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Article

Engaging in mobile phone-based activities for learning vocabulary: An investigation in Japan and Taiwan

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Abstract

Studies investigating the use of mobile technologies when other options are available are still relatively rare in the literature, with the majority of studies requiring that learners use a particular technology, either using their own devices or devices provided by the institution. One exception to this was a study by Stockwell (2010) that examined how learners in Japan perceived the use of mobile phones for language learning and how willing they were to engage in the activities. This study, however, was conducted prior to the spread of smart phones and it focused exclusively on learners in Japan. Thus, the purpose of the current study was to replicate this study, but differed in two ways. First, although it was run in essentially the same environment as the original study, in the current study the majority of learners owned smart phones. Second, the same system was used not only in Japan but also with learners studying at a university in Taiwan. Data were collected through server logs, post-treatment surveys and semi-structured interviews. The results are discussed in terms of the ways in which learners engaged in the activities on their mobile phones, and the effect of the mobile platform on the time taken to complete the activities over the course of the semester. These results were correlated with those from the original 2010 study to identify the potential effect of the smart phone.

KEYWORDS: LEARNER DIFFERENCES; MOBILE PHONE; REPLICATION

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Introduction

The potential of mobile devices to carry out activities for learning both inside and outside of the classroom has been widely cited as a way of making learning more accessible and to allow for more consistent learning opportunities (e.g., Pegrum, 2014). Despite the apparent enthusiasm shown for mobile learning by both teachers and learners, an ongoing problem with mobile learning has been that learners often are reluctant to engage in activities with mobile phones when there are other alternatives, such as a desktop computer. Abdous, Camerena and Facer (2009), for example, found that although learners indicated that they thought listening to podcasts for learning on their mobile devices would be potentially very useful, the majority either chose not to listen to the podcasts at all, or rather downloaded them onto their computers rather than their mobile devices. Stockwell's (2010) study revealed that learners who could complete vocabulary activities on either mobile phones or desktop computers overwhelmingly opted for the latter, despite indicating in a pre-survey that they were interested in completing the activities on their mobile phones. While there were several learners that never attempted to engage in the activities on their mobile phones at all, those that did took longer to complete them on their mobile phones when compared to completing the same activities on a desktop computer. Kim, Rueckert, Kim, and Seo (2013) provided similar results, with learners opting to complete activities on desktop or laptop computers rather than their mobile devices, even though the materials were optimized for a range of mobile devices. The reasons cited by the learners included issues such as the screen size and the drain on the battery, although the study was limited by the fact that the relationship between the type of mobile device and learner engagement were not measured. It is still debatable whether the widespread use of smart phones could play a role in alleviating this problem, but a look at their affordances may shed some light on the issue.

The impact of smart phones on mobile learning

Despite their obvious benefits such as portability and accessibility, mobile devices such as mobile phones do seem to have some limitations that have the potential to reduce their usability in many contexts. Two of the most commonly cited problems have been screen size and input methods (Stockwell, 2008, 2010; Thornton & Houser, 2002), and these features of mobile phones and their applicability to language learning have been the focus of recent studies. For example, research has found that not only do learners feel smaller screens on mobile phones are not appropriate for longer texts (Huang & Lin, 2011), but also that larger screens are more likely to lead to acquisition of content (Kim & Kim, 2012). Given the larger screens on smart phones compared

with older mobile phones, these findings would indicate that smart phones would be advantageous at least in this respect.

Inputting methods have also changed from pre-smart phones, which generally had a keypad and some kind of joystick to allow some degree of navigation, while smart phones have sensitive touch screens. These screens not only allow for smoother scrolling but they also make it possible to type using an onscreen keyboard of a similar layout to that of a computer, rather than needing to type the same key repeatedly in order to bring up the required letter. Suggestions to overcome the inputting problem have included capitalizing upon the features of the touch screen that go beyond the on-screen keyboard, such as touching on correct options or dragging items across the screen (e.g., Uther & Ipser, 2012), using the mobile phone as a mobile flash card (Başoğlu & Akdemïr, 2011) or focusing mainly on audio or video (Gromik, 2010), thereby reducing the need to input anything at all. These ideas certainly have merit, but there are still times when inputting text might be seen as the sensible pedagogical choice, and to that end, avoiding the problem completely might not be the solution. Looking at the improvements in screen size and inputting options on smart phones, however, it might be possible to make the assumption that they would make it far easier and less time-consuming to use than pre-smart phones.

The social context of mobile learning

Another issue of concern with the original study was that it was conducted in Japan, which has been surprisingly slow in its uptake of smart phones (Matsumoto, 2011), and it is possible that this may have contributed to the relative lack of use of the mobile phones for learning. In contrast, a large proportion of work in mobile learning that has appeared recently has come from Taiwan (see Burston, 2013, for an overview of research from 1994 to 2012). These studies are very sophisticated and look at a range of aspects such as memory cycles for learning vocabulary (Chen & Chung, 2008), an intelligent English language learning support system (Chen & Hsu, 2008), an interactive context-aware learning game (Chen & Tsai, 2010) and a context-aware system for listening and speaking (Liu, 2009). A look at the research also reveals, however, that much of this research takes place in relatively controlled environments, where technologies such as PDAs or tablets are provided for the students (e.g., Chang & Hsu, 2011; Chen & Chang, 2011), and learners use these either in classroom situations or outside under conditions that are largely stipulated by the teacher. Learners have generally expressed very positive attitudes towards the mobile-based activities they are assigned to complete, but there are in fact very few studies that investigate how Taiwanese learners engage in activities using mobile devices if other alternatives are available in the same way as has

been shown by other studies such as Stockwell (2010) in Japan and Kim *et al.* (2013) in the United States.

