DEVELOPMENT AND USE OF AN EFL READING PRACTICE APPLICATION FOR AN ANDROID TABLET COMPUTER

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ABSTRACT

This paper reports on the use of an English-language reading practice application for an android tablet computer operating system with students who are not native speakers of English. The application materials for vocabulary learning in reading-passage contexts were created to include words from a database of low-frequency and technical noun-verb collocations which occurred frequently in certain documents related to the study of international affairs: thirty English-language annual reports of United Nations organizations found on official websites; and English-language annual reports and other articles from the websites of twenty international non-governmental organizations. The learning materials were used in an English for specific purposes course intended to support the reading skill development of students studying international affairs at a university in Japan. Research showed that use of the learning materials had three positive influences on students' study behavior: the students' reading speed increased without a loss in comprehension; the students reported that they enjoyed the reading practice with the mobile tablet computer; and they appreciated that it had some merits that differed from reading practice in hard copy formats that may help improve reading skills.

KEYWORDS

Tablet computer, Vocabulary learning, Reading practice application, English for specific purposes (ESP), the study of international affairs

1. INTRODUCTION

Students who are in the Department of Global Affairs at a university in Japan have four English as a Foreign Language (EFL) courses in the core compulsory curriculum during their four years of university studies. These four courses are English for general purposes courses. Although these students do not major in English language studies, many of them are expected to have high levels of English proficiency for study and for career purposes.

The focus of their studies, in mainly Japanese-language compulsory and elective lecture courses, is on three areas of international affairs: International Relations, International Business, and Global Regional Studies. These courses use English as well as Japanese readings. Courses in these three areas could be strengthened by the creation of materials that promote the learning of unknown words that occur frequently in English international affairs texts; and by requiring students to carry out course learning tasks, such as reading English texts, with the target vocabulary, in order to make analytical oral and written reports using the new vocabulary. There is a proposal to establish English for specific purposes (ESP) courses which would be linked to Japanese-language international affairs courses and replace the current English for general purposes courses.

Accordingly, in order to investigate an approach to vocabulary learning in the proposed ESP courses, as a first step, reading passages on International Relations and Global Regional Studies topics were written for a mobile android tablet computer operating system. The key words of the reading passages consisted of the words on a 550-word English vocabulary list of low frequency and technical noun-verb collocations which was compiled for this project. The words on the vocabulary list were selected, according to teachers' views

on the words' usefulness in international affairs courses, from the first stage of this project's database of commonly occurring non-verb collocations taken from a corpus of approximately 1.3 million words drawn from thirty English-language annual reports of United Nations organizations which are accessible on official websites; and the English-language annual reports and other articles from the websites of twenty international non-governmental organizations. These documents were chosen to develop vocabulary and reading learning materials for international affairs ESP courses for two reasons: 1. these texts are related to required readings used in International Relations and Global Regional Studies courses; 2. the English texts are written for an international audience which mainly includes native speakers of the world's other languages.

1.1 English for Specific Purposes

English for specific purposes was formalized as an area of EFL study in the early 1960s (Johns 2012). In this project, ESP was defined as an approach to EFL teaching, adapted from views described by Anthony (1998) and also Dudley-Evans (1998) with the following characteristics: 1. ESP is defined as EFL study which meets the specific needs of the learners in a specific discipline, i.e. international affairs 2. ESP makes use of the underlying methodology and the topics of the discipline it serves, i.e., reading original texts of international organizations 3. ESP is centered on the language appropriate to these topics in terms of the grammar, lexis, register, study skills, discourse and genre. In this case, the special and common vocabulary of the major organizations engaged in international activities.

As the ESP field has evolved, the focus of teachers' attention has moved away from the transmission of grammatical and lexical knowledge to how knowledge is delivered to the learner. This shift of attention has transformed ESP into a strongly learner-centered and learning-centeredness field (Gatehouse 2001). ESP research has, in recent years, looked deeper into the actual acquisition of language. What motivates learners to acquire ESP knowledge and what needs do they have? What strategies are employed by ESP learners? These questions are central matters in the design of ESP materials, as this area continues to be refined and developed further (Gatehouse 2001, Johns 2012), especially at the university level where students are expected to have already achieved general English proficiency.

