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One Step toward Automated Situated MALL

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Southeast Asian Short-Burst Parameters for Autonomous Mobile Learning: One Step toward Automated Situated MALL

Jason Richard Byrne,[1] Toyo University, Japan

Abstract: The aim of the study was to investigate the duration of short-burst autonomous MALL app usage in Southeast Asia. In doing so, it opens the door to informal situated learning activity with greater designed purpose through a contextualized meaning laden connection to the Internet of Things (IoT) and blockchain. The research made use of one year of data from eight language learning apps. The data was collected using Google Analytics focusing on nine countries in Southeast Asia; Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. The results suggested an initial starting point for short-burst autonomous mobile IoT activity in Southeast Asia. The tasks should probably be between seventy and ninety seconds in duration and users can anticipate undertaking two or three tasks per session. The conclusions drawn from the research are that short-burst autonomous activity could work with IoT and blockchain, and as the technologies develop and become more ever-present, it will be possible to test the potential for micro-environmental situational analysis of individual self-study situated learning contexts.

Keywords: CALL, IoT, MALL, Situated Learning, Southeast Asia

Introduction

There is an accelerating trend, according to Godwin-Jones (2019), in autonomous language learning through mobile devices. However, it is possible that in the near future more pedagogical direction can be inserted into informal study through contextual understanding of the user situation. This article looks at on-going research into mobile assisted language learning (MALL) and its potential for interaction with the Internet of Things (IoT) and blockchain. The research analyses one year of data from eight language learning apps. The research focuses on providing evidence for MALL short-burst activity in Southeast Asia. This evidence could help pave the way for the contextualizing of language learning activity, within IoT and blockchain, in a region of the world that is known to be mobile first.

Mobile first is a marketing term that refers to the idea that mobile is now the technology of choice for certain activities, such as news reading and video watching. However, it also extends to countries. For example, according to Martin (2017), Indonesia's internet development largely by-passed the desktop LAN line experience and moved directly to mobile. Data provided by the International Telecommunications Union (2019a) provided supporting evidence for a mobile first context from 2017–2018; 39.8 percent of Indonesians used the internet and 71.9 percent had a mobile device, with only about 20 percent of households and/or individuals owning a personal computer. In contrast, land-line phone ownership was at a very low and stable 3.2 percent. In addition, according to the International Telecommunications Union (2019b) there were only 3.28 broadband subscriptions in Indonesia per 100 people in 2018 and this was an all-time high. Clearly, the data suggests that Indonesia has gone directly to mobile. This data also backs up the findings of research undertaken by the Internet Society (2016), that found 52 percent of respondents in Southeast Asia suggested mobile had now become their primary means of accessing the internet, and 90 percent were doing so every day. This contrasted with about 38 percent for mobile as primary internet access method within more developed economies in the Asia-Pacific region, including Australia, Hong Kong, Japan, Singapore, South Korea, and

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Taiwan (Internet Society 2016). Given there are now 4 billion internet users in the world and 5 billion mobile phone users (Kemp 2018), it seems likely that mobile will see increased internet growth and a greater share of internet traffic in the years ahead. In fact, Cisco (2019) predicts that mobile data traffic will grow worldwide at double the rate of wired data traffic between 2017 and 2022. In Southeast Asia (see Figure 1), this is further supported by the sheer number of mobile subscriptions; only Laos has fewer than 100 percent, in terms of subscriptions to population size. For the purpose of comparison, the US this is 105 percent and the UK 110 percent (We Are Social 2018). It appears very likely that computer assisted language learning in Southeast Asia, and indeed the world, will to some degree evolve into mobile assisted language learning.

