

# Integrating Incidental Vocabulary Learning Using PDAs into Academic Studies: Undergraduate Student Experiences

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**Abstract.** In higher education literature, no in-depth studies have been identified that investigate the value of integrating incidental vocabulary learning using mobile devices into undergraduate students' academic studies. This one-year multiple-case study investigated undergraduate students' dictionary and other uses of Personal Digital Assistants (PDAs) to enhance their incidental vocabulary learning in an English-medium (EM) university. The research findings show that the students made a variety of uses of PDAs to improve their vocabulary learning in the course of academic studies both in- and after class. The research results indicate that PDAs can be used in more flexible, novel and extended ways for English as a foreign language (EFL) vocabulary teaching and learning in both informal and informal learning environments in higher education.

**Keywords:** Dictionary use, EFL, incidental vocabulary learning, mobile technology, PDA use.

## 1 Introduction

English learning is important for university students in non-English speaking countries, especially those students from English-medium (EM) universities. Vocabulary learning is crucial for English learning because vocabulary constitutes the basic building blocks of English sentences [1]. Research into vocabulary learning for English as a foreign language (EFL) students has been prominent. Many research findings show that poor vocabulary frequently leads to incorrect inferences or misunderstanding of the content when reading English materials in their academic studies [1], [2] and [3]. The vocabulary learning strategy literature shows that the use of the dictionary has a positive effect on students' vocabulary learning in terms of their language course studies [1], [2] and [4]. However, in the digital age, few students bring along a thick dictionary to class or places of study. They may bring a handheld electronic dictionary, or a mobile device with downloaded dictionaries such as a mobile phone or a Personal Digital Assistance (PDA). Mobile devices have been

increasingly developed, designed and used to 'ultimately support a lifetime of personal and social enrichment' that can support education [5]. How do EFL students make use of PDAs as a tool on their own to help with their incidental learning of vocabulary in the course of pursuing their degree in higher education? Research in this area remains limited. However, understanding EFL students' perceptions of PDA use for incidental vocabulary learning will help the EFL researchers and teachers understand students' needs and strategies in coping with vocabulary difficulties in their academic readings.

The following section of this paper reviews incidental vocabulary learning literature and identifies the research framework, followed by the research method adopted in a longitudinal multiple-case study. Research results are then presented, and implications relating to the results are discussed.

## **2 Literature on English Vocabulary Learning for EFL Students**

### **2.1 Incidental Vocabulary Learning**

Vocabulary learning activities generally fall into two types: *intentional* and *incidental* learning of vocabulary [1]. The former refers to activities that aim at vocabulary development predominantly. When vocabulary is learned predominantly through extensive reading, with the student guessing at the meaning of unknown words that do not have a predominant focus on vocabulary development, the activities are called incidental learning of vocabulary [6]. Incidental learning creates opportunities for inferring word meaning in context, enables vocabulary acquisition and reading at the same time, and is more individualized and student-based because the vocabulary being acquired is dependent on the student's own selection of reading materials [6]. However, studies have revealed that incidental learning of vocabulary may lead to such problems as incorrect inferences [3]. The problem of guesses may be due to the fact that unlike native speakers, EFL students often lack the word knowledge from context and do not use active reading strategies [6]. They need to be able to have constant access to word related resources such as dictionaries to help resolve problems in their academic study.

### **2.2 MALL in Terms of Incidental Vocabulary Learning**

Some studies have attempted using computer-based dictionaries to improve EFL students' incidental English vocabulary learning in language courses [7]. Hill and Laufer's [7] research findings showed that the use of computer-based dictionaries could trigger more incidental vocabulary related learning activities for Chinese EFL university students [7]. In recent years, studies on mobile technology assisted vocabulary learning are on the rise [8] and [9]. These studies have experimented with improving students' vocabulary learning in the environment where students used mobile technologies for prescribed vocabulary learning tasks, or tested designed personalized learning systems to enhance student's vocabulary learning in a short term in language related courses. Dictionary use via mobile devices has often been

