Tracking Learner Usage of Mobile Phones for Language Learning Outside of the Classroom

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ABSTRACT

Mobile technologies have the potential to empower learners to work outside of the classroom with a freedom that is difficult to achieve with more traditional technologies such as desktop computers. Of these, it is the mobile phone that has attracted a good deal of attention in the language learning literature in recent years (e.g., Kennedy & Levy, 2008; Stockwell, 2010) but questions remain as to whether this enthusiasm is shared by the learners themselves. Stockwell (2008), for example, showed that learners who were given the option of using their mobile phone or a personal desktop computer (PC) for language learning tasks showed an overwhelming preference for the PC. The study investigates server logs of how fifty Japanese learners of English complete activities on both mobile and PC platforms, in terms of the amount of time spent using each platform, when and where learners engaged in the activities, and the effect of a “push mechanism” email they could opt to have sent on a daily basis. Results are discussed in terms of patterns of learner usage with both platforms, and suggestions for activity design to enhance learner engagement are provided.

INTRODUCTION

It is now well established that mobile devices have the potential to provide new learning opportunities to learners in terms of their portability, interactivity, and even their costs compared with other electronic devices (Kukulksa-Hulme, 2005). While there has been a body of work that looks at mobile device activity in the classroom (e.g., Huang & Lin, 2011), there has been a significantly smaller amount of research examining how learners engage in mobile learning outside of the classroom. Learners have generally shown favorable attitudes towards learning through mobile devices in controlled environments (e.g., Gromik, 2011; Thornton & Houser, 2005), but research in natural settings has also suggested that, when given the choice, learners are far more likely to choose to work on PCs.
rather than on mobile phones, citing screen size, input functions, and distractions from the environment as the primary causes (Stockwell, 2008). This seems to indicate that while learners see the potential of mobile learning, they make planned decisions about the best times to use their mobile devices compared with the other available technical (and likely non-technical) options, but we still have a limited understanding of when, where, and how learners engage in language learning activities outside of the confines of a language learning classroom. This study, then, seeks to track learners’ out-of-class use of mobile devices for language learning activities to attempt to shed light on learners’ actual usage and on how they go about making these decisions.

The Nature of Mobile Learning

Learning that takes place outside of the classroom is very likely to take on different characteristics from learning that occurs under supervised conditions. The most obvious reason for this is that learners are balancing their time with the range of other activities in their lives, such as studying for other subjects, family matters, jobs, and so forth, meaning that the amount of time that learners are willing and able to dedicate to undertake activities will vary from day to day and from student to student. In the classroom, typically teachers will assign comparable amounts of time in class to a single activity for all students, and supervise the learners to not only ensure that it is done, but so that they can deal with problems should they arise.

Learning outside of the classroom places the responsibility for time management on the learners themselves. Whether they make the decision to work at home, at school, in the train, or at all, will depend very much on the technologies they have available at given times, the constraints of the environment in which they are trying to learn, and, of course, their own learning preferences. Mobile devices certainly make it possible for learners to undertake learning activities while in transit or other places that might otherwise be considered as wasted opportunities, but mobile learning is also, as Kenning (2007) aptly puts it, “a highly fragmented experience liable to be fraught with distractions” (p. 194), a fact confirmed by learners themselves (see Stockwell, 2008). In the midst of these difficulties with time (and place) management and dealing with distractions, is there a means of encouraging learners to make the most of the potential of mobile learning? The physical characteristics are likely to have a strong impact on what learners do or do not do on mobile devices. If something takes significantly longer or requires more effort, then one might expect that learners will be less likely to use it. On the other hand, mobile devices also bring with them a range of affordances, in that they are by nature very portable, they allow almost instant Internet access, they have quite advanced multimedia functions, and they make communication accessible. The emergence of smart phones has meant that the range of affordances has expanded even further, and the various ways in which these devices can be used has meant that much of what was done on multiple devices in the past can now be achieved with a single device. Not only is Internet access significantly faster than
that of earlier phones, but also checking of email, reading of the news or e-books (while limited by screen size), access to social networking tools, and provision of location-specific information has become possible on smart phones (e.g., see Stockwell, 2012, for a discussion). Successful mobile learning, then, requires appropriate use of these affordances while bearing in mind the potential limitations.