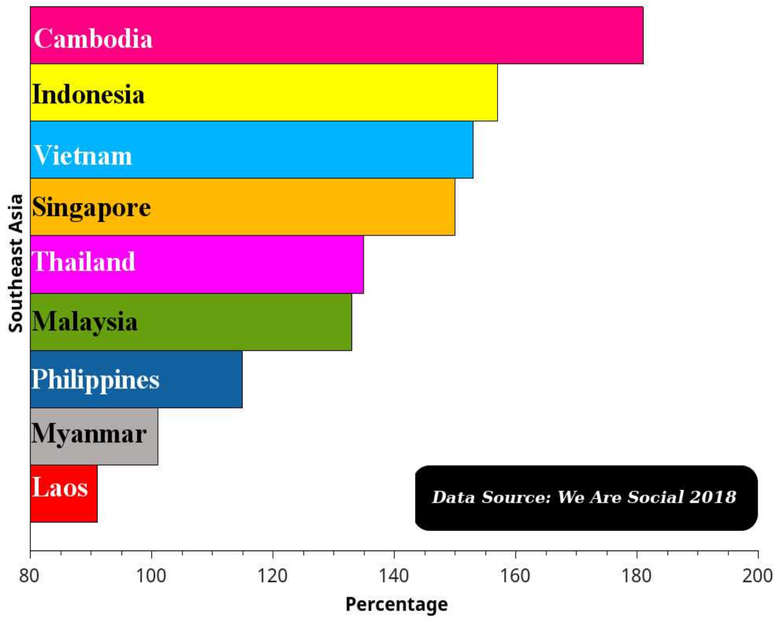

Figure 1: Percentage of Mobile Subscriptions to Population Size
Source: Byrne 2020

Mobile Assisted Language Learning

MALL, it would seem, is going to be the new norm for Computer Assisted Language Learning (CALL). This means that rather than a small niche endeavor, mobile assisted language learning is actually an extremely broad area of practice. Abdous, Camarena, and Facer claim that MALL is reshaping teaching and learning (2009). For example, classroom MALL can include bringing your own device (Gillies 2016; Parsons 2013), or school owned tablets. MALL can be used for filler, pair-work, or group-work activities. MALL can be a part of a blended learning approach (Jin 2014; Tosun 2015) or central to an IT enabled paperless classroom. However, it can also be used outside of the classroom in the form of autonomous self-study (Godwin-Jones 2019). This article focuses on the niche area of autonomous MALL short-burst self-study activity, while being mindful that MALL is now so much more.

Internet of Things

According to Atzori, Iera, and Morabito (2010) the Internet of Things is the pervasive presence of things around us; such as radio-frequency identification tags, sensors, and mobile phones, which can interact with each other and cooperate to reach common goals. It is also likely that the human users will interact with these ever-present things, in their localized environment, through mobile and wearable devices. IoT allows people to engage with their environment and for learner materials to be designed to match the real context of the learner, potentially leading to better outcomes. In this scenario, the learner may appear to be in informal study mode, but there is greater opportunity to direct this learner-centered study through understanding of the context and delivery of materials that engage the context.

Blockchain

Blockchain is the very secure, preferably distributed, networked database technology on which cryptocurrencies such as Bitcoin reside. Blockchain has made a significant impact on the banking industry. According to Tapscott and Tapscott (2017), Citigroup, Credit Suisse, JP Morgan Chase, and Santander are all investing in blockchain. Recently, blockchain has advanced with the introduction of smart contracts and decentralized apps (DApps). Smart contracts are self-executing, electronic instructions that are programmed to be acted upon automatically by the interacting computers (O'Shields 2017). DApps are websites connected to the blockchain by these smart contracts. It is anticipated that DApp driven blockchain will be a disruptive technology affecting many areas of modern life. For example, Bahga and Madisetti (2016) have proposed a peer to peer blockchain platform for the industrial Internet of Things. This blockchain uses a micro payment DApp to unlock manufacturing capability. Furthermore, blockchain will allow for the personalization of big data. Informal autonomous learners will be able to collate data streamed via blockchain, from their actual lives, and re-purpose for short-burst study opportunities delivered to the appropriate IoT triggered event context.

