.6%) preferring not to say or select from the binary gender choices given. The vast majority of the respondents were Japanese, with 231 (98.3%) selecting Japanese as their nationality. 155 (66%) students were second year students, 78 (33.2%) were first year, with the remaining responding as third year students. The age of the students ranged from 18 years of age to 23 years of age, with almost half of the respondents, 112 (47.7%),

being 20 years old. 76 (32.3%) responded as being 19 years of age, 21 (8.9%) responded as 21 years old, 20 (8.5%) were 18, with the remaining 6 (1.7%) selecting either 22 years of age or 23 years of age. The mean age of the participants was 19.66 years old.

2.2 *Instrument and data collection*

A survey was constructed to measure student preferences and uses regarding PC and smartphone uses for academic purposes, then administered via Google Forms (see appendix A). The survey primarily contained statements that required a response to a Likert scale. The statements endeavored to investigate 6 categories: in class usage and preferences, in class non-classwork usage, in-class PC and smartphone use, out of class classwork usage and preferences, ability with specific software, and thoughts on teacher rules and restrictions. Each category contained multi-item scales, and were then randomly dispersed (see appendix A) in an effort to avoid leading respondents toward what they might feel were expected answers [16]. The Likert scale consisted of six points:

1 = strongly disagree 2 = disagree 3 = disagree a little 4 = agree a little 5 = agree 6 = strongly agree

A six-point scale was decided upon in line with Dornyei and Taguchi [16], who recommends a scale that ensures some level of position must be selected by respondents. This is particularly pertinent to this study as respondents in Asian contexts are more likely to choose a midpoint response due to cultural considerations (Chen, Lee, & Stevenson, in [16]). Other question types were also included in the survey. Questions that asked students to select different kinds of usages, and open-ended questions were also included to gain a deeper understanding of student responses. Questions to gain basic demographic information were also included. These questions were placed at the end of the survey to help minimize student fatigue and maintain confidence in the anonymity of the survey [16]. However, as this was a pilot study the open-ended questions were found to be problematic, with many respondents failing to indicate whether they were talking about PCs or smartphones in their responses, or commenting off topic. Therefore, this information was not adequate for analysis, and such questions will need to be altered for further studies. The survey was then administered via Google Forms, and descriptive statistics analyzed with SPSS 25. All means and standard deviations are reported upon below to get a general sense of the results. Furthermore, the frequency of each Likert scale response was computed, then collapsed to either disagree (1 ~ 3 on the Likert scale) or agree (4 ~ 6 on the Likert scale) for further understanding of the results. These collapsed findings are discussed where pertinent. All statements have been re-ordered back into their relevant category for discussion below.

2. RESULTS

3.1 *In class uses and preferences*

All respondents (N = 235) selected how much they agreed or disagreed with the following survey statements. The mean results and standard deviations are listed below in Table 1.

Table 1. In class uses and preferences

Survey Item	M	SD
1. My smartphone is more useful in class than the classroom PCs	3.92	1.25
2. The classroom PCs are more useful in class than my smartphone	3.18	1.40
3. In class I like using my smartphone for classwork as much as possible	3.54	1.36
4. For classwork that I can do on my smartphone or PC (such as researching, checking a word etc.), I like to use my smartphone best	3.54	1.21
5. For work that I can do on my smartphone or PC (such as researching, checking a word etc.), I like to use the classroom PC best	3.62	1.36

6. When I cannot use my smartphone in class, I wish I could use it.	3.31	1.21
7. For preparing slide presentations and speeches I like using the classroom PCs best.	3.89	1.40
8. I wish I could use my smartphone for more classwork in class	3.34	1.36

Though results were quite uniform they did indicate a slight preference for the perceived usefulness of smartphones in class over the classroom computers. With the first statement (M = 3.92, SD = 1.25) receiving the highest mean, and some level of agreement (4 ~ 6 on the Likert scale) from 142 respondents, compared to 93 at some level of disagreement (1 ~ 3 on the Likert scale). On the other hand, the second statement about PC usefulness (M = 3.18, SD = 1.40) received the lowest mean, and 140 respondents responding with some level of disagreement, and 95 at some level of agreement. It also had the highest level of standard deviation, indicating that there was more disagreement about the usefulness of PCs than that of smartphones. This may be related to the wider set of tasks that students utilize their phones for, covering everything from classwork to helping simply to remember homework. Whereas the PCs are mostly confined to more formal class work only.