**Push and Pull Mechanisms**

One concept that has received some attention as a feature of mobile learning is the potential for both “push” and “pull” mechanisms, which means that not only is it possible to “pull” resources from the device at a time that is convenient, but, at times, that they are “pushed” with information without needing to seek it out for themselves. While comparatively new in mobile learning contexts, the idea of push and pull mechanisms is not a unique one. It has its origins in programming circles in the mid-1990s, referring to where information could be provided to users through a process known as “server push,” or retrieved from the server by users on request through “client pull” (see Gundavaram, 1996). The notion is very much the same with regard to learning contexts, and there has been some reference to it in recent years in mobile learning literature (e.g., Mellow, 2005; Motiwalla, 2007). In a push mechanism, the server sends information to learners, and, in one sense, learners have very little alternative but to check it. In a pull mechanism, however, the onus is completely on learners to access information from the server according to their own learning needs. It is evident that there are implications for the way in which learners will engage with the mobile device depending on which mechanism is being applied.

The majority of studies using mobile devices for language learning typically depend on one mechanism or the other. In order to use the pull mechanism, learners need to have devices that allow some kind of interaction, such as through a website or app, where they can access the information that they are after in a relatively convenient manner. Studies that use this type of method—typically for learning vocabulary—have appeared most commonly for Personal Digital Assistants (PDAs), such as Chen and Chung’s (2008) English vocabulary learning system for Taiwanese learners of English, but have also been carried out using mobile phones, as in Stockwell’s (2010) study of Japanese learners of English using an intelligent adaptive vocabulary system. Studies of the push mechanism in second language learning most typically rely on either the email or short message service (SMS) functions of the devices they are used on. In Japan, SMS is a relatively new service, so email has been most commonly used as the means of sending information to learners. Thornton and Houser (2005), for example, sent vocabulary lessons to learners’ mobile phones using emails, and found that the regular sending of messages led to improvements in vocabulary acquisition as indicated by pre- and post-tests. In a context where SMS is more common, Kennedy and Levy (2008) found that Australian learners of Italian who received learning reminders, suggestions to engage in Italian culture, information about upcoming television programs and so forth, found the messages to be both interesting and
useful.

Each of these mechanisms causes the learner to engage with the mobile device in rather different ways, and as such has the potential to alter the learning activities which take place, in terms of not only the content, but also the time and place the learning occurs. The nature of learning outside the classroom, however, makes it exceptionallly difficult to determine the ways in which learners engage in the activities, and indeed what the differences are between push and pull mechanisms with regard to the frequency and length of engagement with the mobile device. For this reason, tools that enable teachers to track what goes on while learners are using them can shed light onto the potential benefits of each of these mechanisms, potentially leading to better task and activity design.

**Tracking Learner Usage in Mobile Settings**

Discussions of the importance of technologies for tracking learner behavior have often appeared alongside discussions of the use of technology in out-of-class situations (e.g., Hwu, 2003). As learners are engaged in activities using technology more and more outside of the classroom, many teachers see a need to understand how learners engage in such activities, either to ensure that activities are being done as they were intended (or at all), or to determine whether or not tasks or activities should be redesigned to suit the ways in which learners actually undertake them (see Fischer, 2007, for a discussion of tracking in language learning environments). There is often a gap between what teachers have in mind regarding the way that technologies should be used and the ways in which learners actually use them, and this individualism in student usage patterns has implications for “issues in CALL such as instructional design, the implementation of second language acquisition principles in CALL materials, and the extent of the real impact of CALL software on learning, especially in less controlled environments such as the web” (Fischer, 2012, pp. 27-28). It is this last point which is particularly relevant for mobile learning environments, where learners are very much in control of when and how they use mobile devices, creating a need for tracking methods that are unobtrusive yet collect sufficient data to be meaningful.

Tracking learners should be undertaken with a clear view of what the purpose of the tracking is (Bertin & Narcy-Combes, 2007), and of course data cannot be collected indiscriminately. Methods that would be more applicable to in-class situations such as observation (e.g., Tanaka, 2005), mouse clicks, keyboard activities or cursor movements (e.g., Hwu, in press), or screen captures (e.g., Roussel, 2011) are very difficult to carry out in mobile settings, particularly when devices are owned by individual learners themselves. In such cases, the vast majority of the activities carried out on the device are private, such as web browsing, writing emails or text messages, social networking, and so forth, meaning that methods that only track information about learners during the times that they are engaged in the tasks and activities that researchers wish to investigate are necessary. The difficulties in recording and storing such information within the device itself and its subsequent retrieval would suggest that this would need to occur at a server
level, as is done with Learning Management Systems (LMSs), such as WebCT (e.g., Hwu, 2003). In this way, having information sent and stored on a server while learners access the activities that they are undertaking allows for researchers to store a wide range of access statistics (i.e., when learners logged on and off, scores, time taken to complete individual learning activities, and so forth), while still allowing learners to maintain their privacy with other activities carried out on the mobile device.