Hypothesis

If we can contextualize the short-bursts of MALL autonomous self-study then we can direct the information flow and make them more meaningful. IoT provides the where, and to a certain extent the what, of user activity. Blockchain provides the data collection, collation, analysis, delivery, and payment system to direct meaningful activity. Therefore, by bringing short-bursts of autonomous self-study together with IoT and blockchain there is an opportunity to maximize the utilization of study time and improve autonomous mobile self-study though pedagogical design.

An Automated Micro-Environmental Situational Analysis for Situated Learning

The conceptual model underpinning the need for the research is situated learning based on automated micro-environmental situational analysis. Situated learning is based on the idea that learning is heightened when it takes place in real-world contexts (Brown, Collins, and Duguid 1989). A micro-environmental situational analysis of individual self-study users can be used to aid pedagogical approaches based on situated learning. Situational analysis is used in business to help formulate business plans and marketing strategy, for example, SWOT analysis. Situational analysis is used in language education, according to Richards (2001), to position curriculum development within its macro and micro societal constraints. Sakai and Kikuchi (2009) used it at the micro-environmental level to help understand EFL learner demotivation among Japanese high school students. Recently, the importance of situational analysis in EFL materials development has been noted by Manurung (2017) and the situational context highlighted by Mitchell, Mitchell, and Vozdvizhenskiy (2015). Huang et al. (2016) looked at what they termed situated mobile learning. Essentially, they were using mobile devices to promote vocabulary learning, while keeping control of the learning context. They guided the students to environments that matched the materials they wanted to teach, providing a learner experience based on the Brown, Collins, and Duguid (1989) situated learning model. However, in a mobile self-study context, where the actual user is unknown and the environmental variables are not controlled, an automated technologically assisted situational analysis must be applied to the context in real-time in order to create the potentially enhanced experience of situated learning. Reinders and Pegrum (2016) suggest context sensitivity is the technological trait that can afford situated learning. As can be seen in Figure 2, the when, where, what, and duration afforded by IoT and mobile could provide a significant level of context sensitivity, potentially leading to better self-study learning outcomes for individual users.

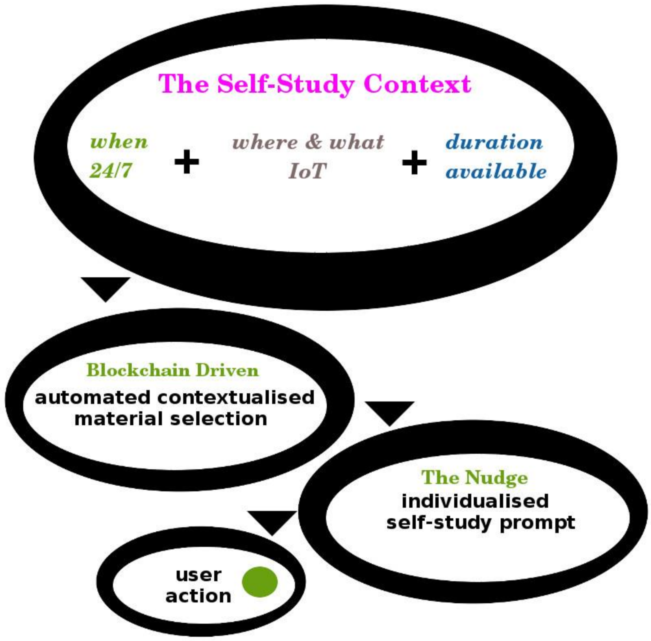

Figure 2. Context Sensitivity and Situated MALL *S*elf-Study
Source: Byrne 2020

Automated Situated Learning Example

Location:	Japan, Tokyo, Park.
When:	December 15, 2019, 2 p.m.
Weather Tag:	Tokyo afternoon, 6 degrees Celsius, sunny with high winds.
Local IoT Tags:	Park sensors - family area gate, dog run gate, tennis court gate Food stall sensors - ice-cream, hot dogs.
User Profile Tags:	Two children, no pets, dislike sports…
IoT Blockchain:	Send IoT and user tags to the situated learning analysis server.
Analysis:	Park, family area - word association “children,” “play.” Cold, windy, December—so hot dog, not ice-cream.
Human Readable:	The user is most likely with their children in the park and maybe eating a hot dog or can smell them nearby. It is quite cold and very windy.