In regards to student preference when given a choice of completing tasks with either a smartphone or PC, a small preference for PCs was found. However, though the means indicate more statements of agreement to both statements, the difference between the means and standard deviations of statements 4 (M = 3.54, SD = 1.21) and 5 (M = 3.62, SD = 1.36) is so small that it is difficult to say a definitive preference was found.

However, students seem relatively satisfied with the amount of time they use smartphones in class, with more respondents in some level of disagreement for statement 6 (126) and statement 8 (127). However, again this does not indicate a strong preference either way.

The lack of clear definitive results either way in the responses may be due to the fact that students have found a balance in employing both technologies when given access to both and see use in both. It could also be impacted by the fact that as indicated by Chen, Lee, and Stevenson (1995, cited in [16]) respondents in Asian contexts avoid taking a definitive stand, and therefore respondents chose the less strong positions.

3.2 *Classroom usage (non-classwork)*

All respondents (N = 235) selected how much they agreed or disagreed with the following survey statements. The mean results and standard deviations are listed below in Table 2.

Table 2. Classroom usage (non-classwork)

Survey Item	**M**	**SD**
1. I often use my smartphone in class for non-classwork (checking and sending SNS messages etc.)	3.11	1.44
2. My smartphone stops me from studying well in class	3.26	1.42
3. My teachers often catch me using my smartphone for non-classwork	2.59	1.16
4. I know it is bad to use my smartphone for non-classwork in class	4.11	1.44
5. It is difficult for me to stop using my smartphone for non-classwork in class	2.88	1.45

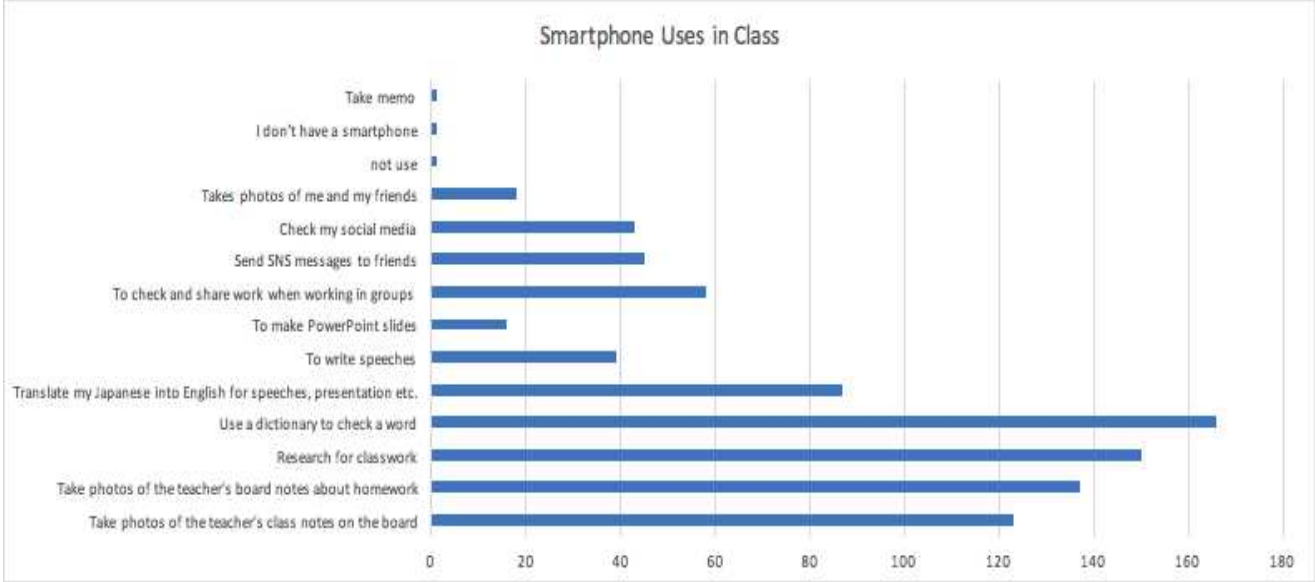
As Beasley et al. [4] and Dietz and Henrich [11] reported most students in this study reported they are able to regulate their smartphone use in class. This is indicated by statement 5 (M = 2.88, SD = 1.45) indicating that on average most students disagree with the statement indicating that it is difficult to stop using smartphones in class. Furthermore, statement 4 (M = 4.11, SD = 1.44) indicates that respondents know they should only use smartphones in class for classwork. Additionally, more students disagree with statements 1 (M = 3.11, SD = 1.44) and 2 (M= 3.26, SD = 1.42), indicating that most students avoid using their smartphones for non-classwork, and believe that their smartphones do not