considered simply a reference for students and is not assumed to induce other vocabulary learning activities [10] and [11]. The concerns regarding whether dictionary use of the PDA will be referential only for students' incidental vocabulary learning across their academic studies in higher education, and what other uses of the PDA can help students' incidental vocabulary learning activities are unknown. This empirical research was an attempt to fill this gap. It aimed at investigating students' free use of mobile devices - PDAs to foster their incidental vocabulary learning in terms of dictionary and other uses at an EM university in Hong Kong from the perspective of the students. The research questions are: (1) what dictionary use and other uses of the PDA did the students make to support their incidental learning of vocabulary in their academic studies? (2) how did dictionary use and other uses of PDA help the students with their incidental learning of vocabulary?

### **3. Research Methods**

Qualitative research through a multiple case study approach was adopted for a period of one year from April 2006 to March 2007 to gain a deeper understanding of the processes and outcomes of the PDA use in incidental vocabulary learning by the students, and add confidence to the research findings [12].

#### **3.1 Context**

According to Hulstijn, Hollander, and Greidanus [13] intermediate and advanced EFL students enlarge their vocabulary to a great extent through incidental vocabulary learning. Students in EM universities in Hong Kong are considered advanced EFL learners as they passed certain English proficiency tests before being enrolled in these universities. These students often perceived a need to continue their study of English because most of the students' native language is Chinese. They need to read and understand lecture handouts, academic papers, and books with the help of a dictionary throughout the course of pursuing a Bachelor's degree. Laufer and Hill [14] claimed that in EM universities in Hong Kong, no instruction is given on the usage of dictionaries in their English enhancement courses. This provided opportunities for this research study to examine students' optimal lookup conditions in their incidental vocabulary learning.

#### **3.2 Student profile**

Three students were selected from first-year undergraduate students at a university on a voluntary basis. The criteria for student selection were: positive attitudes towards technology use, different disciplinary studies, gender, nationality/region. Finally, three students/cases were chosen for this research study. Their profiles are shown in Table 1. A consent letter containing terms and conditions in participating in this project was given to the students. In this project, each student was provided with one 1 G mini memory card and a PDA - a Dopod 818 Pro device for free use. Dopod 818

Pro is a wireless enabled device with both phone and PDA functionalities. In the university, free wireless access was available on campus and in university residential halls, where students could access the Internet using the device.

**Table 1.** Student profile

Student*	Age at the time of the study	Major	Year of study	Nationality at the time of the study
Ann	19	Journalism	1	Mainland Chinese
Andy	20	Engineering	1	Hong Kong permanent resident
Evan	20	Biotechnology	1	Hong Kong permanent resident

\*Pseudonyms are used to protect the students' identities.

### 3.3 Data collection and analysis

Student electronic journals (e-journals), student artifacts as screenshots created using the PDA and face to face interviews (F-T-F interviews) were the main means of data collection over a period of one year. Retrospective interviews were also made based on the questions raised from student e-journals and artifacts submitted. Categorizing and contextualizing strategies were adopted to analyze the data collected at different stages [15].

The data analysis underwent two stages. First, content analysis was used to categorize the data collected adopting Nvivo qualitative analysis software. Student data sources were initially coded on the broader themes: dictionary use, other uses, vocabulary learning. Coded themes of data were then recoded according to sub-themes. A constant comparative analysis was conducted on data to find sub-themes that initially emerged from student perceptions of the PDA use and their learning. A final list of sub-theme codes was placed in matrices by student names along with excerpts from F-T-F interviews, and e-journals. Afterwards, student artifacts and retrospective interviews were coded and put into the matrix by themes and sub-themes and student names in order to triangulate data. The triangulated sub-theme data were further analyzed for common themes that describe common practices and thinking among the three cases in using the PDA for their study. Another sub-theme: common uses and perceptions, from all three cases emerged. The sub-themes of other uses included other PDA functional uses. The sub-themes of learning included referential, data collection, situated, constructive, reflective, explorative and conversing uses. In the second phase of data analysis, a more descriptive method was adopted to contextualize PDA uses in each case to understand the 'true story' behind the uses for vocabulary learning in relation to the sub-themes.