On face value, the social context of Taiwan, it would appear that learners would embrace learning through mobile technologies. Taiwan is a major producer of mobile devices, and companies such as HTC have gained international reputation. Perhaps as a result of this, ownership of smart phones has long been one of the highest in the world (WantChinaTimes.com, 2011), and while of course there are issues associated with how learners perceive mobile technologies as learning tools, it would appear that learners would be willing to use their mobile devices for a range of daily tasks. Japan has been somewhat slower to embrace smart phones, with figures in the same year being as little as 10% of Taiwan (Matsumoto, 2011). Cost has been a reason cited for the slow uptake of smart phones, but in recent years, figures have shown a marked increase; and a survey of university students in 2012 showed that ownership was around 60% (Stockwell, 2012). Thus, while smart phones have become far more commonplace in Japan compared with the past, there still does not seem to have been the general acceptance that has been seen in Taiwan, and it is possible that this might have had an impact on the degree to which they are used in learning contexts as well.

Background to the study

As alluded to above, this replication sets out to determine whether the reluctance to engage in language learning activities evident in Stockwell's (2010) study was – in part at least – as a result of the technology at the time, or whether these attitudes still exist, despite the developments in technology. At the time of the study, pre-smart phones were the standard in technology in Japan, which had limitations in terms of screen size and input methods. Access to the Internet using mobile phones often incurred a cost unless the students opted to use a free-access plan, which some, but not all of the students chose. The original 2010 study was informative, but at the time none of the learners possessed smart phones, which may have had an effect on how students perceived the technology for their learning and other purposes. In addition, the original study was carried out solely in a Japanese context, and it was thought that data from a different context – in this case Taiwan – would help provide a wider perspective. Given the fact that smart phones were adopted far more rapidly than in Japan, it was thought that the comparison with Taiwan would make it possible to see if the view towards smart phones in general had an impact on the way in which they were used for learning purposes. The replication was intended as, using Porte's (2013) distinction, an approximate replication, in that it was largely the same as the original 2010 study. The current study was conducted in two parts with a common methodology, the first in Japan and

the second in Taiwan. The software from the 2010 study was updated and optimized for smart phones. In the same way as the previous study, the study also considered the time taken to complete the activities (as measured over the period investigated), the scores achieved, and the patterns of mobile phone usage compared with PC usage. The study also sought to examine learners' views towards mobile learning to determine if there has been a change in perspective of mobile phones as learning tools. As a replication of the 2010 study, the same three research questions were posed, as follows:

1. Are there differences in the scores achieved in activities completed on mobile and PC platforms?
2. Are there differences in the time required to complete the activities on mobile and PC platforms?
3. Do learners improve in speed and scores over time on each platform?

In each case, if differences were found, the ways in which they differed and the possible causes were examined. As with the previous study, further information about the patterns of usage and learners' perceptions of using the two different platforms were also measured.

Method

Setting

The study was conducted with a total of 160 learners in two individual cohorts, one in Japan and the other in Taiwan. The same teaching materials were used in both cohorts, and the teachers of both cohorts conferred in advance of the study to maintain consistency across the cohorts as much as possible, ensuring that the materials were used in the same way. A commercial textbook was used with listening resources being made available to both cohorts through the same Moodle, operated by one of the authors. Vocabulary activities were created to support the textbook materials, and to provide learners with an opportunity to improve upon their vocabulary. This was not only to assist learners develop their general lexicon, but also to help them prepare for weekly vocabulary quizzes. The same mini quizzes were held in both cohorts, and although there were different weightings provided in each cohort, grades were awarded to learners for completing the online vocabulary activities. A post-survey revealed that smart phone ownership for the Japanese learners was around 74.3%, with 29 out of the 39 students owning smart phones. Of the 125 learners in Taiwan, 109 had smart phones, which came to 87.3%, a figure little higher than that of the Japanese learners. Around 40% of the Japanese learners and 45% of the Taiwanese learners suggested that they had used their phones for language learning before, but this was limited almost exclusively to

online dictionary use. There were, however, two Japanese learners and three Taiwanese learners who responded that they used BBC or CNN apps or websites for listening, and a further two Taiwanese students used an app called Dr. Eye, a Chinese-English English-Chinese dictionary which includes a word list function and text-to-speech (TTS) capabilities which they indicated they used for pronunciation.

The Japanese cohort

The learners in Japan were enrolled in a compulsory first-year English-language subject in the School of Law at Waseda University, Tokyo, which focused predominantly on improving listening skills and vocabulary. The Japanese cohort was made up of two intact classes in 2013 coming to a total of 39 students. Both classes were taught by one of the authors. The classes were not streamed, and learners were randomly assigned at the beginning of the academic year by the faculty's student affairs office. Learners were all aged between 18 and 21, and were almost all fresh high school graduates. Learners had reasonable syntactic and lexical knowledge of English, with TOEIC scores ranging between 450 and 650, although the majority was at the lower end of the range. The learners were generally quite motivated to achieve high scores in the subject in order to maintain their Grade Point Average to enable them to enter the graduate law school, but attitudes towards English were mixed.

Classes were held once a week for 90 minutes a week over a 15-week period, and class time was mostly dedicated to completing listening and speaking activities along with weekly vocabulary quizzes. The vocabulary activities were included as part of the assessment for the subject (10% of the overall score for the subject), with a score of 10 being awarded if all activities were completed by the end of the semester. The weekly quizzes were based on the vocabulary activities and the listening that was carried out in class, and with a total of 20% being assigned to the ten quizzes. In addition to the vocabulary and listening activities, learners were asked to give presentations in English based on the topics covered in the videos in the latter half of the semester.

The Taiwanese cohort

The Taiwanese learners were enrolled in two compulsory first-year English-language subjects in the Department of Applied Foreign Languages at Chia Nan University of Pharmacy and Science, Tainan. The first subject aimed at improving pronunciation and listening, and the second on expanding learners' vocabulary. The study was conducted in 2013 over a single 18-week semester with three individual classes (two pronunciation classes with 32 and 30 students respectively, and one vocabulary class with 63 students), coming to a total of 125 learners. Four learners did not participate in the classes, however,

so only 121 learners were included in the study. All three classes were 100 minutes per week in duration and were taught by one of the authors. Participants were mostly university freshmen and were all aged between 18 and 21. Learners were generally of a pre-intermediate level, and about half of the learners were motivated to achieve high scores in the subject in order to enable them to pass the threshold of graduation. Learners were given a mark of 20% for completing the vocabulary activities with a further 10% for the online quizzes. A different proportion was assigned to the activities than the Japanese cohort, as the teacher in Taiwan believed that placing a higher weighting on the activities would encourage the learners to engage in them more actively, which would result in improved performance on the weekly vocabulary quizzes. Completion of the vocabulary activities and quizzes was required to receive the overall 30% of the subject. In addition to the listening activities in class, the classes also involved other activities using teaching materials determined by the department, meaning that the class was divided into two parts, the first part using the textbook used in the Japanese cohort, and the second part using materials from the department. Around 50 minutes of each class was dedicated to the learning materials described in this study while the remainder was spent on the other materials.