The purpose of the current study was to build on Stockwell’s (2008, 2010) earlier studies to determine when and where learners accessed their mobile phones to shed some light on the factors that lead to the decision to use their mobile device as a tool for completing learning activities as opposed to using a desktop PC. Using an intelligent vocabulary learning system, learner activity was tracked, specifically attempting to determine the amount of time taken to complete activities on each platform, the scores achieved, where learners were when they completed activities on each platform, and the effect of a push mechanism on learner usage. The methodology adopted for the study is described in the following section.

**METHODOLOGY**

*Participants*

The participants in the study were fifty pre-intermediate learners enrolled in two classes in a compulsory first-year English-language subject in the School of Law at Waseda University, Tokyo. The primary focus of the subject was the development of listening skills and vocabulary, and authentic videos — based on a range of human interest topics such as aging society, the environment, interactive education, and so forth — were used in the class. One 90-minute class was held per week over a 12-week period in 2011. Learners were quite homogenous: the vast majority had entered university directly from high school, with TOEIC scores ranging between 450 and 650, but most at around the 500 to 550 mark. The School of Law generally attracts a higher number of male students than female, and in the 2011 intake, there were 14 females compared with 36 males in the classes. As is typically the case in Japanese universities, learners come in to the program with advanced reading and grammar skills, but have had very little practice with listening or speaking, so the classes centred mainly around listening comprehension activities and discussion sessions about the videos, both conducted in small groups. A weekly vocabulary quiz was held based on the videos from the previous weeks, meaning that learners needed to be familiar with vocabulary as well as to have listened sufficiently to an audio version of the videos before the class.

In order to help guide the students in their study, learners were given the option of completing vocabulary activities that were specifically designed to assist them in doing the quizzes. The vocabulary items were selected from the videos, and although the learners were already able to hear them used in context in the video, the activities were designed to enhance their understanding of the items. An orientation on how to use the activities was given in the first class in the semester, where learners were shown how to log in and complete each activity type on each
of the platforms for which it was designed (see the description in the following section). During the orientation, learners were also shown how to change various settings including the notification settings, the number of items shown per activity, and how to review through previous lessons.

An anonymous survey was taken directly after the orientation to determine background information about learners’ experience with learning through technology, including desktop computer (PC) and mobile devices. The survey also asked about technology ownership, including whether they had a PC at home, if they owned a tablet computer, and whether their mobile phone was a smart phone (SP) or non-smart phone (NSP). The results showed that 44 of the 50 learners had access to a PC at home, that two had their own laptop computers, only one learner owned a tablet computer, and that all owned mobile phones, 16 of which were smart phones and 34 were non-smart phones. Information about how the learners used their mobile phones for learning and non-learning purposes was not collected as a part of the current study.

Out-of-class Activities

The system used in the study was largely the same as the one in earlier studies (see Stockwell, 2008, 2010); however, given the increase in smart phones over the past two years, the activities were also adapted to display easily on smart phones as well. Due to the incompatibility issues of apps native to each platform (i.e., iOS, Android, etc.), it was decided that the activities would, in addition to the PC site (which also displayed through smart phones) and the mobile site for non-smart phones, be made available for learners to use through a web app interface for smart phone owners. The web app was selected over creating native OS-specific apps due to incompatibility issues (see Godwin-Jones, 2011, for a discussion). The system included code to determine what device was used to access the system (e.g., mobile phone, tablet or PC). Screen shots of the activities on the PC and mobile phone have been included in Figures 1 and 2 respectively.
Figure 1. Screenshot of vocabulary activities on a desktop computer