Lesson selection:	Three mini lessons identified. A cold windy day in the park Playing with children Ordering a hot dog
Automatic Retrieval:	The lessons are sent to the user's device.
Push notification:	The learning materials are ready.

At this stage, the learner has the option to open the pushed lesson and study or block the location, time or date, as self-study triggers. In other words, blocking tells the application to never send a lesson when at this location, time or on this date, as this is not appropriate for the learner and does not meet the learners' needs. However, to make use of an automated micro-environmental situational analysis to create situated learning experiences, first we must be sure that the micro-environmental features, such as short-burst duration and MALL self-study, occur at all. A short-burst of activity means sporadic, possibly random activity, which lasts for a short period of time, probably measured in minutes. Once this short-burst activity is established, the implementation of IoT and blockchain applications to further appraise the situated learning conceptual model will become viable.

Short-Burst MALL Existence and Duration

Byrne (2016) found when looking at geo-location data from two apps, being used in over 6000 cities, that they were primarily used for self-study activity. There was little evidence in those cases for classroom activity. It strongly suggested that autonomous MALL self-study activity does exist. However, the duration of the activity was unknown. The focus of this article is to provide some parameters to the duration of self-study MALL.

- How long is a short-burst session?
- How long is a short-burst task?
- How many tasks will be undertaken per session?

Answers to these key research questions can provide an affordance to the roll out of IoT and blockchain integration for situated learning. Information on time usage can improve content design to meet the users' time needs. It will also inform blockchain specification and IoT sensor requirements.

Methods

The duration of typical app usage is based on live app data from eight mobile learning apps focused on eight different languages; Dutch, English, French, German, Italian, Portuguese, Spanish, and Swedish. The user data focused on the Southeast Asian nations of Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.

Google Analytics

The research focused on data collected, using Google Analytics (n.d.), over a one-year period from the eight language learning apps. The apps are all Android grammar learning apps with 89,986 users in Southeast Asia, recorded accessing the apps during the data collection period. It should be stated 89.5 percent of the users were using the English grammar app and 49,462 of the English app users (61.4%) were in Myanmar. If we had solely focused on apps this would have skewed the results. However, by giving each of the nine countries equal weighting we have kept greater balance. Even still, English app users, as can be seen in Figure 3, do significantly influence the country results.

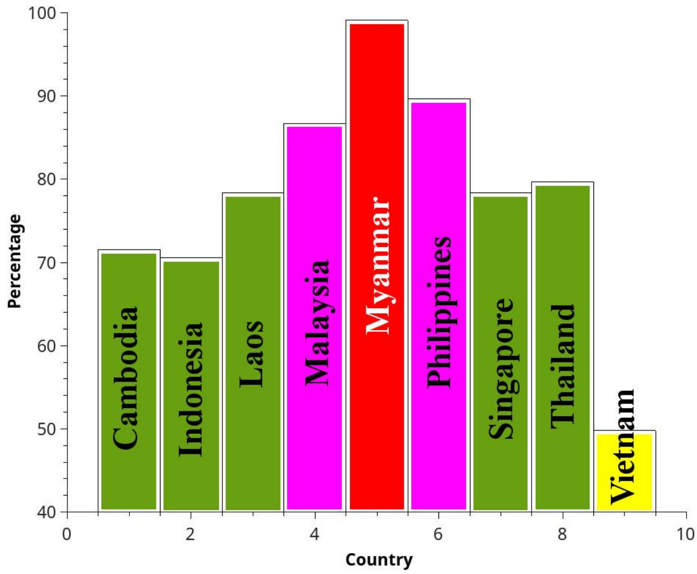

Figure 3: English App Users as a Percentage of Total App Users
Source: Byrne 2020

Furthermore, when we focused on individual countries within individual apps, it was decided to only use data based on a minimum threshold of seventy-five users, to ensure statistical significance without resorting to complex statistical procedures. Only the English and French apps had data for all nine countries, while the German app was used in six countries. The Dutch and Italian apps were used in three countries, the Swedish app in two countries and the Spanish app in one. The Portuguese app no longer met the criteria for selection.