Vocabulary activities

The vocabulary activities used were based on the activities previously described in Stockwell (2010, 2013), but they were updated to make them more appropriate for use on smart phones, including adapting to screen size through determining the device and browser used. The previous mobile version was retained to cater for those students who did not use smart phones. The vocabulary activities integrated into Moodle, where learners could access the audio of the videos covered in class, as well as other resources that were designed to assist them in learning. The system was tested on pre-smart phone devices as well as on iOS and Android devices, and it worked satisfactorily on all operating systems. Learners could put a shortcut on their home screen of their smart phones which enabled them to get straight into the system without needing to go through the main Moodle login page.

As the features of the system have been described in detail in the earlier study, only the main features are provided here. In short, the system provided vocabulary activities to learners based on the materials used in class, initially providing recognition activities to allow the learners to see the new vocabulary items in context, followed by production activities where learners were required to write the items. Recognition activities included selecting the correct word to fit into sample sentences and matching a word to the appropriate English meaning. Production activities followed essentially the same format,

but rather than selecting from a range of options, learners were required to write the word in the appropriate tense to match the context. One point that was different from the system described in Stockwell (2010) was that because it was not possible to get the Chinese translations for the system ready on time, activities that related to the L1 were dropped from both the Japanese and Taiwanese learners to maintain consistency. A key feature of the system was that it kept a profile of each individual learner, and presented vocabulary to the learners based on whether or not they answered questions correctly. Words that the learner appeared to be having difficulty with were provided more frequently than those that were deemed to be 'known' to the learner, so that learners could focus on those words with which they were having trouble. A further feature of the system was that push notifications could be activated if the students wished, through which word lists and reminders to use the system could be sent to users' email accounts.

Learners were told that they could complete the vocabulary activities using a desktop computer (PC), their mobile phone, or any combination that they wanted to during the semester. Learners were free to use either their mobile phones or computers, and activities completed on either platform were recorded in the database in exactly the same way. They also informed that they could switch between platforms as they saw fit, and could even start a lesson on one platform and complete it on the other if necessary. An explanation on how to use the activities was given in the first class in the semester in both cohorts, where learners were shown how to log in and complete each activity type. Time was also spent on ensuring that learners understood how to complete the activities, and learners were given the opportunity to ask questions about how to use the system on both the PC and the mobile platforms in both the first class and in subsequent classes. All participants in both cohorts were told that data would be collected and used for research and further development purposes, but that records of their scores could not be linked to their identity. Specific details of the two cohorts are listed below.

Data collection and analysis

As with the initial Stockwell (2010) study, data were collected primarily through server logs that were kept by the system, recording information about the platform and operating system of device students used to complete an activity, the lesson number, the type of activity, the starting and finishing times of the activity, and the score attained for the activity. As with the earlier study, due to the range of extraneous variables, the objective of the study was not to determine whether the vocabulary activities were linked to vocabulary acquisition, but rather the main purpose was to determine how the learners engaged in the vocabulary activities. In order to shed

light on details that could not be seen through the numerical data from the server logs, a post-treatment survey was also administered, along with semi-structured interviews with a small number of volunteers (four volunteers in Japan and 12 in Taiwan), and observation notes by the researchers in charge of each cohort. Due to space limitations, these results have not been presented in detail in the current study, but rather have been used to support the server log data.

The combined server logs in the current study exceeded 50,000 entries, including detailed reports of the platform used to carry out activities, the amount of time taken to complete them, the scores achieved on each platform, and the total number of activities completed by each learner. Patterns of usage were also analyzed to determine whether learners carried out the activities consistently as expected by the teacher, or whether they were carried out in bursts. Comparisons between the two cohorts were made to determine if there were differences in the two environments. The results are presented below.

Results

The results showed that there were some differences in the patterns of usage of the vocabulary activities compared with the previous study, and also that there were differences between the Japanese cohort and the Taiwanese cohort, as can be seen in Table 1. Figures for those who chose not to use the mobile phone at all (0%) and those who used the mobile phone for all activities (100%) are marked separately. One of the most striking findings was that the majority of the Taiwanese users opted not to use mobile phone at all, with 94.2% of the learners not even trying to use the activities once, compared with 38.5% of the Japanese learners. The figure of 0% indicates that the learners decided from the outset not to use the mobile phone to complete the activities. This contrasts with the learners who used the mobile phone for up to 20% of the activities, which would include those learners who did indeed try to use the mobile phone, but then decided that they preferred to use a PC rather than their mobile phone. This figure was 17.9% for the Japanese cohort and 5.7% for the Taiwanese cohort. These might be considered as those learners who considered the mobile phone for learning, but decided based on their experience that the PC was more suitable for them. The results indicated that eight (20.5%) of the 39 Japanese learners used the mobile phone for more than 60% of the vocabulary activities, with six learners (15.4%) using their mobile phone for more than 80% of the activities. This is a slight increase when compared to the figures from the 2010 study, where 11.1% of learners used their mobile phones to complete over 80% of the activities in 2009.