Figure 2. Screenshot of vocabulary activities on a smart phone
Regarding the activities, the learners were free to choose between using a PC (either at home or in a university self-access computer room) and their mobile phone. The activities were intentionally designed for the PC and mobile platforms such that they suited the screen size for the device that they were being used on. There were five activity types for each unit, starting with three recognition type activities that required learners to select the correct word for an English sentence, to select the correct word for a definition given in English, or to select the correct word for a meaning given in Japanese. After they had exposure to each word at least three times, production type activities were also included, namely, filling in a blank in an English sentence through writing the appropriate word and writing the correct word for an English definition. The system kept a profile of each individual learner, and recycled items that learners had difficulty with in the activities with greater frequency until they scored correctly with the item consistently. Learners completed a unit when the system judged that they were competent with all of the items in the unit. Each activity could be completed in a couple of minutes, and were designed so that learners could utilize even extremely short spans of available time to work on the activities (such as when using their mobile phones), but at the same time, they were also able to do the activities in blocks if they wanted to complete a unit in one sitting, which generally took between 10-30 minutes, depending on whether they used a PC or mobile phone, and how many items they had difficulty with. The system recorded exactly how far through a unit a learner had progressed, and they could leave off part way through a unit they had been working through on either their PC or mobile phone and resume again at any time on either platform seamlessly.

While the activities within themselves acted as a pull mechanism, where learners needed to access them from their mobile phones or their PCs of their own volition, the system also included a reminder function, which acted as a push mechanism. Learners could choose to have reminders sent to them daily to their mobile phones with a list of the items that they were having difficulty with, along with Japanese translations and a link to the vocabulary activities page. A feature of the reminder function was that if learners did not access the lessons for a period of two days before completing the relevant unit for the week, they were sent an email to notify them of this fact along with a link to the activities. The notification also included a link to the activities that learners could click to immediately engage in the activities should they desire. The notification was sent daily at 5pm, as it was thought to be a time that would not interrupt learners’ classes, and would hopefully catch many of them on their way home, as learners in previous studies had indicated through a post-survey that they engaged in the activities while commuting (Stockwell, 2008).

Data Collection and Analysis

Tracking of learner behavior took place through server logs of the learners. Data collected included the times learners logged on and off the system, whether they used their mobile phone or a PC to undertake the activities, where they were when
they completed the activities, and the amount of time taken to complete individual questions. While most of this information was collected without the need for intervention from the learners, the interface included a question each time asking learners to detail where they were as they started to undertake the activities. This took the form of a checklist for ease of completion, and to maintain, as much as possible, the unobtrusive nature of the tracking. Learners were told in advance of the study that data would be collected and used for research and further development purposes, but were also informed that records would be collected anonymously with no information linking their scores to their identity.

The server logs contained nearly 14,000 entries at the end of the period investigated, and as such dedicated software developed by the author was used to carry out the data analysis. Data were broken down into the number of activities completed by each learner, the platform used for each log in, all log in and log out times, the time taken to complete each activity, and the locations where learners indicated that they completed the activities. Analysis of the data sought to identify clear patterns of mobile use that could be compared with PC usage, looking specifically at the times and places that learners accessed the activities. The effect of the push notifications was also investigated to see whether learners tended to access the activities shortly after the message was sent, or if they waited until later to do this. The results are presented forthwith.

RESULTS

As with previous years, the number of learners who opted to use the mobile phone remained very low, and as is shown in Table 1, over 70% of the learners opted to not use their mobile phones at all to complete the activities. Only two of the 50 participants completed all of the activities on their mobile phones, and a further two used their mobile phones for more than 80% of the activities. Access logs showed that there was very little difference between smart phone (SP) and non-smart phone (NSP) usage, but that smart phone users appeared to be marginally more likely to use their mobile phones for the activities than non-smart phone users. Due to the small use of both types of phone users, however, it was difficult to make any conclusive statements about the implications of using the smart phone on activity engagement.

Table 1. Percentage of tasks completed on mobile phones (N=50)