## 4 Results

The following are results obtained from the analysis of the three cases. For the sake of clarity, the findings from the cases are presented individually. Then findings across

the cases are also described. The research questions in relation to *what* dictionary and other uses of the PDA students made, *how* dictionary and other uses helped students' incidental vocabulary learning are answered.

#### **4.1 Case 1: Ann**

Ann, from Mainland China, lives in a university hall. Majoring in Journalism, she took as many opportunities as possible to improve her English as she considered her English was not good enough. She had used a handheld electronic dictionary to help with her studies. As soon as she participated in this research project, Ann gave up using the electronic dictionary, and downloaded the free Oxford English-Chinese Dictionary from 'Mdic' that consisted of a set of dictionaries. Ann also took advantage of Internet access using the PDA. The following are the main uses that Ann made in her incidental vocabulary learning.

##### **Dictionary uses of the PDA: *what* and *how***

- Downloaded dictionary on the PDA provided more opportunities for her to refer to unknown words in context. Ann reported that the dictionary use increased her vocabulary retention by frequent exposure to unfamiliar words through repeated consultation, and helped solve problems in the reading materials such as the handouts and PowerPoint slides 'just-in-time' during lectures or self-study when a computer was not available.
- Downloaded dictionary on the PDA provided opportunities for her to understand unfamiliar words through discussion with classmates. Ann reported that she often discussed with classmates unfamiliar words encountered during their study.

##### **Other uses of the PDA: *what* and *how***

- Online search using the PDA provided opportunities for her to gain deeper understanding of new words. Ann reported that she usually used the downloaded dictionary on her PDA to look up unfamiliar words. But if she still could not quite understand the word, she preferred to do an online search via Google 'define' using the PDA (See Figure 1), or browse Wikipedia using a computer if a computer was available.
- The Notes function on the PDA provided opportunities for her to take down useful English expressions in context and reflect on the meaning and use afterwards. Ann wrote down many expressions of English taken from lectures, talks or reading materials, and used them in her course work or project reports after reflection and reconstruction.
- Downloaded materials on PDA provided the opportunity for her to review English words and expressions whenever she wanted. In order to learn 'idiomatic' English, Ann downloaded passages and exercises from the book series 'New Concept English' to her PDA. She wanted to review and learn them by heart so that she could make free use of these expressions in her course work or project reports.

## 4.2 Case 2: Andy

Andy is from the Department of Mechanical Engineering. Andy used to consult dictionaries using a computer. In many cases, when he encountered vocabulary problems, and a computer was not available, he could not solve his learning problems in time. As soon as he joined this project, Andy found the Mebook consisting of varied dictionaries from the Internet. He downloaded a Professional English-Chinese Dictionary in his disciplinary study to the PDA. Andy also used the device to get access to the Internet for his vocabulary learning. The following are the main uses of PDA by Andy.

### **Dictionary uses of the PDA: *what and how***

Downloaded dictionary on the PDA provided the opportunities for him to solve the vocabulary problems during his revision of courses. Andy reported that he usually looked up engineering related new words and expression from hardcopy handouts distributed by the lecturers before, during and after lectures using the dictionary on the PDA. It was really helpful for his revision and reflection.

- Downloaded dictionary on the PDA provided opportunities for him to share the vocabulary knowledge with peers in context. Andy reported that when he worked in a group, they would from time to time encounter unfamiliar words and expressions. In such cases, he would consult the dictionary, and then share the knowledge with the group.
- Downloaded dictionary on the PDA provided opportunities for him to learn the pronunciation of unfamiliar words. Andy considered that his pronunciation of English was not proficient, so he downloaded the Professional English-Chinese Dictionary with a sound function. He could listen to the sound of the unfamiliar words. He said this helped him learn these words better (See Figure 2).