Table 1: Percentage of activities completed on mobile phones in each cohort (*N* = 160)

Percentage of Activities Completed on Mobile	Number of Learners by Cohort	
	Japan	Taiwan
100	2 (5.1%)	0 (0%)
81-99	4 (10.3%)	0 (0%)
61-80	2 (5.1%)	0 (0%)
41-60	2 (5.1%)	0 (0%)
21-40	2 (5.1%)	0 (0%)
1-20	7 (17.9%)	7 (5.7%)
0	15 (38.5%)	114 (94.2%)
n	39	121

There were also some differences in the scores and the amount of time taken to complete each activity on the mobile and PC platforms. The results for the Japanese cohort and the Taiwanese cohort have been presented separately as there appeared to be very different patterns evident in both of them. As described earlier, there were originally five activity types in the study in 2010, but the translation activity was dropped from the system for the present study, as it was not possible to get the Chinese translations ready in time before the study was started. In order for comparisons with the previous study to be made, the original names of the activities have been used here as well, with Activity 3 (matching an English word to its Japanese meaning) being omitted. Activities 1 and 2 were recognition activities, where Activity 1 was a multiple-choice activity where learners chose the appropriate word to fit into an English sentence and Activity 2 was a matching task where learners matched a word to its English meaning. Activities 4 and 5, in contrast, were production activities where learners wrote down the appropriate word for an English sentence (Activity 4) or wrote the word for an English meaning (Activity 5).

Figure 1 shows the differences in the scores achieved on the PC and on mobile phones, and revealed that learners actually scored higher on the mobile phone than the PC for the two recognition activities, but that they scored a little higher on the PC for the production activities than on their mobile phones. This contrasted with the results from the 2010 study, where learners scored marginally higher on PC for all activities except for Activity 4. The results for the Taiwanese learners (see Figure 2), however, more closely resembled the patterns from the 2010 study, with learners scoring slightly higher for Activities 1 and 2 on PC, but almost the same for Activity 4. In contrast, there is a marked drop in the score for Activity 5, with a difference of around 20% compared to the difference of around 5% seen in Activity 1 and 2.

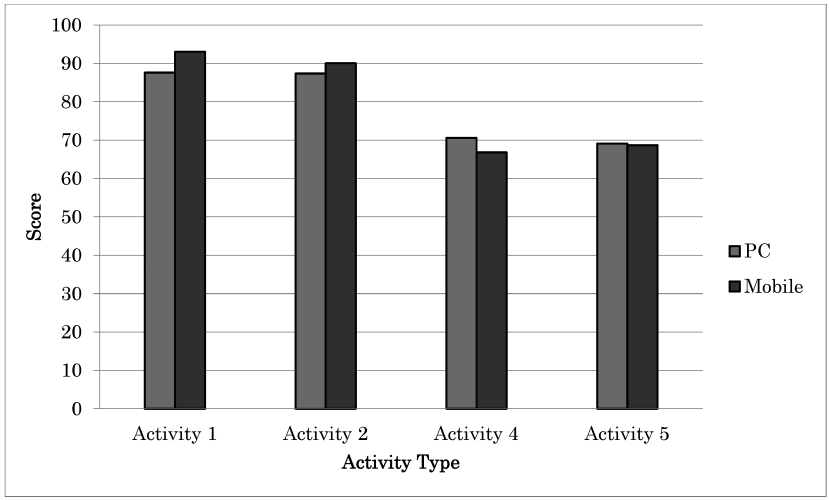

Figure 1: Scores achieved for each activity on both PC and mobile phone for the Japanese cohort (*n* = 39)

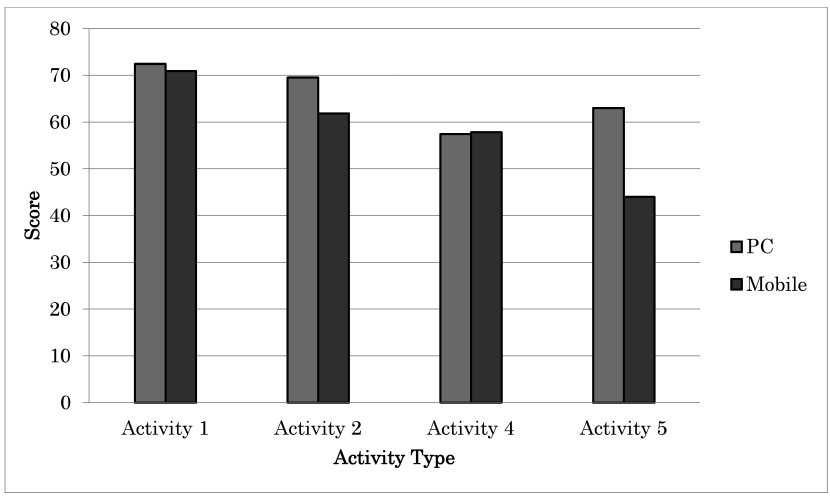

Figure 2: Scores achieved for each activity on both PC and mobile phone for the Taiwanese cohort (*n* = 121)

As can be seen in Figure 3, the difference between the amount of time spent on the activities on PC and mobile phones for the Japanese learners was quite pronounced, averaging around 0.8 minutes (48 seconds) longer on mobile phones, but this was somewhat reduced compared to the 2010 study, where the difference was around 1.4 minutes (84 seconds).

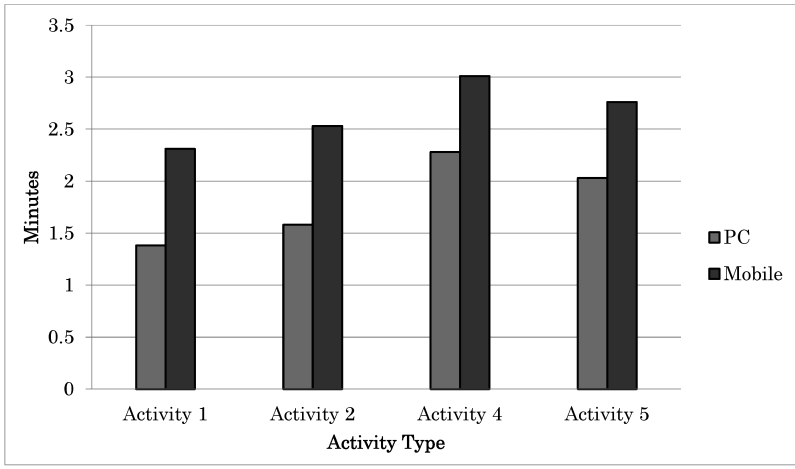

Figure 3: Time taken for each activity on both PC and mobile phone for the Japanese cohort (*n* = 39)

In contrast, for the Taiwanese learners (see Figure 4), the difference was much smaller, averaging around 0.3 minutes (18 seconds). For Activity 4, however, learners took less time to complete the activity on their mobile phones than on the PC, but a look at the records showed that there were very few instances of the mobile phone being used, and in fact, there were also blanks in the responses, so it is likely the learners attempted the activity but gave up before completing it. This was also confirmed by the relatively low score achieved compared with the other activities.