<table>
<thead>
<tr>
<th>Percentage of Tasks Completed on Mobile Phone</th>
<th>Number of Learners by Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>2 (4.0%)</td>
</tr>
<tr>
<td>81-99</td>
<td>2 (4.0%)</td>
</tr>
<tr>
<td>61-80</td>
<td>1 (2.0%)</td>
</tr>
<tr>
<td>41-60</td>
<td>2 (4.0%)</td>
</tr>
<tr>
<td>21-40</td>
<td>3 (6.0%)</td>
</tr>
<tr>
<td>1-20</td>
<td>4 (8.0%)</td>
</tr>
<tr>
<td>0</td>
<td>36 (72.0%)</td>
</tr>
<tr>
<td>N</td>
<td>50</td>
</tr>
</tbody>
</table>
Examination of the amount of time required to complete each of the five types of activities (1. Choosing the appropriate word for an English sentence, 2. Choosing the appropriate English word for a Japanese meaning, 3. Choosing the appropriate English word for an English definition, 4. Writing a word in English for an English definition, and 5. Writing the appropriate English word for an English sentence) showed that learners typically required an extra 60-90 seconds to complete activities on their mobile phones compared to using a PC. The difference with the PC did not seem to increase for the production activities (Activities 4 and 5) compared with the recognition activities (Activities 1, 2 and 3). The system could determine whether a smart phone or a non-smart phone was used for the activities, and as Figure 3 shows, there was very little difference between the amount of time required to complete activities on either type of device. No distinction was made in the current study between using a laptop computer or desktop computer, and while the system could determine whether learners used a tablet computer rather than a mobile phone or PC, it was unable to report on whether the PC was a laptop or desktop machine. No records of tablet PC usage were recorded in the server logs.

Figure 3. The number of minutes required to complete each activity on both PC and mobile phone (N = 50)

![Figure 3. The number of minutes required to complete each activity on both PC and mobile phone (N = 50)](image)
The study also sought to determine precisely when and where learners undertook activities on mobile phones and PCs to identify differences between the usage patterns. As can be seen in Figure 4, there was a very strong concentration of activity around Wednesday and Thursday on the PC, with these two days alone making up nearly 80% (79.7%) of total time spent on completing the vocabulary activities. This was thought to be very likely due to the fact that the weekly vocabulary quiz was held in class on Thursday afternoons, and a further look at the lead up in the 24-hour period before the class was very revealing in this regard (see Figure 7). Although this trend was still evident to a degree with mobile phone usage, it was far less obvious than it was for the PC. Learners tended to use their mobile phones a little more regularly throughout the week when compared with PC users, with 27.9% of usage being on Mondays and a further 29.6% on Wednesdays.

**Figure 4. Access to activities on both PC and mobile phone according to day (N = 50)**
As described in the methodology, learners were able to turn on or turn off the notifications to their mobile phones at any time throughout the semester, and, as may be seen in Figure 5, a large proportion of the learners took advantage of this function. The first week of classes was used as both a general orientation to the subject, and also as an introduction to the online vocabulary system. Although touched on in the first class, the push notification function was covered in class again in the second week of semester. As Figure 5 shows, only a small number of learners used the notification function in Week 2, but this increased sharply from Week 3, and gradually increased through to Week 6, where it reached 58%. The number fluctuated from 56-58% (i.e., between 28 and 29 students of the 50 participants) through until the end of the semester. Despite the fact that learners were not told that it was possible to do this, two of the learners included a PC email address rather than a typical mobile address (the carriers are different in Japan, making it obvious as to whether it is a PC or mobile email address), but it is unclear as to whether these were accessed from their PCs or their mobile phones.

Figure 5. Number of learners who turned on push notifications (N = 50)
In order to determine what times learners accessed the vocabulary activities from their mobile phones or PCs, and to investigate whether or not the push notification had an effect on learners’ mobile phone usage, the times of usage throughout the day across the semester were analysed. Figure 6 shows that there were quite significant differences in the times that learners used PCs and mobile phones, and that they accessed the activities at a wide range of times throughout the day. The server logs revealed that there was a surprisingly large amount of access to the vocabulary activities after midnight, with 28.9% of PC usage and 25.4% of mobile usage occurring between 12am and 4am. While PC usage dropped off after this time, mobile phone usage remained relatively high between 4am and 6am, and after a slight reduction from 8am and 10am, rose very sharply to 30.5% between 10am and 12pm. One major difference with PC usage was that PC usage started to increase from around 12pm through to 6pm, whereas mobile usage dropped off extremely sharply after 12pm, with no usage at all between 4pm and 10pm. This in itself indicated that learners did not access the online system after the notifications were sent out at 5pm, although it is not possible to determine whether or not they read the message at that time or waited until later.