In terms of vocabulary learning, ESP texts are thought to be more accessible for learners, who have a solid understanding of the knowledge and use of high frequency words, if they are provided with opportunities to study and use low frequency words, including academic and technical vocabulary. It is important to keep in mind that because these kinds of words are required for both receptive and productive use by the ESP learner, and moreover, that because no matter how advanced their English level is, vocabulary learning in general is considered to be one of the most challenging and on-going parts of language acquisition, the learning of specialized ESP vocabulary should be investigated by the development of new teaching materials and methodologies.

Nation (2008) states that ESP vocabulary learning challenges arise partly from the French, Latin and Greek, origins of some ESP words which have different stems and affixes from most high frequency words. Nation also explains that a key factor in vocabulary acquisition is repetition of exposure to new words and expressions for better recall and retention; however, more specialized vocabulary occurs less often in the lower-proficiency levels of language learning, and thus, also in English for general purposes textbooks. Therefore, the field of ESP is not only concerned with delivering relevant and authentic content to the learner, but also with the teaching and learning of low frequency and technical vocabulary.

Instructors and course designers for ESP must look carefully at the needs of learners, assessing language use and how to assist learners in acquiring and transferring new words into productive use. With the recent rapid developments in information technology in education, a range of new educational tools and materials have become available. When the needs of the learners in ESP courses are based around specific language functions in specific situations, learning materials that can immerse the learner in the situation they find themselves in, and in the required language, would be of great value within ESP (Belcher 2006).

1.2 Applications developed for ESP Courses

The reports of the following four research studies on projects in different parts of the world which developed and used mobile computer-based ESP applications are relevant to this study. Hoven and Palalas (2011) conducted a study in Canada that focused on the problem of making ESP course materials that meet the needs

of learners, particularly when the need is work-related. They reported on two adult professionals who were learning occupational English for accounting. The two learners had high-proficiency general English skills, however, they were lacking in the specific English skills needed for accounting. A blended learning course, a combination of in-class learning activities and out-of-class computer-based independent learning activities, was designed. An iPodTouch mobile device was used to provide speaking and listening skill learning materials for the out-of-class independent learning activities. The aim of the project was to give the two students more learning opportunities than is usual with conventional classroom-based materials with class-based homework assignments by making it easier to practice independently outside of class in any place and at any time of their choosing.

The content of the course consisted of podcasts and vodcasts based around scenarios connected to accounting. Reading, writing, grammar, and vocabulary exercises with audio quizzes were components of the podcast and vodcast learning materials. There were also links to additional online materials and a dictionary. The materials contained ample repetition of key terms, easy access to definitions to clarify meanings, and an aural spelling practice feature. The participants were given a questionnaire which allowed them to reflect on their experiences of using a mobile device for learning. They reported that they were satisfied with the ESP course because they believed the English skills they needed to work in accounting had improved, particularly in listening.

Song and Fox (2008) carried out a study at a university in Hong Kong with three participants to assess how mobile devices could assist in students' incidental learning of vocabulary for specific purposes by using e-journals and interviews to monitor their learning. These non-native English speaking students were taking courses in which English was the medium of instruction, rather than EFL courses. They used mobile devices with mobile phone capability and wireless access. One participant showed an increase in vocabulary retention, which was attributed to, by the student, to frequent exposure to, and repetition of new words, as well as to the use of the Internet during lectures (a form of 'just-in-time' learning) to get word definitions and thus, achieve better comprehension. The three participants also reported using the notepad application to record new words during lectures, and also from the online reading material which they had downloaded. Other comments reflected student perceptions that the benefits of mobile devices exceeded non-mobile computer-based learning tools which they said were less convenient. The mobile device enabled them not only to access what they required when they required it, but the mobile device was also easier to use for review purposes, as well as for collaborative learning through its capacity to put them in contact with classmates and the teacher to ask questions outside of class time.

Hsu's (2012) study provides an example of how the use of a mobile device was used to assist Taiwanese university students taking ESP courses with field research tasks related to work in tourism. The instructor sent tasks about a local tourist attraction to the students by mobile phone. The students used the mobile devices to conduct synchronous interactions with the instructor to acquire information that was required to complete the field-research tasks. The completed tasks were submitted by mobile phone. The purpose of this study was to improve vocabulary learning by using English for problem solving in a field-research learning environment relevant to actual communication that is required for specific occupational purposes.