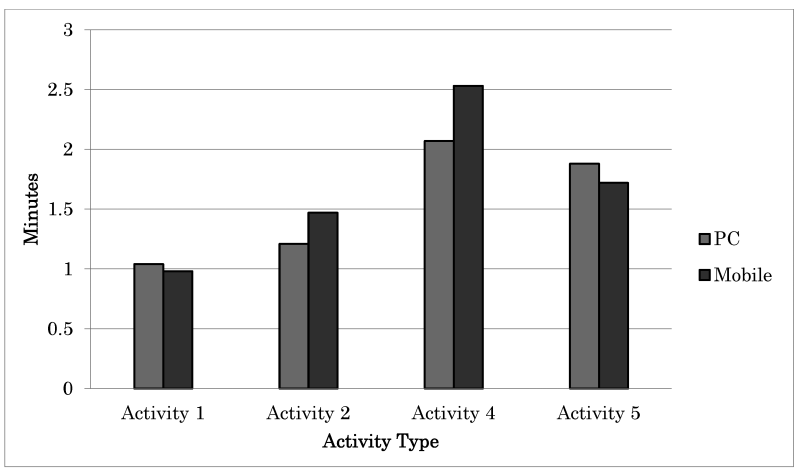

Figure 4: Time taken for each activity on both PC and mobile phone for the Taiwanese cohort (*n* = 121)

An aspect of the current study that was of interest was the way in which the learners engaged in the activities over time. In the 2010 study, this analysis was performed by searching for clusters of mobile phone usage to determine whether learners used the mobile in short bursts or whether they accessed the activities for extended periods. This analysis was also carried out in the current study as well, and very similar patterns were found for both the Japanese learners and those Taiwanese learners who used their mobile phones for the activities, with some learners opting to do three or four activities in spare moments, and others who appeared to carry out the activities for longer periods. The majority of learners did, however, seem to carry out several activities in one block, and there were very few instances of learners completing just one or two activities on the mobile phone at a time.

In this study, the patterns of usage of the mobile phone across all of the ten units covered in the semester were also analyzed. For this analysis, only those students who actually completed activities on their mobile phones were included. The results showed that there were very different patterns exhibited by the Japanese learners (see Figure 5) and the Taiwanese learners (Figure 6). For the Japanese learners (n = 24), there was an initial higher period over the first two units, but this dropped off slightly from the third unit, followed by a steady climb until the eighth unit, after which mobile phone usage dropped off. It was expected that this was likely caused by the fact that learners were required to use PCs for completing other work towards the end of the semester such as essays and other reports, and as a result they just completed the activities while they were using the PC. Discussion with the learners about this revealed that this was indeed the case, and that learners preferred to use the PC because they were using it for other things.

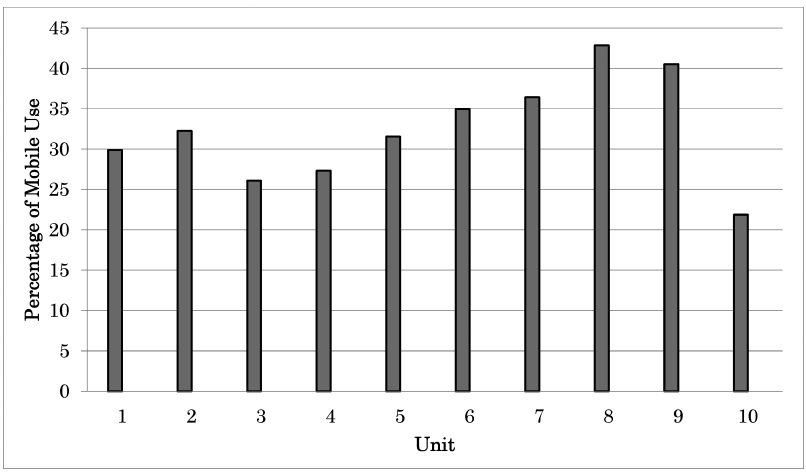

Figure 5: Percentage of activities carried out mobile phone for each unit for the Japanese cohort (n = 24)

The patterns of usage for the seven Taiwanese learners who used their mobile phones to complete the activities are shown in Figure 6. It appears the learners tried the activities somewhat cautiously in the beginning, but there was a larger proportion from the third unit, contrasting with the drop that occurred at this point for the Japanese learners. Oddly, there was no mobile phone use for the fourth unit, but there was declined usage over the fifth through seventh unit, after which time, none of the learners used their mobile phones to complete the activities. Thus, where we see a gradual increase in mobile phone usage in the Japanese learners, the opposite trend appears to be evident in the Taiwanese learners.