Figure 6. Access to activities on both PC and mobile phone according to time (N = 50)
Due to the obvious blocks of usage of the PC (and to a degree the mobile) around the day of the class, the amount of usage before class was calculated. Figure 7 gives a breakdown of the total amount of usage for each time slot that occurred in the 24-hour period before the class. The percentage indicates the amount of usage in a particular time slot that took place on this one day, that is, 100% for 6pm to 8pm indicates that all activity that took place between 6pm and 8pm was carried out on the Wednesday night before the class. The breakdown clearly shows that users of PCs concentrated their usage before the class, and the early morning usage indicated earlier in Figure 6 could be attributed almost exclusively to preparing for the vocabulary quiz in the class the following day. Thus, Figure 7 suggests that when using PCs, learners focused their study on the night before the class, often continuing until the early morning. The preparation for the class decreased dramatically after 4am, however, and only a small proportion of morning access of the activities was carried on Thursday morning before the class. PC usage stopped completely at 9am, however, and there was essentially no use of the system on the PC then before the class.

Mobile phone usage took on a rather different pattern, and while there was still a focus of usage around 11pm through to 2pm on the day before the class, it was obvious that learners also completed the activities on their mobile phones on other days of the week, suggesting that this late night usage could not be attributed solely to preparing for the class the following day. One significant difference was the use of the system between 8am and 9am on the day of the class, which, judging by the time and the responses given in Table 2, was likely to have been while commuting.

Figure 7. The degree to which learners completed on both PC and mobile phone in the 24-hour lead up to the class (N = 50)
Table 2 gives a breakdown of the locations learners engaged in the vocabulary activities on the PC and on their mobile phones. As described in the methodology section above, this required learners to actually click a radio button to indicate where they were when doing the activities on either platform. The figures showed that only 15.4% of mobile activity took place while learners were in transit, and that they were more likely to complete the activities at home (43.9%). Use of the system at university was also markedly higher than that of while in transit, suggesting that learners sought a more stable environment in which to complete the activities. There was also a proportion of learners who responded “Restaurant/Café,” making up over five per cent of the total usage. The “Other” category did include a place for learners’ to fill in the location, but this was almost always left blank. One learner, however, wrote “train station” and another wrote “Harajuku,” a famous shopping area for young people.

Table 2. Locations where learners used mobile phones for undertaking activities (N=50)

<table>
<thead>
<tr>
<th>Location</th>
<th>PC</th>
<th>Mobile</th>
</tr>
</thead>
<tbody>
<tr>
<td>In transit</td>
<td>0.0%</td>
<td>15.4%</td>
</tr>
<tr>
<td>University</td>
<td>44.1%</td>
<td>25.5%</td>
</tr>
<tr>
<td>Home</td>
<td>52.5%</td>
<td>43.9%</td>
</tr>
<tr>
<td>Restaurant/Café</td>
<td>2.3%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Other</td>
<td>1.1%</td>
<td>4.9%</td>
</tr>
</tbody>
</table>

PC usage was balanced mainly between home and university, with no indication of using the system while in transit. This would likely confirm that learners did not choose to use their laptop computers while travelling, but the responses to “Restaurant/Café” indicated that it was possible that learners did use their laptop computers in these places as well (although they have been categorised as PC usage rather mobile usage for the purpose of this study). The majority of learners used PCs at home to undertake the activities, and this was followed fairly closely by university, with a small amount of activity taking place in restaurants and/or cafés. As with mobile phones, extra information with “Other” was generally not provided, but responses that were given included “friend’s house” and “while I was out” without any further qualifying information.

DISCUSSION

Revealing Nature of Tracking

The current study used tracking of learner behavior through server logs as a means of determining the ways in which learners engage with activities using mobile phones compared with PCs. The results from the study revealed patterns of usage which indicate that there are quite large differences in the ways in which learners undertake learning using the two platforms that go beyond simple prefer-
ences for one type of technology than another. Learners typically select different times depending on whether they use a PC or a mobile phone, with mobile phone usage taking place mostly across the morning or very late at night, most typically at home, and essentially no usage at all in the afternoon or in the evening. In contrast, when using PCs, learners tend to focus their usage in blocks in the afternoon or after midnight, working primarily at home at night and at university during the afternoon.

An interesting outcome of the study was that the tracking of learner usage revealed a discrepancy between the amount of time spent using the system in transit compared to results from earlier studies. Stockwell (2008), for instance, found that nearly 80% claimed that they conducted vocabulary activities while in transit, giving the impression that learners primarily used their mobile phones for learning purposes while they were travelling to and from university. The tracking data from the current study, however, showed that just over 15% of actual instances of use of the vocabulary activities on mobile phones took place while learners were in transit, preferring to study at home on the mobile phone instead. While it is possible that this represents a changing trend in mobile phone usage, it may also be possible that learner self-reports were simply not reliable (see Fischer, 2007). It was also interesting to note that those instances of learning in transit only took place in the morning, and none of the learners opted to use their mobile phones for learning on their return trip home.

