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A ubiquitous English vocabulary learning system: evidence of active/passive attitudes vs. usefulness/ease-of-use

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Abstract

English vocabulary learning and ubiquitous learning have separately received considerable attention in recent years. However, research on English vocabulary learning in ubiquitous learning contexts has been less studied. In this study, we develop a ubiquitous English vocabulary learning (UEVL) system to assist students in experiencing a systematic vocabulary learning process in which ubiquitous technology is used to develop the system, and video clips are used as the material. Afterward, the technology acceptance model and partial least squares approach are used to explore students' perspectives on the UEVL system. The results indicate that (1) both the system characteristics and the material characteristics of the UEVL system positively and significantly influence the perspectives of all students on the system; (2) the active students are interested in perceived usefulness; (3) the passive students are interested in perceived ease of use.

Keywords: applications in subject areas, interactive learning environments, multimedia/hypermedia systems

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Abstract

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1. Introduction

English is one of the most important languages (Liu, 2009; Liu & Chu, 2010). The world today is a global village, and English is a significant language with which to communicate. In many areas, English is the most important foreign or second language (Laborda, Magal-Royo, Rocha, & Álvarez, 2010; Sun, Huang, & Liu, 2011). Thus, it is a vital issue to develop a sound approach by which to assist students in learning English (Liu, Chen, & Chang, 2010; López, 2010).

Many studies have indicated that vocabulary is the foundation of language learning (Sun et al., 2011; Wilkins, 1972). As Wilkins (1972) stated, "without grammar, very little can be conveyed; without vocabulary nothing can be conveyed". That is to say, we can express our own ideas effectively only when we have sufficient vocabulary with which to do so. Nevertheless, students often adopt ineffective and inefficient ways to learn vocabulary, such as rote learning (Kim & Gilman, 2008). Early on, Atkinson (1972) showed that rote learning is less efficient than spaced repetition. Later, Meara (1996) revealed that silent repetition is less effective than repeating words aloud. Consequently, students need an effective way to learn vocabulary other than the use of rote memory.

Several investigations have been carried out to apply technology to vocabulary learning. Early on, multimedia technology was used to facilitate vocabulary learning

(Sun & Dong, 2004; Kim & Gilman, 2008). Sun and Dong (2004) argued that multimedia technology can be used to create an authentic, vivid, attractive, and multi-sensory learning context. Students in such a context can learn vocabulary more effectively since they can use contextual cues to determine the meaning of new words. Accordingly, these researchers utilized cartoons to create a multimedia learning context in order to support vocabulary acquisition in children. Their results showed that such a context could support their goal effectively. Similarly, Kim and Gilman (2008) used visual and spoken text and graphics to develop a multimedia learning context in order to help middle school students study vocabulary. Their results revealed that graphics are useful in assisting students to understand the definitions of new words. Later, mobile technology attracted researcher's attention. Chen and Chung (2008) used a personal digital assistant to develop a personalized mobile vocabulary learning system in order to enable students to learn vocabulary regardless of where they were. Meanwhile, they considered the fact that students often forget learned vocabulary over time, and thus their system recommended students appropriate vocabulary in light of their memory cycles and vocabulary abilities. Their results indicated that both the performance and the interests of students could be promoted through their system. Recently, researchers have been interested in WordNet technology. Sun and his colleagues (2011) applied WordNet technology to develop near-synonyms and similar-looking (NSSL) technology in order to find NSSL words and further offer the definitions of the NSSL words being considered. They indicated that NSSL words easily lead to confusion, especially when similar-looking words have similar translated meanings, such as "transform" and "transfer". Accordingly, they developed an NSSL technology to increase students' awareness of such words. In their experiment, students expressed that the NSSL technology was beneficial with regards to assisting them in knowing the differences among the NSSL words under consideration.

Although the above studies reveal that technology is helpful with regard to learning vocabulary, these studies have still proven to be inadequate in the area of the provision of a systematic process by which to learn vocabulary. With regard to this process, Brown and Payne (Hatch & Brown, 1995) proposed a systematic vocabulary learning (SVL) process to learn vocabulary. The SVL process can be represented by five phases: (a) encountering, (b) getting, (c) understanding, (d) consolidating, and (e) using. The encountering phase means that students have an opportunity to encounter new words. The opportunities for this may come from reading books, newspapers, magazines, and so on. The getting phase signifies that students use strategies to get a clear image about the form of the new word. The strategies involved in this process include "associating a word with a similar sounding word", "associating a word with a similar-looking word", and so on. The understanding phase implies that students use methods for obtaining the meaning of a new word, such as referring to a dictionary. The consolidating phase means that students use strategies to consolidate the connection between both the form and meaning of the new word. The strategies include flashcards, matching exercises, crossword puzzles, and so on. The using phase signifies that students use the new word. Thus, these five steps comprise the SVL process and play important roles in learning vocabulary (Brown & Payne, 1994), as Fan (2003) indicated that all strategies of vocabulary learning are, to a certain extent, related to these five steps.