Fotouhi-Ghazvini, Earnshaw, Robison, and Excell (2009) created an ESP game for Iranian university students in a computer engineering course. The aim was that by playing a game, they could expose students to, and facilitate the retention of, a large amount of specialized vocabulary that otherwise would be hard to learn using traditional methods. The researchers designed the game so that incidental learning could occur by using iconic visual imagery memory elements. They created a game with the hope that even though the students were exposed to a large quantity of vocabulary items, they would be able to sustain a high degree of motivation due to the dynamic and engaging nature of a game. A mobile phone was used to provide the learning materials to allow the students to access the materials more frequently. The game was based around the basic processes of a computer. The game was set in an interactive city with characters that represented the elements of a motherboard. As the students progressed through the game they could 'visit' different areas of the city gaining computer-engineering knowledge and learning new words in context for better comprehension.

These four studies, although small in terms of participants, offer encouragement that out-of-class vocabulary learning tasks that allow students independence in learning can be facilitated by the use of mobile devices.

2. RESEARCH QUESTION

Would the use of the reading practice application on a mobile device help students read ESP reading passages with low frequency and technical vocabulary which occurs frequently in international affairs documents?

3. DESIGN OF THE APPLICATION

This project involved the development of an ESP low-frequency and technical noun-verb collocation vocabulary list to create reading task learning materials for use as an application on a mobile android tablet computer operating system.

In order to develop the application, we used the ADDIE model, a practical model for the design and development of instructional materials which centers all component processes in a holistic systematic planning environment. The ADDIE model has five phases: Analysis, Design, Development, Implementation and Evaluation; each phase has an outcome that naturally leads into the subsequent step (Gagne, Wager, and Keller 2005).

3.1 Students' Needs Analysis

26 second- and third-year students in the Department of Global Affairs at a university in Japan, voluntarily participated in the study. The participants were asked five open-ended questions: 1. What type of words do you want to learn? 2. What kind of international affairs texts do you want to read? 3. What kind of resources do you use in order to get information about the international affairs topics which you are interested in? 4. How do you use the knowledge that you obtain from the texts? 5. What kind of work do you want to do after you graduate?

As for Questions No. 1 and No. 2, all the participants answered that they wanted to learn initialisms, acronyms, and words and phrases which are typically used in the publications of the United Nations, international non-governmental organizations, and other organizations referred to in the texts and lectures in their courses in various aspects of international affairs. They said they wanted to read the aforementioned publications; however, they found the vocabulary and the concepts expressed by unfamiliar expressions difficult. As for Question No. 3, all the participants answered that they preferred to use search engines such as Google or Yahoo as their primary information resources, rather than the traditional hard-copy texts available in the library. The answer to Question No. 4 and Question No. 5 was that the knowledge from English-language international publications would be useful in the research for their graduation theses as well as for the work some of them hoped to do which would involve international communication in English.

3.2 Design of the Application

In order to meet the needs of the students, the application was designed to have the following two functions: 1. to encourage students to look up the international affairs vocabulary on the ESP vocabulary list, including initialisms and acronyms, and to present to the students the meaning and the pronunciation of the specialized vocabulary; 2. to highlight the vocabulary on the ESP list in the reading passages prepared for this project in order to present to the students the meaning and the pronunciation of the target vocabulary.

3.3 Course Design

In order to accomplish the primary aim of our project to help students read international affairs passages, an elective ESP course was added to the curriculum in which students read texts in class on the screen display of a mobile android tablet computer with a Wi-Fi Internet connection. The students were required to read as many passages as possible. The students were required to write a summary in English of each passage that they had read on a report sheet which was handed in to the teacher.

The following is the procedure of activities in each class session: 1. The students read one reading passage given by the teacher and answered comprehension questions. 2. The students wrote a summary of the text and handed it in to the teacher. The answers to the comprehension questions were given to the students. 3. The students looked for other authentic texts which were related to a topic of the first reading passage that the teacher provided them, using search engines such as Google or Yahoo on the Internet. 4. The students chose one text to read. After reading the text, the students wrote a summary. Steps 3 and 4 of the class procedure were repeated until the end of the class session. 5. The students took the mobile tablet computers home after class. They were free to use the mobile device with its free Wi-Fi connection to review their in-class work, to read other authentic international affairs documents, and to use the mobile device in any way they wished, as long as they took personal responsibility for their out-of-class use, including the payment of any extra costs. They submitted a report on the out-of-class activities the following week.