### **Other uses of the PDA: *what and how***

- The PDA provided opportunities for him to solve vocabulary problems by making phone calls to his classmates, or MSN chat with his friends. Andy reported that when he could not find the unknown academic words in the dictionary on the PDA, he would call his classmates for their help. He also used MSN to chat with his friends to solve vocabulary problems.
- Online dictionary accessed via the PDA provided opportunities for him to search academic terms online if those terms could not be found in the dictionary on his PDA. Andy preferred consulting the downloaded dictionary on the PDA. However, if there were some terms that could not be found in the PDA, he would connect the PDA to the Internet and look up 'Yahoo Online Dictionary'.
- Notes function on the PDA provided opportunities for him to take down unfamiliar words in context and re-read and look up meanings later. Andy would take down unfamiliar words using the Notes function on the PDA during lectures when he could not find these words in the downloaded dictionary on the PDA, and other means of communication were not convenient in the lecture rooms.

### 4.3 Case 3: Evan

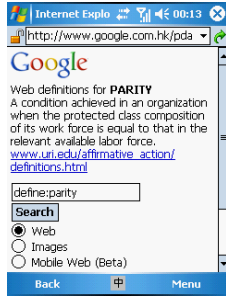
Evan is from the Biotechnology Department. Though he is a local Hong Kong resident, he considered that his English was not proficient. Before joining this project, he always carried a paper dictionary. He used the downloaded English-Chinese dictionary Dr. eye on his PDA after he joined this project. He used dictionaries at home, university library, on campus, in transport, abroad during trips, etc. for vocabulary learning in his academic studies. The following are the main uses of PDA reported by Evan in his incidental vocabulary learning.

#### **Dictionary uses of the PDA: *what and how***

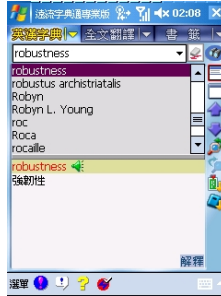
- The downloaded dictionary on the PDA provided opportunities for him to consult academic vocabulary in context. Evan reported that the dictionary – Dr. eye played a key role during the situations when he encountered vocabulary problems in reading academic papers, handouts or books in biology. It was useful and convenient for his learning.
- The downloaded dictionary on the PDA provided opportunities for him to improve his understanding of lectures, and help him do his assignments on overseas trips. Evan reported that he used to guess new words and expressions during lectures if there was no dictionary available. With the PDA, he made fewer guesses as guessing sometimes caused serious misunderstandings.
- The downloaded dictionary on the PDA provided opportunities for him to learn the pronunciation of unfamiliar words. Dr. eye has a sound function. He reported that he frequently referred to this function. He felt that his pronunciation was considerably improved after the one-year trial, and practicing the pronunciation helped him remember words better.
- The downloaded dictionary provided opportunities for him to help construct and proofread his course work. Evan noted that when he was writing assignments, sometimes, he would forget how to spell a word, or express ideas. In such cases, he would use synonymous expressions with the help of the dictionary on his PDA. Evan also constantly reported that he used the dictionary on his PDA to do proofreading after he completed essay writing.

#### **Other uses of the PDA: *what and how***

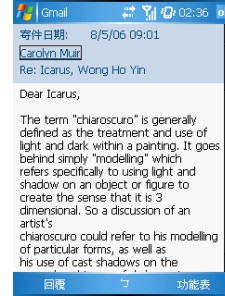
- The PDA provided opportunities for him to get access to the Internet and write emails to his lecturers to solve problems relating to academic terms. Evan mentioned one time when he had encountered an academic term ‘chiaroscuro’ that he could not understand even with the help of the online dictionary on his PDA. He then wrote an email to his teacher who responded immediately, explaining the term to him. He found this experience really enhanced his learning (See Figure 3).
- Camera function on the PDA provided opportunities for him to capture photos with academic terminology for later memorization and reflection. Evan used the camera function on the PDA to capture some pictures from books in the library or PowerPoint slides during lectures in relation to Bio-technology courses.