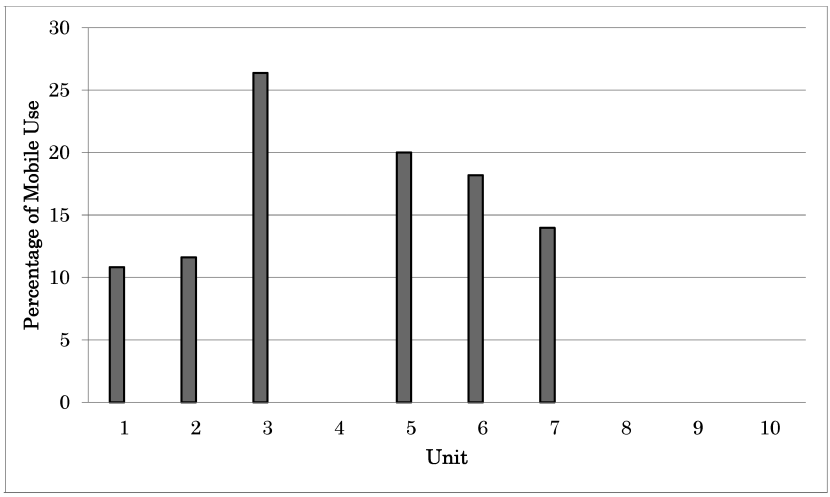

Figure 6: Percentage of activities carried out on mobile phone for each unit for the Taiwanese cohort (*n* = 7)

Finally, the effects of using the activities over time were also investigated. The scores achieved by the Japanese and Taiwanese learners with the activities and amount of time taken to carry out the activities on each platform were investigated, as is shown in Tables 2 and 3 respectively. Only those learners who completed activities on both platforms were included in the analysis below.

As can be seen in Table 2, there appeared to be a general increase in scores achieved on the PC over the ten units for both the Japanese and Taiwanese learners, but this seemed to be less evident in the scores of the activities carried out on the mobile phone, which was markedly higher than the PC for the first units. This may have been due to a novelty effect in completing the activities on the mobile phones where learners spent more time in thinking through the possible responses than on the PC. This appears to be supported to some degree by the time taken to complete the activities, as shown in Table 3.

Table 2: Scores achieved in the activities for each unit on mobile phone and PC for the Japanese and Taiwanese cohorts

Japanese Cohort (n = 24)										
Platform Used	Unit									
	1	2	3	4	5	6	7	8	9	10
PC	73.2	76.5	74.9	81.6	82.9	83.1	84.3	89.5	87.0	83.5
Mobile	89.2	81.8	89.4	80.1	77.6	78.0	81.0	86.3	90.4	84.1
Taiwanese Cohort (n = 7)										
Platform Used	Unit									
	1	2	3	4	5	6	7	8	9	10
PC	46.1	71.4	60.9	72.5	65.5	62.1	65.9	74.5	77.2	75.6
Mobile	94.8	80.0	60.1	–	68.1	65.9	9.2	–	–	–

Table 3: Time taken to carry out the activities for each unit on mobile phone and PC for the Japanese and Taiwanese cohorts

Japanese Cohort (n = 24)										
Platform Used	Unit									
	1	2	3	4	5	6	7	8	9	10
PC	2.19	1.59	2.03	1.57	2.15	1.69	1.52	1.79	1.55	1.28
Mobile	2.55	2.36	2.89	2.78	2.38	2.75	2.79	2.60	2.68	2.05
Taiwanese Cohort (n = 7)										
Platform Used	Unit									
	1	2	3	4	5	6	7	8	9	10
PC	1.16	1.30	1.83	1.37	1.20	1.60	1.27	1.48	1.46	1.10
Mobile	1.93	2.00	1.44	–	1.43	2.04	0.4	–	–	–

The figures for the amount of time spent on both the PC and mobile platforms show that learners did spend more time completing the activities on mobile phones compared with the PC, but while this might have been in part due to the differences in the inputting and screen size, it may also have been a result of learners spending more time to think about each question, at the very least in the earlier units. The very short time along with the low score achieved for Unit 7 on the mobile phone by the Taiwanese students appears to indicate that some learners attempted the activity but abandoned it midway. A very interesting difference between the two cohorts is that the Taiwanese learners generally took less time than the Japanese learners to complete each of the activities on both PC and mobile phone. The differences in scores between the two cohorts were likely due to initial proficiency differences, and this may have had an impact on the way in which the learners engaged in the activities, spending less time on them because they either perceived them as too difficult,

or could not see a clear link between the activities and what they were doing in class time. This point will be further addressed in the discussion section.

A final related observation about the activities concerns the way in which learners engaged in them over the semester. An examination of the server records made it possible to see the ways in which the learners completed the activities over the course of the semester, and there were some significant differences between the Japanese and the Taiwanese learners in this regard. The Japanese learners tended to engage in the activities quite consistently on a week-to-week basis during the semester, 45 of the Taiwanese learners (37.2%) completed the vast majority of the activities at the very end of the semester. Many of these learners did make some attempts on the activities early one, but then did not return to the activities at all until the last weeks of the semester, presumably in order to receive the marks for completion of the activities. This was a trend seen in only three of the Japanese learners (7.7%). This is again also related to the way that the activities were perceived by the learners in the two cohorts, as well as the way that they were presented to the learners in terms of their relevance to the subject and the weighting assigned to them. The results are discussed in more depth in the following section, along with key results from the post-treatment surveys and the teacher observation notes.

Discussion

Impact of smart phones for mobile learning

The purpose of the current study was to replicate Stockwell's study from 2010, which was published at a time when none of the learners possessed smart phones, and the phones that were used had considerably smaller screens and inputting was limited to a keypad. In the current study, however, while ownership had not reached 100%, the vast majority of the participants had smart phones, with 74.3% of the Japanese learners and 87.3% of the Taiwanese learners owning smart phones. Because there were learners in both cohorts that did not have smart phones, it was necessary to retain the earlier mobile version of the system used in the previous study in addition to the desktop version and the version that was optimized for smart phones.

RQ1 was concerned with the scores achieved on mobile phones compared with the PC platform, and the results showed that there was very little difference, with the exception of a gap-filling task by the Taiwanese learners, where they were required to type their responses in to the mobile phone. The results coincide very closely with the outcomes of Stockwell's (2010) study, indicating that neither the smart phone nor the country of the learners seemed to have a particularly large impact. RQ2 examined the amount of time taken to complete activities on mobile phones, and the current study showed that using smart phones did seem to have an impact on the amount of time taken

to engage in the activities when compared to the 2010 study, with the difference in time between using the PC and mobile phones reducing to around 0.8 minutes compared to 1.6 minutes in Stockwell's (2010) study. There did not appear to be any difference between the Japanese and Taiwanese learners, and it should also be pointed out that the reduction in time did not seem to be directly translated into increased usage of the mobile phone compared with 2010. Mobile phone usage was marginally higher in the current study with regard to the Japanese learners, but given the slight increases per year shown in the 2010 study, the increase in the current study could not be considered as particularly large. Regarding RQ3, which examined the improvement in time taken to complete the activities over the period of the study, the results were somewhat inconclusive. There appeared to be little pattern in the time taken by the Japanese learners over the semester, and there were insufficient data from the Taiwanese learners to make any conclusions, considering that none of them engaged in the activities on mobile phones for the final three weeks.