4. DEVELOPMENT OF THE APPLICATION

4.1 Project Word List

A fundamental way of supporting vocabulary teaching and learning has been to compile word lists of high-frequency words from a large corpus of texts. Word lists consist of a learnable number of relatively few words that make it clear to students which words should be learned first and best. West's General Service List of English Words (GSL) selected by frequency of occurrence and by criteria of usefulness from a wide variety of written texts provides information about different meaning senses of 2,000 common words and their comparative rates of occurrence (West 1953). Although about 80% of the words in a variety of written academic texts can be found in the GSL (Nation 2001, Cobb and Horst 2004), it was decided to use the more-recently compiled British National Corpus (BNC) to create the word list used in this project because the BNC is newer, larger, and also an on-going project (Nation 2004, Nation 2006). Coxhead's (2000) 570-word Academic Word List (AWL) was also used in creating our word list. The AWL's usefulness is based on the fact that 8.5% or more of the words in academic texts can be found on this relatively short list. It was taken into account in the compilation of the project word list that the AWL was created by using the GSL and not the BNC.

There is an argument that in spite of the wide coverage and usefulness of word lists for interdisciplinary academic purposes, discipline-specific vocabulary lists are also needed because academic words vary across disciplines in range, frequency, collocation and meaning (Hyland and Tse 2007) and because some of the words common to one certain field and specific to topics such as international affairs may come from a narrower learnable pool of low-frequency and technical words. It is essential to help students extend their academic vocabulary knowledge because as many as 98% of the words in a text must be known for comprehension (Hu and Nation 2000).

An obvious learning problem with most word lists is that the words have been taken out of the contexts that they were found in. In order to deal with this issue, the list compiled for this project consists of words in the key collocations they were found to occur in. Goto (2007) analyzed the syntactic features of selected English essays in various physical science fields from corpora assembled by the Nagoya Institute of Technology, using 'Machinese Syntax,' a syntactic parser which produces information on base forms and compound structures, part-of-speech classes, inflectional tags, noun phrase markers, and syntactic dependencies. By multivariate analysis, three patterns of noun collocations were found: 1. verb + noun, 2. noun + preposition, 3. noun + noun. In this study, the first of the three patterns was adopted as Akano (2008) claims that a priority should be placed on explicitly teaching this pattern to Japanese EFL students because of the centrality of the verb-noun combination in expressing key meanings, and the value of teaching vocabulary in the tightly conventional patterns which tie words together, rather than teaching new vocabulary as single isolated words on lists

A corpus of English language texts was used to create the word list. The corpus consists of two components in PDF versions formatted for print: 1. annual reports and other major reports of UN organizations 2. annual reports and other major reports of prominent international NGOs. The PDF versions of the reports were converted into texts using xdoc2txt.exe. The bodies were extracted from the texts and lists

of words were compiled. The texts have yielded a word database of 1,262,303 tokens (total number of words) and 28,371 types (different words).

The word list for this project was created in the following way: 1. Words that occurred at a frequency of less than 10 times were removed from the data base. 2. Initialisms and acronyms were extracted from the data base. 3. Words which were included in the BNC most frequent 2,000 word family list (head words plus inflections and derivations) prepared by Nation (2006) were also eliminated from the data base. 4. In addition, the AWL word family list (head words plus inflections and derivations) were eliminated from the data base. One ESP word list was developed with two sections: one section was a list of all of the initialisms and acronyms which occurred in the texts 10 times or more; the other section of the list was a 2,499 preliminary word list of words which occurred 10 times or more and in at least 6 of the 50 documents. From the preliminary word list, nouns with their verb collocations were selected for the final word list. Teachers' intuition about word usefulness was applied to select words for a shorter more learnable list of 550 nouns (with their verb collocations) which were considered particularly useful for international affairs courses.

4.2 Development of the Application

The application has two functions: 1. a dictionary function 2. a function that highlights the words from the ESP international studies vocabulary, including initialisms and acronyms, which are in the reading passages provided by the teacher on the tablet computer and also in Internet texts with URLs listed in the learning materials. Figure 1 is a screen display of an Internet text, with its URL listed in the learning materials, that shows the highlighted vocabulary in an Internet text.