These patterns have the potential to reveal a lot about the learners’ concept of mobile phones as learning tools compared with PCs. Learning on a PC tended to be far more planned, studying for a concrete goal, such as the weekly vocabulary quiz that took place in class, and learners blocked away a certain amount of time in order to be able to do this. Learning on the mobile, on the other hand, appeared to be more spontaneous, and while it often took place early in the morning, it did not seem to coincide with preparation for the test in the same way as learning on PC did. Thus, learner tracking revealed, in much the same way as Fischer’s (2007, 2012) work did, that learners do not necessarily complete activities in the way in which teachers plan them. While it was expected that learners would take advantage of potentially wasted time such as travelling, they frequently opted to use the mobile at home. This could be due to a lack of access to a computer at home, but it could also simply be related to the more stable learning environment, both in terms of suitability to study but also regarding other practical aspects such as an Internet connection, which may be unpredictable compared with fixed locations, meaning that they were comfortable with the device in this setting.

It was difficult to determine if there were any differences in usage as a result of whether or not a smart phone was used by learners given the very small number of learners who opted to use the mobile phone to complete the activities. While smart phones certainly would be thought to increase general usage of the device compared with non-smart phones, this was not significantly translated into mobile engagement of the activities. The fact that a web-based interface was used did limit the design to a degree. This may have had an impact on learners’ views of the learning activities, and this may also have ultimately negatively affected learners’
usage of the mobile for the activities.

**Uses of the Push Mechanism**

A second interesting point that was evident from the study was the effect of the push mechanism. One of the most surprising results was that there were no instances of learners going back to the use the vocabulary activities within a six-hour period after receiving the email notification from the server. In saying this, however, nearly 60% of learners chose to turn the notification function on (the default setting was to not send messages), despite the fact that they did not use them as a direct reminder to undertake the activities. Of interest was the fact that many learners who did not access the mobile site at all turned on the email notifications, meaning that even though they received the reminders on their mobile phones, they had no desire to complete the activities on their phones.

This raises potential important issues regarding the function of the push mechanism, and indeed, the role of the content of messages sent to learners in this way. Firstly, even though learners did not go back to the system, it is quite possible that they used the information contained in the messages about the vocabulary that they were having difficulty with as an additional guide without completing activities themselves. Thus, sending information that learners see as being useful can indeed be a way of engaging them in mobile learning without needing to interact with the system, but rather as a vocabulary notebook might where learners list the words they have trouble with. Secondly, despite the fact that the original function of the push notifications was to remind learners to undertake the activities, ultimately a function of providing easily accessible vocabulary lists that could be accessed without an Internet connection was provided instead, and it is quite possible that this number made up at least a part of those learners who indicated that they used their mobile phones for learning in transit despite the relatively low figures of access. From this, it becomes clear that the push mechanism has the potential to work as a mobile component in conjunction with a PC component, providing helpful information with a lower cognitive load that is more accessible in a wider range of environments. Further research is required, however, to determine when and how learners actually used these messages, and how they might be optimized to suit learner needs.

**CONCLUSION**

The current study indicated that detailed tracking of learner usage of mobile devices for language learning can shed important light on actual learner behavior that often conflicts with teacher expectations of learner usage. While many teachers may have expectations of mobile learning as a means of having learners engage in learning activities at any time and at any place, the reality from the current study is that while learners undertake these activities at a range of times, locations appear to be, at least as far as engaging in interactive materials are concerned, predominantly centred around home and university. Furthermore, learners tended to plan their learning activities on PCs more than they do on mobile phones, prefer-
ring to prepare for class quizzes in blocks as opposed to the more sporadic type of access that was seen on mobile phones. Furthermore, many learners chose to have information sent to their mobile phones even though they did not use their mobile phones for other learning activities, suggesting that learners appear to make choices about what platform to use for what purposes. Through tracking learners—particularly regarding what happens outside of the classroom—teachers can become aware of what learner preferences actually are, making it easier to tailor activities and information given to learners to suit their preferences. This would allow learners to make the best of both mobile and non-mobile technologies such that they complement one another in an optimum manner.

NOTE

1 The semester is typically 15 weeks long, but as a result of the earthquake disaster in Japan, it was reduced by three weeks due to the need to carry out safety checks of the buildings before the semester started.

REFERENCES