Designing for learning through smart phones

What features of smart phones would lend themselves to increased engagement through mobile devices? Screen size has been cited as a problem with learning through mobile devices since they started to be used for educational purposes (e.g., Stockwell, 2008), and although this has been alleviated to some degree with larger screens, there are still limitations with the amount of text that can be included on the screen. Despite the fact that the system in the current study was designed to be read easily on smart phones (and pre-smart phones) and operate with the on-screen keyboard, many learners both in Taiwan and in Japan felt that the screen was too small, and in particular, a number of Taiwanese learners indicated that they felt the font size was not big enough to do the activities properly on their mobile phones. Even though the font size had already been increased in the smart phone version, it was evident from the post-treatment surveys that this was not big enough for the learners, and that they preferred to have even larger fonts.

The majority of the learners indicated that they liked the design of the activities themselves and found them useful, but that the small font size was a limitation. A follow-up on this in the semi-structured interviews revealed interesting implications for designing resources for use on mobile devices. One of these was that learners requested the text on the screen be large enough for them to be able to see without needing to bring the phone closer to their face. That is to say, learners wanted to be able to complete the activities holding their phones around 30 cm away from their faces, and felt uncomfortable about having to adjust the distance depending on the activity. In saying this, there were also several learners that did not seem to be particularly bothered

by smaller fonts, and perhaps it is necessary to include options where learners can choose the font size to suit their own individual preferences. Given that learners do appear to have their own preferences regarding screen design (including font size), providing them with customizable themes might be one way to make learners feel that they have some say in the way that content is provided to them.

Perceptions of activities and impact on engagement

Generally speaking, learners still seemed to show some resistance to using their mobile phones for learning, confirming results from Kim *et al.* (2013) and Abdous *et al.* (2009). Learners seemed to be quite enthusiastic about using their mobile phones when they talked with the teacher, but mobile phone usage remained relatively low, despite the enthusiasm they exhibited. This trend was evident in other studies such as Petersen, Divitini and Chabert (2008), where learners expressed an interest in using mobile blogs in advance, but ultimately did not use them. The results of the study showed, however, that there were quite significant differences in the ways in which the Japanese and the Taiwanese learners engaged in the activities, with the Japanese learners taking longer to complete each activity, and with over a third of the Taiwanese learners completing the activities at the end of the semester in blocks, rather than consistently during the semester as intended by the teachers. As described earlier, the vocabulary activities were designed to help learners build their vocabulary, and at the same time to allow them to prepare for the weekly vocabulary quizzes. Completing the activities at the end would certainly still make it possible to achieve the first of these two objectives, but if they were not accessed until after the weekly quizzes were finished, then obviously they would not have been able to fulfill this second objective.

The reasons for this difference likely lie in the ways in which the learners perceived the online activities and their relevance to what was covered in the classes. In Japan, the teacher had taught the class for several years, and was familiar with how to encourage the learners to use the activities, and to emphasize the relationship with the quizzes and other in-class activities. While of course the teacher in Taiwan was also aware of this goal through several discussions held both face-to-face and through Skype and email in advance of the project, it was possible that this relationship was not made as clear to learners early on as it might have been. A possible cause for this is that the textbook that was used in Japan was the only teaching material used, while in Taiwan, the textbook was combined with other teaching materials that needed to be covered in accordance with the requirements of the department. Not only did this limit the amount of time that could be dedicated to using the materials in class, but the dual focus of the classes may well have

also resulted in confusion on the part of the learners, who may have seen the online activities as an 'optional extra' during the semester, and provided they were finished by the end of the semester, that they had fulfilled the requirements for the final grade. The teacher in Taiwan realized that learners were behind in doing the activities after the mid-term examination, and encouraged the learners to engage in the activities more actively, which did result in a change in how the learners completed them. This had important implications for teaching, in that the teacher may see the reasons for undertaking activities and believe that students understand this, but in fact the reasons may not be as clear to the learners as expected. Hubbard and Romeo (2012) have argued for not only technical training, but also strategic and pedagogical training, that go beyond explaining how to use technologies, but to link them specifically to learning goals and make sure that learners understand why they are necessary. A final difference could well have been the discipline that the learners were enrolled in. Peacock and Ho (2003) found that learners from varied disciplines employed very different strategies, with computing majors using fewer metacognitive strategies than learners from other areas of study. In the current study, the Japanese learners were law majors and the Taiwanese learners were English majors, and it is possible that this also had some impact on the ways in which the learners engaged in the activities.

Utilizing private spaces

The issue of the place of the mobile phone within a learner's life as a private tool for communication or device that can be used for learning has received some attention over the past several years, and learners have expressed concerns about using the mobile phone for educational purposes (see Stockwell, 2008, for a discussion). An examination of learners' uses for their mobile phones revealed that social networking applications such as LINE or Facebook were the primary uses for over 90% of smart phone users in both Taiwan and Japan. The spread of smart phones has also resulted in a shift in perception of the mobile phone as well, and many learners use the mobile phone as just another means through which they can use them not only for private purposes such as social networking, email, and so forth, but also for work, study, and other non-private uses as well, much in the same way that computers have also been used for multiple purposes, which was evident in the responses from as many as 75% of learners who indicated that they had downloaded apps for language learning in the past. In saying this, however, there was still a significant number of learners (38.5% of the Japanese learners and 94.2% of the Taiwanese learners) who chose not to try to use their mobile phones for the activities at all, meaning that there were learners who still did not view the mobile as a learning tool. This was evident in comments from

both the Japanese learners and the Taiwanese learners such as 'I never considered using the mobile phone' (Japan) and 'I think it [the mobile phone] is not a good way to learn' (Taiwan), indicating that there are still psychological barriers to using mobile devices for learning. This may have been as a result of previous unfavorable learning experiences from apps that they had downloaded, or simply because they believed that mobile phones were simply not suited to learning. Of interest was the number of students that responded that the screen was too small for learning despite the fact that they never even tried to use the mobile phone, which would suggest that there is an image of the screen being too small for learning that may be founded on pre-conceived ideas rather than on experience.