**Fig. 1.** Screenshot of 'Google define' online search



**Fig. 2.** Screenshot of word 'robustness' with pronunciation



**Fig. 3.** Screenshot of an email correspondence

#### 4.4 Common Uses and Perceptions of the PDA from Cases 1, 2 and 3

It is noted that perceptions from all of the three students in some aspects are quite similar, if not identical. First, all of them reported that downloaded dictionaries on the PDA provided opportunities for them to get faster access to unknown words than using a computer. Secondly, all students felt more confident when they encountered problems during lectures or self academic studies and increased their self-efficacy. They could solve vocabulary problems in time during lectures, and better understood what lecturers conveyed by using different searching options such as dictionaries both on- and offline. They also reported that the PDA helped them improve their vocabulary learning efficiency as well as their academic studies in general. Moreover, all the students had kept on using the PDA to consult unfamiliar words in participating in the one-year project. However, Andy reported that he used the PDA as a dictionary less in the second half of the year as he knew most of the academic terms in his disciplinary study. The other two students – Ann and Evan did not make such claims.

### 5 Discussions

Patten et al. [11] categorize the use of material such as dictionaries and e-books on mobile devices into a 'referential' function in terms of its mobile educational applications in formal learning situations. They posit that referential applications generally do not go beyond information delivery. Based on this framework, Clough et al. [10] further developed an informal mobile learning framework derived from their survey of web forum users in terms of mobile learning activities. They classify the use of referential materials into individual and collaborative referential activities. These frameworks shed some light on analyzing incidental vocabulary learning activities using PDA of this study. However, in-depth analysis revealed that uses of referential materials via PDA rendered learning that is far more complex than these frameworks show. A diagram of the PDA uses derived from this study is presented in Figure 4.



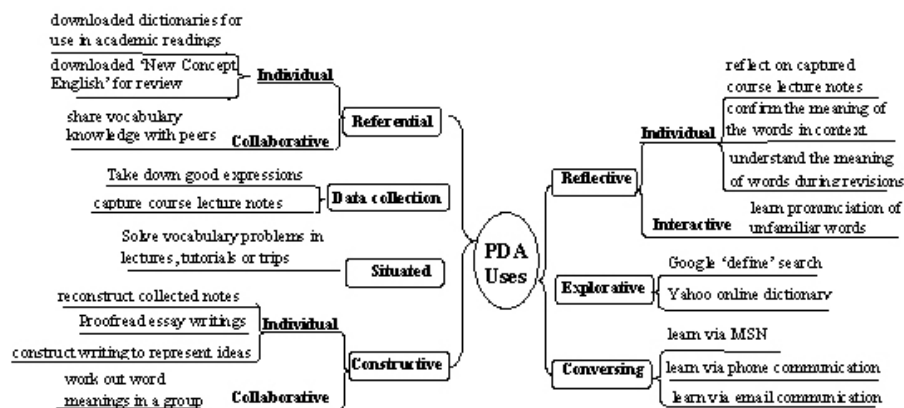


Fig. 4. Diagram of PDA uses for incidental vocabulary learning

### 5.1 Referential Uses

Referential applications provided student access to content at places where learning activities occur, taking advantage of the portability and mobility of mobile devices [11]. Such uses reported by the students include both individual and collaborative reference. Individual uses include the uses that the students made to refer to unknown words in revision of academic reading materials such as handouts, slides, articles or books. Collaborative uses were concerned with the use of PDA to look up unknown words, and share them with other students. This dictionary content access provided the students a chance to learn vocabulary 'just-in-time'.

### 5.2 Data Collection Uses

Data collection made use of the capability of the mobile device to record data and information about their environment [10] and [11]. Such uses described by the students using Notes on the PDA to take down good 'English expressions' or capture photographs of some images in academic books or lecture slides for later review and reflection. Such data collection was usually unfeasible or problematic without the use of the mobile device [11].