hinder their study in class. Again, with the standard deviations as high as they are, and no clear strong position to any of the statements there was clearly a certain level of disagreement amongst the respondents about their positions on the statements.

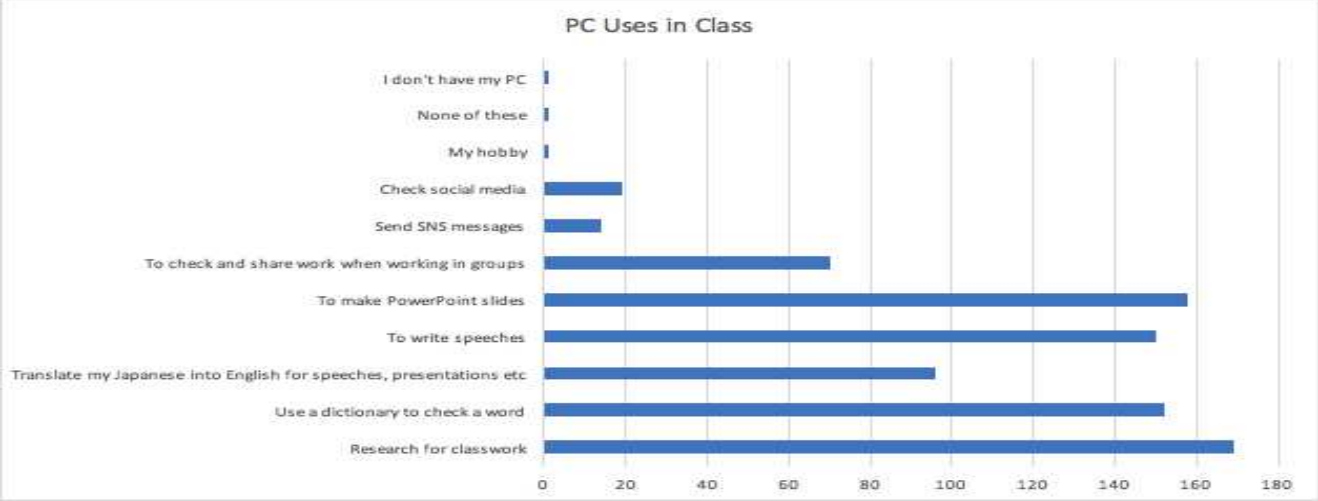
3.3 *Actual class usage - PCs vs smartphones*

To further understand how students actually use their smartphones and PCs in a situation where they have access to both. Students selected from a list of commonly observed and/or reported activities often completed with either technology. The responses are displayed below in Graph 1 for smartphone usages, and Graph 2 for PC usages.

Graph 1 - Smartphones uses in class



Graph 2 - PC uses in class



As can be seen in Graph 1, students choose to utilize their smartphones for the more convenient activities such as taking photos of whiteboards and using applications for quick translations. However, as Mothar et al. [9] theorized students still require PCs for more heavy duty work, such as making speeches and PowerPoint slides. Importantly, activities related to classwork were far more popular in both cases when compared to activities related to non-classwork, such as checking social media. Indicating that students mostly employ accessible technologies in a thoughtful and useful manner when in class.

3.4 *Out of class preferences related to classwork*

All respondents (N = 235) selected how much they agreed or disagreed with the following survey statements about their out of class preferences related to classwork. The mean results and standard deviations are listed below in Table 3.