The Apps

The author was the lead developer of the eight apps used in the study and had permission to collect and use the app data for educational and research purposes. All eight apps have been recently unpublished and are no longer publicly available to new users. The eight apps focused on a simple multiple-choice format of question, answer and three distractors. They each had three levels; beginner, intermediate, and advanced. In addition, they provided a quick answer review button and post-game feedback on the choice selections made. The apps were designed with the concept of short-burst activity in mind. It was not expected that a user would use for long sittings. It was anticipated that the apps would be used anytime that a user had a small amount of free-time.

User Privacy

The apps included a terms of service and privacy statement, where it was stated that data may be gathered and used for research purposes, and users were asked to accept the terms prior to using the apps. Furthermore, the extracted data was anonymous. Once the data had been downloaded to the primary research computer, the cloud stored data was deleted from the research Google Analytics account.

Calculations

In Southeast Asia, the average duration for the eight apps per country was calculated using the formula in Figure 4.

$$cd = \frac{(\text{Dutch } n * d)+(\text{English } n * d)+(\text{French } n * d)+(\text{German } n * d)+(\text{Italian } n * d)+(\text{Portuguese } n * d)+(\text{Spanish } n * d)+(\text{Swedish } n * d)}{ct}$$

n = users
d = duration
ct = total country users
cd = country duration

Figure 4: Average Duration Formula for Eight Apps in One Country
Source: Byrne 2020

Results

The results are based on a significant number of users (see Table 1), Laos being the lowest at 810 users and Myanmar the highest at 49,907 users. The results focus on the three outlined short-burst research questions with regard to session duration, task duration, and number of tasks completed per session.

Session Duration

The average results for the nine countries fall within a range of 91 seconds. Myanmar has the lowest average user duration per session at 2 minutes and 46 seconds. The Philippines has the highest average user duration per session at 4 minutes 17 seconds. Five of the nine countries, Cambodia, Indonesia, Malaysia, Thailand, and Vietnam, had average durations that approximated to 3.5 minutes. Interestingly, Myanmar and the Philippines, which reported the largest numbers of users, both have average durations roughly 45 seconds from this 3.5 minute mid-point. This would suggest that it is not unreasonable to plan for short-burst activity with highs of approximately 4 minutes 15 seconds and lows of around 2 minutes 45 seconds activity.

Table 1: The Eight Apps Combined Average Duration in Southeast Asia

Country	Users	Average Duration (mins)
Cambodia	3090	3:27
Indonesia	7785	3:34
Laos	810	4:05
Malaysia	4057	3:36
Myanmar	49907	2:46
Philippines	12193	4:17
Singapore	1297	3:59
Thailand	6494	3:33
Vietnam	4353	3:25

Source: Data Adapted from Byrne 2020

There appeared to be a meaningful symmetry in the data. The two largest data reporting countries provided the range of ninety-one seconds, while many of the smaller user reporting nations fell precisely halfway along this range. What could this mean? The answer appears to be found in average number of tasks undertaken per session per country.

Tasks per Session

The data not only provides evidence for the amount of time users were willing or able to spend, but the number of tasks they were willing to perform. The grammar apps consisted of one main task; a seven-question multiple-choice quiz. There were also two subsidiary tasks, one for checking results and the other for changing game level. The grammar apps required users to navigate three screens in order to complete the first main task and there after a minimum of two screens (see Table 2). The subsidiary tasks also took two screens to fully complete.