Another point that would be thought to have had an impact on mobile phone usage was the environment in which the students lived. The post-survey of the Japanese students revealed that the majority engaged in the activities during commuting to and from university. This was possible as most students in Japan commute by train or bus, meaning that there is time to sit down and use the activities. A look at passengers on trains in Tokyo in recent years shows that looking at mobile phones – be they smart phones or otherwise – is the way that many people choose to pass the time while en route to their destination. In the university in Taiwan, however, students will typically commute by scooter, meaning that the time that might have been spent on engaging in activities by the Japanese students just was not available to the Taiwanese learners, reducing the opportunities to use their mobile phones. As a result, the environment the learners were in would be thought to have had an impact on how the learners engaged in the learning activities using their mobile phones.

Suggestions for replication studies

The current study was conducted as a replication of the study carried out with Japanese learners between 2007 and 2009, with the results being published in 2010. As described above, at that time, none of the learners had smart phones, and an objective was to determine whether or not using smart phones would make a difference to the ways in which learners engaged in activities using their mobile phones. Second, the study also sought to see if there would be different outcomes in a different environment, hence it was decided to also include an investigation of learners in Taiwan. The replication of the study in the same environment was not particularly difficult, because many of the variables were already fixed, such as the level and objectives of the students and the teaching materials used in the class. As a result, it was possible to get comparable data with the previous study controlling for the variable of the technology.

There were, however, difficulties in replicating the study in the Taiwanese environment. First, there were obvious differences in the course itself due to curricular differences between the two universities. This meant that the teacher in the Taiwanese university needed to adjust the classes in order to match the classes that were held in the previous study in Japan. As described above, because there were also elements that needed to be covered because of the curriculum of the university in Taiwan, and this meant that the teaching materials were a part of the larger picture rather than the entire course. As a result, it is possible that there was an impact on the way in which the activities were perceived by learners, as well as at the very least in the amount of time the learners were prepared to devote to completing the activities. If learners were required to complete a larger amount of material, then they would likely be less willing to spend time completing the vocabulary activities, be they on PC or on their mobile phones.

One other issue that became apparent during the study was support. As the materials were written and managed by the teacher in Japan, support was provided from the Japan side. This generally did not pose a problem unless there were troubles during class time. There is only a one-hour time difference between Japan and Taiwan, and the teachers stayed in close touch during the class time in case of emergencies, but there were some cases of minor difficulties that required the teacher in Japan to provide support. On one occasion, this resulted in the postponement of a vocabulary quiz, and although this was made up in a later class, it is possible that there was some effect on the way in which the materials were viewed by the teacher and the learners. One area in which this may have been reflected was that a small number of learners in Taiwan complained to the teacher that the system was not functioning properly, and that they were unable to progress to the next unit. When the teacher in Japan checked the system, no problem was found and the learners only needed to attempt the activities one or two more times without making mistakes in their responses, and they would have been able to proceed to the next lesson. This seemed to indicate some degree of lack of trust in the system which was not apparent in the learners in Japan, which may have been a result of students feeling that support was not as available as it might be. On two occasions, the teacher in Japan received emails about the system written in Japanese, which then needed to be confirmed with the teacher in Taiwan before action could be taken, meaning that it took time to provide support when needed. In other words, the support system for dealing with problems for the students in Taiwan needed to be set in place from the outset of the study, and this may have also affected the way in which the learners viewed and engaged in the activities.

Conclusion

Replication studies in language learning environments allow us to gather further evidence about a phenomenon, and these may help us to see the effect of some of the variables that make up the complex whole of learning a language. In the current study, the focus was on the shift of mobile technologies towards smart phones, which has had a clear impact on the way in which people view mobile devices and the role that they play in our everyday lives. Given this changing role, the purpose was to determine whether or not using smart phones would have an effect on the way in which learners engaged in vocabulary activities, and would result in increased use of mobile phones to complete the activities compared to the initial study that was published in 2010. In addition to the change in technologies themselves, the earlier study was conducted entirely in a Japanese context, and the characteristics of the Japanese learners were likely to have affected the way the learners engaged in the activities as well.

The results suggested that new technologies are likely to have had some effect on reducing the amount of time taken to complete activities, but this did not seem to have any particular impact on the degree to which learners used their mobile phones to engage in the activities, with learners showing a gradual increase in the amount they used their mobile devices compared with the results from the 2010 study. In the Taiwanese context, however, usage was very limited, with the vast majority of learners not even attempting to try the activities on their mobile phones. This was likely a result of two main reasons – first, the way in which learners viewed the activities as a part of the whole learning environment, and second, the time that was available to learners to use their mobile devices.

The study showed that even if the same tools are used in a comparable learning environment, the technologies will likely be used differently, and teachers need to be aware of the complete learning context to enhance usage as much as possible. This may in part be a result of the learning applications themselves, but other factors such as how teachers and learners view the learning tools, and how technologies are used on a day-to-day basis. While of course there is a need to continue developing applications, using technology for language teaching and learning in the future will depend on providing learners with the skills to engage in activities that are available. This is a combination not only of making sure that the activities suit the immediate needs of the learners, but also of ensuring that the learners develop trust in the tools being used, and are able to see a clear relationship between the activities and the focus of their learning. Furthermore, opening channels of communication to be aware of learner preferences in the tools they use, and trying to allow learners freedom to adjust these to the preferences as much as possible will likely lead to greater integration of mobile technologies into the larger language learning context.

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