### 5.3 Situated Uses

Situated use refers to the mobile devices that offered the opportunities for spontaneous, personal, informal, and situated learning for a socially situated practice [16]. The PDA uses are shifting the focus from smart planning to smart situated actions [17]. In this study, such uses students made included: finding out the meaning of academic terminology during lectures or tutorials when the lectures or tutors raised

questions, solving vocabulary problems when students used small chunks of time to do their academic assignments on buses, trains, planes and at hotels, etc.

#### **5.4 Constructive Uses**

These uses refer to the activities in which the students created or constructed knowledge individually or with others [10]. These uses allowed students flexibility to represent their ideas as they saw fit using collected information or chunks of text or pictures [18]. Students in this study constructed their academic writings to represent their ideas with words and expressions collected using the PDA, choose appropriate words in essay proofreading with the help of the dictionaries on PDA individually, or work in concert with others to work out the meaning of words during their study. These uses afforded students a sense of involvement and vested interest that helped them sustain their intentions for further knowledge construction and learning [18].

#### **5.5 Reflective Uses**

In reflective uses, the mobile device functioned as an intellectual partner with the student to engage and facilitate deep learning [18]. In this study, these uses were composed of individual and interactive reflective uses. In individual uses, students used dictionaries on PDA to compare and confirm the meanings of the academic terms when they revised their course materials. In addition, they reflected on their captured lecture notes or images using PDA in order to better understand the vocabulary in the pictures, which not only aided students' vocabulary retention [19], but also helped reflection when they were out of the learning environment. For interactive use, students used the downloaded dictionary with sound function so that they could consult the pronunciation of unfamiliar words for their own learning needs. Hill [20] found that Chinese learners appeared to benefit from hearing the pronunciation of unfamiliar words as a means of retention. In this case, the PDA functioned as an intellectual companion for them to interact with.

#### **5.6 Explorative Uses**

In explorative applications, students searched and interpreted the information that was related to their learning needs [18]. Students reported that whenever they wanted to get detailed explanations of certain words or academic terms, they would take the last resort by online searching via PDA or computer such as Google 'define' search, and the Yahoo online dictionary. Sometimes, they would use online or downloaded Wikipedia via a computer for the searching process. This process promoted meaning making by constantly forcing the students to interpret the information they were finding on website or downloaded resources in response to their intentional search, and determining how relevant it is to their intended purpose [18]. Rich information about the meaning of unknown words explored positively affects their learning [13].

### 5.7 Conversing uses

Conversing use refers to the social interactions which led to learning mediated by the mobile device by taking advantage of the mobile device's unique characteristics of connectivity to the Internet and phone function [18]. In this study, students used the PDA to solve vocabulary problems by making phone calls, through emails or MSN chat. Evan reported that he understood what 'chiaroscuro' meant after he wrote to his teacher an email about it; and Andy mentioned how he and his classmates came to a common understanding of the word 'ductile' via MSN chat. In these applications, the PDA afforded 'conversation social interaction' for students to work together and socially reach a common understanding [18].

## 6 Conclusions

This research study examined undergraduate EFL students' use of dictionaries and other uses of the PDA to enhance their incidental vocabulary learning in pursuit of their undergraduate studies at an EMI university. In general, students' attitude towards the technology use was positive. Their experiences in using the tools on the PDA enhanced and extended the way they learned vocabulary. Students did not restrict themselves to make only a referential use of the PDA for their vocabulary learning, they also employed various tools on the PDA for data collection, situated, constructive, reflective, explorative, and conversing uses. In addition, students' uses of the PDA were not fixed but adaptable and dynamic in the learning processes. These learning activities further drove students to make more creative PDA uses to improve their vocabulary learning in the course of their academic studies.

This three-case study is limited in its capacity for generalization, especially as the cases were chosen from highly motivated technology users. Nevertheless, the research indicates that the PDA can be used in more flexible, novel and extended ways for EFL vocabulary teaching and learning in higher education. It is not the technology itself that changes learning practices but students' use of the technology. The research results shed some light on how to improve incidental vocabulary learning practices using mobile technology in both formal and informal learning environments in higher education.

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