Table 3. Out of class preferences related to classwork

Survey Item	**M**	**SD**
1. When not in classes, I use my smartphone more than my PC/laptop for homework	3.91	1.35
2. When not in classes, I use my PC/ laptop more than my smartphone for homework	3.53	1.35
3. I use my smartphone to finish online homework such as MReader and TOEIC listening	3.47	1..43
4. I use my smartphone to the classroom homepage for messages from the teacher or shared classwork	4.17	1.31
5. I use my PC to finish online homework such as MReader and TOEIC listening	3.81	1.34

Again, though not a strong indication of preference for either smartphones or PCs was found, a slight preference for using smartphones outside of class for classwork can be seen. Furthermore, agreement was found for utilizing smartphones to access the university portal and class pages. However, with a standard deviation (SD = 1.31) at this level, it does indicate that some students do not use their smartphones for such activities, and others much more so. However, again for specific online or more heavy-duty work, such as MReader and listening activities, a slight preference was found for using PCs.

3.5 *Ability with specific software*

To investigate students' abilities with PC software and their opinions about its importance versus smartphone applications students responded to the statements in Table 4.

Table 4. Ability with specific software

Survey Item	M	SD
1. I can use Microsoft Word on a PC well	4.17	1.29
2. I can use Microsoft PowerPoint on a PC well	4.07	1.33
3. I can confidently email my professors using a PC	3.59	1.07
4. Using software like Microsoft Office on a PC is necessary for my future	4.77	1.19
5. Using email well on a PC is necessary for my future	4.26	1.25
6. I want to use Microsoft Office more confidently on a PC	4.25	1.05
7. Before university I often used PCs for schoolwork	3.00	1.47
8. I can use smartphone apps more confidently than PC software	3.87	1.13
9. I think smartphone use will be important for my future job	4.33	1.19

The results indicate that generally students feel somewhat confident in using the most common forms of PC software and believe in the necessity of PC skills for their future. They also would like to use PC software more confidently (M = 4.25, SD = 1.05). This may be indicative of the fact that before university students didn't often use PCs for schoolwork (M = 3.00, SD = 1.47). Interestingly, students also believe that smartphones will be necessary in their future careers (N = 4.33, SD 1.19). Therefore, teaching students best practice and utilization with both PCs and smartphones could be seen as a benefit to students.

3.6 *Opinions about classroom policies*

Finally, all respondents (N = 235) responded to statements about classroom policies. The means of how much they agreed or disagreed to each statement in regards to the Likert scale are listed below.

Table 5. Opinions about classroom policies

Survey Item	M	SD
1. My teacher says using smartphones for classwork is okay in class	3.34	1.19
2. My teacher bans using smartphones in class at all times	3.10	1.34
3. I think my teacher is too strict about smartphone use in class	3.01	1.19
4. I think all teachers should allow smartphone use in class for classwork	3.39	1.28
5. I think smartphone use in class should be banned	2.89	1.21

Again, no clear opinion about smartphone policy is indicated by these results. With a small majority (N = 129) disagreeing on some level with statement 1 that teachers allow use in class for classwork, compared with those that agreed at differing levels (N = 106). However, an even bigger percentage (though still minimal) disagreed on some level with statement 2 about teachers always banning use (N = 145), compared with those that agreed (N = 90). Respondents however mostly disagreed that teachers are too strict about smartphones in class (M = 3.01, SD = 1.19). This also had the

equal lowest standard deviation for this category indicating that respondents mainly only agreed a little at most. Therefore, indicating some level of satisfaction at current policies in their classes. The most definitive opinion was for statement 5 (M = 2.89, SD = 1.21) indicating that students don't want smartphones banned in class, and believe there is a place for them in an academic setting.

3. DISCUSSION

As can be seen by the results smartphones are a natural part of life for students. They utilize them to complement their learning and study, not only for entertainment and communication purposes. Furthermore, they do this in conjunction with PCs when given access to both, making optimal use of both within their skill sets. However, as indicated by the results students have a slight preference for using their smartphones over PC's in regards to usefulness when given access to both. The uses of PCs and smartphones in class and out of class by respondents indicate that smartphones offer a convenient and portable method for quick easy tasks related to class, more so than the laptop computers they have access to, which they still choose to employ for more heavy work such as preparing slide presentations. Furthermore, students believe there is a necessity for skills with both smartphones and computers for their futures. Therefore, utilizing both smartphones and PCs in class can not only help students prepare for their futures, but enhance their learning both in class and out. Furthermore, students often have limited time in class to study and mobile learning can offer greater chances along with more meaningful and engaging practice if also adopted by teachers [15]. Therefore, considering how to utilize and balance the use of smartphones and PCs for classwork should also take homework possibilities into consideration along with in-class use. Thus, if the potential of effective and balanced smartphone usage is employed by teachers, new methods of engaging and advancing student learning may be unlocked.