Table 2: Likely Tasks Performed Per Screens Traversed

Screens Traversed	Tasks Performed
3	1
5	2
7	3
9	4

Source: Data Adapted from Byrne 2020

Looking at the screens per session for the eight apps in Table 3, the Philippines averages 7.97 screens per session, suggesting users undertook an average of 3.49 tasks. Myanmar averages 5.57 screens per session suggesting they undertook an average of 2.29 tasks. All other countries fell between these two, as they did with average duration (see Table 1), suggesting a correlation between time spent and number of tasks performed. It also would suggest that users from the nine countries spent a similar amount of time on each task.

Table 3: Average Screens Traversed and Likely Tasks
Performed for Eight Language Learning Apps

Country	Users	Average Screens Traversed Per Session	Likely Number of Tasks Per Session
Cambodia	3090	5.87	2.44
Indonesia	7785	6.18	2.59
Laos	810	6.93	2.97
Malaysia	4057	6.94	2.97
Myanmar	49907	5.57	2.29
Philippines	12193	7.97	3.49
Singapore	1297	6.41	2.71
Thailand	6494	5.96	2.48
Vietnam	4353	5.7	2.35

Source: Data Adapted from Byrne 2020

Duration of Tasks

The likely range for average time spent on a task was extremely narrow; see Table 4, with Myanmar likely spending an average of seventy-two seconds per task and Singapore eighty-eight seconds.

Table 4: Average Time per Task for the Eight Language Learning Apps

Country	Users	Average Time Per Task in Seconds
Cambodia	3090	85
Indonesia	7785	83
Laos	810	82
Malaysia	4057	73
Myanmar	49907	72
Philippines	12193	74
Singapore	1297	88
Thailand	6494	86
Vietnam	4353	87

Source: Data Adapted from Byrne 2020

Task Time Issues

The three basic tasks performed within the app were quite different and likely to take different amounts of time. The results are consequently an average of the three. However, it was known that the subsidiary tasks made up less than 10 percent of all game screens visited, presumably minimizing their impact on average results. Therefore, the results are quite probably a reasonable indication of how long it takes to perform the main multiple-choice task, although slightly skewed by the subsidiary tasks and the use of a back button to leave a task uncompleted. Irrespective of any doubts over the precise duration of the main task, the data do express how long users are willing to spend per session, how many tasks they are likely to try to perform per session and it provides an approximate average duration for completing a task.

Variation among Language Apps

If we break the data down by language studied, as was explained in the methods section, many countries were deselected due to having less than seventy-five users for the specific data point. Table 5 shows that the results for English study, as might be expected, does not significantly change. The range of predicted tasks undertaken is from 2.29 in Vietnam (no change) to 3.68 in the Philippines (slightly higher). The French study app is the only other app with data for all nine countries and its range for tasks undertaken is 1.38 in Singapore to 2.32 in Vietnam. The French app appears to have significantly fewer tasks undertaken than the English app, and this is especially true in the Philippines and Singapore. The German study, with the exception of Myanmar, is a two task per session event. German study appears particularly popular in Thailand, where task usage exceeds English. The other apps tend to display weak usage results, the only exception being Italian usage in Indonesia. The Dutch app task results were extremely different and quite poor in comparison to the other apps. Overall, the average number of tasks performed per session for the thirty-four country app entries found in Table 5, was 2.09 tasks.