Figure 1. Screen display of an Internet text linked to the learning materials

5. EVALUATION OF THE APPLICATION

The application was used from September 2012 to December 2012. 26 students were enrolled in the course. A comparison was made of the time the participants took to read a reading passage with and without the tablet. A course evaluation was completed by the participants at the end of December.

5.1 Time taken to read an ESP Reading Passage

The participants were required to read one of the reading passages from the project's learning materials at the beginning of October. They were asked to read the same passage at the end of December. At the first reading, the participants were not allowed to use the android tablet in which the project's application had been installed. The second time, they were allowed to use the tablet. Twenty students out of 26 answered 8 or more of 10 comprehension and analysis questions satisfactorily at both readings. The times of students who

had adequate comprehension of the text at the first reading were compared, on the assumption that time spent laboriously extracting the meaning reduced time and perhaps, motivation to read more texts.

A two-tailed *t*-Test was used to compare the times the participants spent reading the passage at both readings. The times at the first and second readings proved to differ significantly ($p < .001$, $r = .87$). Therefore, it was concluded that the use of the application helped the students read the passage fluently. Table 1 shows the results of the comparison of the times spent reading the passage at both readings.

The students reported that they were able to read quickly the second time because the tablet application allowed them to check word meanings more quickly than with a paper-based text. They said that they were accustomed to reading words from the ESP word list in context. They believed that they had become better at making text-based guesses about words and expressions because the ease of confirmation had given them confidence in their reading. The students said that because of the convenience of the tablet they had done more reading in international studies areas than before.

Table 1. Time required to read an ESP reading passage

	n	Mean (SD)
1st reading (without tablet)	20	33.30 (9.70)
2nd reading (with tablet)	20	13.50 (5.52)
Gain	20	-19.80 (11.49)

$p < .001; r = .87$

5.2 Student Evaluation of the Course

At the end of December, a student course evaluation consisting of 16 questions was conducted. Fifteen questions were intended to focus attention on the use of the application and one question asked the participants whether reading with the use of the application for the android tablet computer suited their own learning styles. Students were also asked to write their own opinions in an open-ended question on the advantages and disadvantages of reading texts using the android tablet computer. A 6-point Likert scale was used for the responses in order to adequately allow for the expression of a range of participants' feelings about the course. The ratings of 3, 2 and 1 respectively correspond to somewhat disagree, disagree, and strongly disagree; the ratings of 4, 5, and 6 respectively correspond to the ratings of somewhat agree, agree, and strongly agree. Twenty students out of 26 answered the questions. The rate of reliability of the questions was high ($\alpha = .91$). Table 2 shows participants' self-evaluation of their own learning with the application in the android tablet computer.

Table 2. Participants' self-evaluation of their own learning with the application in the android tablet computer

Item	Mean (SD)
1. The application is useful for reading a text quickly.	3.00 (1.00)
2. The application let me read a text faster than I can read a paper-based text using an electronic dictionary.	3.47 (0.84)
3. The application shortened the time spent reading a text, so I could concentrate on understanding the text.	3.47 (0.96)
4. The application is useful for understanding a text.	3.42 (0.96)
5. The application is useful for improving reading skills.	3.26 (1.10)
6. Reading a text with the use of the application improved my reading skills.	3.21 (0.92)
7. I became conscious of the words highlighted by the application.	3.68 (1.23)
8. The application is useful for learning vocabulary.	3.00 (1.25)
9. The use of the application increased my vocabulary.	3.05 (1.03)
10. The Japanese meanings of words in the application helped me understand a text better than the Japanese meanings provided in paper-based texts or in an electronic dictionary.	3.21 (0.86)
11. It would be better to have a paper-based list of the vocabulary highlighted in the application to read a passage.	4.53 (1.07)
12. I enjoy reading texts using the application.	3.84 (1.07)
13. The application motivated me to read other international affairs texts.	2.95 (0.78)
14. I want to continue reading texts using the application.	3.21 (1.03)
15. The use of the application alone will improve my English language skills.	2.74 (1.28)
16. Reading a text with the use of the application suits my own learning style.	3.00 (0.67)

$n = 20$

As is shown in Table 2, according to the response to item 1, on the whole, the participants expressed a neutral uncommitted view on whether the use of the application would improve reading speed. However, when asked whether their own reading speed was faster with texts on the application compared to their reading speed of hard copy texts with the use of an electronic dictionary (item 2) to check the meaning of unknown words they were quite confident that they read faster with the application. Moreover, they had strong beliefs that reading speed was an important factor in improving comprehension of a test (item 3) because of the time it allowed them to think about the meaning of the text.