However, as also indicated by the results the students are not resistant to regulated use of smartphones in class, but nor do they want smartphones banned from the learning environment. Therefore, clear classroom policies with relevant penalties for unregulated use can help mitigate any off-task usage that may lead to diminished learning. Indeed, though smartphones have the potential to be a powerful learning tool, simple open access can negatively impact upon student learning. Therefore, clear and consistent classroom policies can help mitigate this problem. Classroom policies must be explained clearly and implemented consistently. This should be done through clear statements in class and through classroom policy guides and syllabi distributed to students. Policies should explain expectations of use and have clear penalties outlined. Penalties of off task use can include such things as loss of class points or being marked as absent ([4], [5]). Furthermore, for teachers concerned about more rigorous measures to help ensure on-task use of smartphones only, contracts can also be employed [4]. These contracts can be negotiated with students, allowing teachers insight into how students wish to utilize their phones for class, and signed at the beginning of semester. Thus, giving onus to the student to stay within agreed usages. Furthermore, explicitly educating students on the negative impact that off task smartphone use, and PC use for that matter, can have on learning can help strengthen student motivation to utilize their technologies thoughtfully [4]. This can come in the form of seminars and activities that help educate students about cyberloafing behavior and the negative impact it can have, as well as educating students about the positive impact effective smartphone use can have on academic success [8]. Furthermore, if smartphones are used for group activities peer assessments at the end of task can also help students to maintain thoughtful use of their smartphones during said activities. If policies such as those discussed here are employed they can help inform students and increase their thoughtful use of available technologies. Moreover, it will not only impact on student engagement and learning by allowing them to utilize a tool they see as an extension of themselves, but help students prepare for their future professional careers. As found in the results of this study students rightly believe that smartphones will have a role to play in their future working lives. However, they must also be mindful that different contexts also have their own set of norms and manners [4]. Thus, clear consistent regulated use can help them prepare for such realities.

Furthermore, as discovered in the results of this study students still choose to use PCs for heavier workload tasks and consider them important for their futures. Thus, the emphasis must be put on blended and balanced use in class between PCs and smartphones. When possible, time and practice must be promoted and allocated for work with both technologies. Indeed, smartphones may not be suitable when students need to multitask, such as search for information whilst writing a script, or a larger screen size is required [9]. Therefore, clear instructions on whether an activity can be carried out on a smartphone, a PC, or both is imperative. Furthermore, though smartphones are widespread they are not universal, therefore activities with smartphones in class should be mindful of those that do not own such

technology. Accordingly, group work should be an important consideration when setting up activities that employ smartphones [6]. Furthermore, employing smartphones in class for certain activities can not only improve student engagement and help reinforce correct use of smartphones, it can indeed help them improve utilization of this technology. When shown how to utilize technology for formal learning students are more likely to utilize it for informal learning [17]. Thus, teachers can help guide students to use smartphones in more productive and powerful ways by helping to improve best practice and shift ideas that smartphones are mostly useful for entertainment and quick easy tasks.

The survey results of this study indicate students not only employ their smartphones for entertainment purposes, but as a means to enhance their learning in class. They do this in a mostly balanced way when given access to both PCs and smartphones, employing the most suitable for the task at hand. They also do not wish to have smartphones banned in class, but understand that they must be regulated. Therefore, the authors of this paper assert that balanced smartphone use and activities that utilize current student knowledge of PCs and smartphones can help create an enhanced learning environment that helps to prepare students for their future professional lives, and improve their best practice. However, the negative implications of distraction and diminished attention of unregulated access to smartphones in the classroom must be mitigated by a strong and consistent policy of use, preferably at the institution or departmental level, but most importantly consistently implemented by the classroom teacher.

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Appendix A. Survey administered to students

Student opinions about smartphones and PC use for study

We would like to ask you to help us by answering the following questions concerning foreign language learning. This survey is conducted to better understand student opinions about smartphone and PC use for study. This is not a test so there are no "right" or "wrong" answers and you don't even have to write your name. All answers will be anonymous, so we won't know which ones are your answers. The results will be used for research purposes only. We are interested in your personal opinion. Please give your answers sincerely. Thank you very much for your help.