Table 5: App Tasks per Session in Southeast Asia

Country/App	Dutch	English	French	German	Italian	Portugal	Spanish	Swedish
Cambodia	-	2.62	1.91	-	-	-	-	-
Indonesia	0.76	2.79	2.25	2.37	2.42	-	-	-
Laos	-	3.13	2.22	-	-	-	-	-
Malaysia	-	3.11	2.25	2.08	-	-	-	-
Myanmar	-	2.29	1.64	1.3	-	-	-	-
Philippines	0.66	3.68	1.4	2.57	1.8	-	1.79	1.7
Singapore	-	3	1.38	2.02	-	-	-	-
Thailand	0.53	2.57	2.18	2.81	-	-	-	1.49
Vietnam	-	2.54	2.32	2.08	1.7	-	-	-

Source: Data Adapted from Byrne 2020

Looking at Table 6, the range of average time per task for the English app has remained unchanged. Myanmar provides the low of 72 seconds and Singapore the high of 88 seconds. However, the other six apps with data have slightly varied from the English app, although not by a great extent. If we were to widen the range from 69 seconds to 100 seconds, then only four of 34 data entries are outside this range. Significantly three of these anomalies are from the Dutch app. The fourth anomaly is the data from Laos on the French app. It seems that the study of six languages; English, French, German, Italian, Spanish and Swedish, are remarkably consistent in terms of the time taken to complete an app task. In fact, if we look at the average task duration in seconds per app, while also factoring in the number of users per country, we see the following average task duration times (in seconds); English, 74, French, 90, German, 87, Italian, 86, Spanish, 85, Swedish, 84.

Table 6: App Task Duration in Seconds for Southeast Asia

Country/App	Dutch	English	French	German	Italian	Portugal	Spanish	Swedish
Cambodia	-	80	99	-	-	-	-	-
Indonesia	230	79	91	88	81	-	-	-
Laos	-	77	118	-	-	-	-	-
Malaysia	-	72	75	79	-	-	-	-
Myanmar	-	72	86	69	-	-	-	-
Philippines	235	73	84	83	85	-	85	81
Singapore	-	88	93	87	-	-	-	-
Thailand	315	83	96	93	-	-	-	85
Vietnam	-	88	84	89	93	-	-	-

Source: Data Adapted from Byrne 2020

Conclusion

The data suggest that it took the average Southeast Asian user between 74 and 90 seconds to complete an activity of an English, French, German, Italian, Spanish or Swedish app. The data also suggest that they were willing to undertake on average, two activities per session, although English app users were somewhat closer to three activities. Consequently, the sessions tended to last for several minutes, but probably less than five minutes. These data offer initial parameters to guide short-burst IoT activity development. Once we understand the context from IoT data of where the users are, and what they are doing, we can refine apps to meet real needs. We will be able to build a personalized program of language study based on user habits, lifestyle and location.

Furthermore, the combination of this geo-located, habitual, lifestyle information will allow us to create a predictive contextualized model of individual user learning behavior, that may complement existing educational models (Essa and Ayad 2012; Zukerman and Albrecht 2001). This will enable app developers and educators to provide better learning and improve learning outcomes. Essentially, the app usage experience will be enveloped within unique learner scaffolding, or as Vygotsky (1978) termed the "zone of proximal development," suited to the needs of each individual learner.

The Internet of Things will interact with user mobile, or wearable, devices in multiple ways. For example, an IoT enabled device with known social function, such as the toilet, fridge, television, bed, or bath could transmit messages to nearby devices. These could trigger activity within a user's device that is listening for local signals, such as downloading contextually relevant materials. In addition, a Wi-Fi hot-spot might act as an IoT dispenser of local material or as a geo-located reference marker to a specific location, such as a shopping center, airport, stadium or library. Furthermore, blockchain and mobile devices are quite likely to play a future role in identification confirmation, meaning IoT sensors will be placed at sensitive and important locations, such as ATM machines, check in counters at airports, and the checkout aisle in your local store or any location where identification will improve security or decrease fraud. A mobile language app, by being aware of these signals, will be aware of where we are and what we are doing. Based on our findings, the app could send the user a few 90 second activities; just after we have completed our ATM transaction or while we are known to be waiting in the checkout aisle. If the mood takes them, or the context inspires them, then Southeast Asian users will probably find a few minutes to attempt two, or three, ninety-second language learning tasks focused on where they are, or what they might be doing.

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