The students expressed slightly stronger than neutral views that the use of the application would improve understanding of texts (item 4) but when they were asked, more specifically, if their reading proficiency would improve (item 5) they were quite confident that it would. They expressed moderately better than neutral views (item 6) of whether their own reading skills had actually improved.

Five items (items 7 to 11) elicited information related to whether the use of the application was useful for learning vocabulary. The students were somewhat more optimistic than a neutral view that the application was useful for vocabulary learning (item 8) but they did not know whether their own vocabulary knowledge had improved or not (item 9). They were somewhat more appreciative of the value of the way Japanese meanings of difficult English words and expressions were accessible on the application (item 10). They said that they strongly believed that highlighting target words in the context of a reading passage was helpful (item 7); however, they expressed a very strong desire for a hard copy list of the target words (item 11) to supplement the application.

The participants in the project expressed strong feelings that the use of the application was enjoyable (item 12). In contradiction to this view, their rating on whether they used the application to read other international studies texts (item 13) was very close to a neutral 3. This is borne out by the fact that the use of the mobile tablet computer outside of class for vocabulary and reading activities was not common. However, they were more optimistic, at a rating of 3.5, about whether they would like to continue using the application for reading international affairs texts (item 14).

In response to item 15 about whether the use of the application on its own was sufficient, they stated strongly that it was not sufficient. In keeping with that response, the students were moderately sure that the use of the application suited their own learning styles (item 16).

Overall, the students did not express negative views (i.e. ratings below 3.0) about the use of the application and they were quite positive about the impact of the use of the application on their reading speed. Their other responses were quite encouraging considering that the students constantly use mobile devices for other communication purposes. A challenge will be to encourage students to use mobile communication devices for independent study purposes.

6. CONCLUSION

Research showed that use of the learning materials had three positive influences on students' study behavior: the students' reading speed increased without a loss in comprehension; the students reported that they enjoyed the reading practice with the mobile tablet computer; and they appreciated that it had some merits that differed from reading practice in hard copy formats that may help improve reading skills. There is not yet any evidence that the use of the application contributed to an improvement in the reading of international documents by supporting the learning of vocabulary commonly found in the documents of international organizations. However, the project gave no reason to believe that further ESP approaches, using tablet computers, to vocabulary and reading skill teaching and learning should not be explored.

This project's short-term use of an ESP reading practice application for an android tablet computer operating system was, in effect, because of the fundamental successes of the project, a pilot study for on-going action-plan research into ways to help Japanese students build the low-frequency and technical vocabulary necessary to develop English reading skills sufficient for the rapid comprehension of authentic documents of international organizations published in English for international audiences, without relying entirely on native-language translations. It is considered possible that on the basis of ESP vocabulary knowledge and reading proficiency, students may add listening, speaking, and writing skills which will allow them to study in international groups and to have careers in international organizations.

The accomplishments of this project that may likely provide an educational infrastructure for the future developments of ESP international affairs materials include: 1. The corpus of international documents and the database of the most frequently occurring, low-frequency and technical noun-verb collocations which were extracted from the corpus. 2. The list of initialisms and acronyms drawn from the database. 3. The 550 headword noun-verb collocation word list, in sentence context, and also the reading passages which feature words from the word list with comprehension questions. 4. The experience gained from the successful use of an application of original learning materials on a mobile device, an android tablet computer. 5. The establishment of an ESP course for international affairs which was linked in content to texts that are used in other Japanese-language international affairs courses.

In the next steps of this project it will be useful to conduct vocabulary and reading tests to win students confidence and to investigate which materials are effective for a variety of English proficiency levels and for a variety of learning styles. On this basis, e-textbooks which can be integrated into applications for android tablet computers will be designed for vocabulary learning and reading comprehension skill building.

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