Please read the sentences below. Then answer how much you agree or disagree with each sentence,

1. (Strongly disagree (全くそう思わない)) 2. (disagree) 3. (disagree a little) 4. (agree a little) 5. (agree) 6. (Strongly agree (強くそう思う))

1. It is difficult for me to stop using my smartphone for non-classwork in class.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

2. In class I like using my smartphone as much as possible.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

3. For work that I can do on my smartphone or classroom PC (such as researching, checking a word etc), I like to use the classroom PC best.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

4. My smartphone stops me from studying well in class.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

5. I wish I could use my smartphone for more classwork in class.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

6. I know it is bad to use my smartphone for non-classwork in class.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

7. The classroom PCs are more useful in class than my smartphone.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

8. Before university I often used PCs for schoolwork.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

9. For classwork that I can do on my smartphone or a classroom PC (such as researching, checking a word etc), I like to use my smartphone best.

Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

10. I think smartphone use in class should be banned.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

11. When not in classes, I use my PC/ laptop more than my smartphone for homework.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

12. My teachers often catch me using my smartphone for non-classwork.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

13. I can use Microsoft Word on a PC well.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

14. I use my smartphone to finish online homework such as MReader and TOEIC listening activities.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

15. I often use my smartphone in class for non-classwork (checking and sending SNS messages etc).
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

16. For preparing slide presentations and speeches I like using the classroom PCs best.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

17. I use my smartphone to check the classroom homepage for messages from the teacher, or check shared classwork.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

18. Using software like Microsoft Office (Word, PowerPoint etc) on a PC is necessary for my future.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

19. I use my PC to finish online homework such as MReader and TOEIC listening activities.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

20. I can use Microsoft PowerPoint on a PC well.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

21. I think smartphone use will be important for my future job.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

22. My smartphone is more useful in class than the classroom PCs.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

23. I want to use Microsoft Office (Word, PowerPoint) more confidently on a PC.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

24. I think my teachers are too strict about smartphone use in class.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

25. I can confidently email my professors using a PC.
Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

26. When I cannot use my smartphone in class (forgotten/ lost/ teacher rules etc), I wish I could use it.

Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

27. Using email well on a PC is necessary for my future.

Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

28. My teachers ban using smartphones in class at all times.

Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

29. My teachers say using smartphones for classwork is okay in class.

Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

30. I think all teachers should allow smartphones in class for classwork.

Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

31. When not in classes, I use my smartphone more than my PC/laptop for homework.

Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

32. I can use smartphone apps more confidently than PC software.

Strongly disagree (全くそう思わない) 1 2 3 4 5 6 Strongly agree (強くそう思う)

Please read the sentences, then choose all the answers true for you. More than one answer is ok.

33. I use my smartphone in class to;

a. Take photos of the teacher's class notes on the board

b. Take photos of the teacher's board notes about homework

c. Research for classwork

d. Use a dictionary to check a word

e. Translate my Japanese into English for speeches etc

f. To write speeches

g. To make PowerPoint slides

h. To check and share work when working in groups (e.g. taking pictures of 1 copy, so all members have a copy on their smartphones to check)

i. Send SNS messages to friends

j. Check my social media (such as Twitter, Line etc)

k. Take photos of me and my friends

l. Other:_____

34. I use my PC in class to;

a. Research for classwork

b. Use a dictionary to check a word

c. Translate my Japanese into English for speeches, presentations, etc.

d. To write speeches

e. To make PowerPoint slides

f. To write speeches

g. To check and share work when working in groups (e.g. emailing something to my classmates)

h. Send SNS messages to friends

i. Check my social media (such as Twitter, Line etc)

j. Other:_____

Please write a sentence or two about why you like to use your smartphone OR classroom PC best in class for classwork

36. Why should all teachers allow/ not allow students to use smartphones in class for classwork.

37. Thank you very much for your participation. We have tried to make this questionnaire as comprehensive as possible but you may feel that there are things we have missed out. Using a few sentences please write any necessary comments below.

Gender: Male Female Prefer not to say Other_____

Nationality: Japanese Other _____

Age: 18 19 20 21 22 23 24 Other_____

Year of study: 1st 2nd 3rd 4th Other_____

Major: _____

THANK YOU!
Thank you very much again for your participation. It is very much appreciated.