Despite the fact that the SVL process is useful, it has been not suitable for current learning contexts due to technological advances. About a decade ago, Nelson (1998) applied Internet technology to the SVL process in order to develop web-based vocabulary learning. However, at the time, he only focused on the consolidating phase rather than all of the SVL phases; that is, his work was unable to provide students with a complete SVL process. Furthermore, current learning contexts have evolved into ubiquitous learning contexts (Huang & Wu, in press; Hwang, Tsai, & Yang, 2008). Consequently, the SVL process needs to be injected with new vitality and energy to enhance its effects.

In this study, we developed a ubiquitous English vocabulary learning (UEVL) system to help students to experience the SVL process in ubiquitous learning contexts. To explore the perspectives of students on the UEVL system, an experiment based on the technology acceptance model was constructed (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). Specifically, we implemented the UEVL system and deployed the system at a university. A questionnaire was developed to explore students' perspectives on the UEVL system. Finally, a series of analyses were carried out to examine the model and draw a conclusion about the analyses.

2. Related studies on technology-assisted language learning

Technology-assisted language learning has received increasing attention in recent years, and related studies include computer-assisted language learning, mobile-assisted language learning, and ubiquitous-assisted language learning. Computer-assisted language learning refers to the use of computer technology for the purpose of language acquisition (Warschauer & Healey, 1998). Early on, computer-assisted language learning was developed on big computers and was considered to be an ideal means to assist students in learning because computers do not become tired or impatient while repeatedly presenting the same material to students. Later, as personal computers emerged, and communication technology advanced, various computer-assisted language learning tools were developed to enable students to communicate with real speakers and to immerse them in multimedia learning contexts. Mobile-assisted language learning refers to the use of mobile technology for learning language. It originates from mobile learning (Huang, Jeng, & Huang, 2009; Huang, Lin, & Cheng, 2010; Jeng, Wu, Huang, Tan, & Yang, 2010) Mobile technology includes many advantages, such as flexibility, low cost, small equipment size and user-friendliness. As a result, researchers have tried to explore how to use mobile technology to support language learning. Related works include vocabulary learning (Chen & Chung, 2008), reading comprehension (Lan, Sung, & Chang, 2007), sentence construction (Morita, 2003), and listening (Edirisingha, Rizzi, Nie, & Rothwell, 2007). Ubiquitous-assisted language learning refers to the use of ubiquitous technology for the purpose of learning language. It came out of ubiquitous learning (Huang & Wu, in press; Hwang, Tsai, & Yang, 2008). Ubiquitous technology refers to sensor and computer technologies that are available and embedded in the everyday environment. That is to say, ubiquitous computing occurs all around users, whether or not they are aware of it. Owing to the characteristics of ubiquitous computing, researchers have tried to apply the technology to develop ubiquitous-assisted language learning. Related works include a focus on conversation (Ogata & Yano, 2004), listening and speaking (Liu, 2009) and reading comprehension (Wu, Sung, Huang, Yang, & Yang, in press). Such ubiquitous-assisted language learning provides students with context-aware information and opportunities for self-learning (Liu, 2009) so that they can achieve their learning goals anytime and anywhere (Tan, Liu, & Chang, 2007; Liu, Tan, & Chu, 2009). Overall, technological development has enabled students to have convenient learning contexts in which to learn language.

Despite much research on technology-assisted language learning, little effort has been devoted to applying ubiquitous technology to support the SVL process. In the past decade, there were several studies that used other technologies to support vocabulary learning (Chen & Chung, 2008; Kim & Gilman, 2008; Nelson, 1998; Sun & Dong, 2004; Sun et al., 2011), but they did not yet support student performance with regard to the SVL process in ubiquitous learning contexts. From the survey of technology-assisted language learning in the paragraph above, it can be observed that the trend of language learning gradually evolved into ubiquitous learning contexts. Ubiquitous learning contexts enable students to gain authentic knowledge and further achieve meaningful learning (Huang, Chiu, Liu, & Chen, in press; Liu & Chu, 2010; Liu, Tan, & Chu, 2009). More importantly, students in such learning contexts can experience real feelings and emotions as they do in real world through interacting with learning material and the real environment (Liu, 2009). However, until now, there has been no study that supports student experiences with the SVL process in ubiquitous learning contexts. To make up for this deficiency, the UEVL system used in this study was developed to investigate the issue, and the details of the system are described in the next section.

3. Ubiquitous English vocabulary learning system

3.1. System design

In this work, we aimed to develop a UEVL system for the purpose of providing support to students engaging in the SVL process. To this end, ubiquitous technology and NSSL technology were used to develop a UEVL system, and a video clip was used as the learning material. Ubiquitous technology is able to sense the situation of students and provide them with appropriate learning material in real-world contexts (Huang & Wu, in press; Hwang et al., 2008). This implies that the ubiquitous technology can be used to provide students with opportunities to learn new vocabulary when they encounter new contexts. NSSL technology is able to find specific NSSL words and also offer their definitions (Sun et al., 2011). This means that NSSL technology can be used to find NSSL words associated with new vocabulary and to assist students in getting clear images of the new vocabulary and an understanding of the definitions. A video clip is one type of visual information that is able to provide students with approximate real-world contexts. According to dual coding theory (Clark & Paivio, 1991; Schnotz, 2002), the effects of visual information on learning are more significant than those derived from verbal information because visual information is processed in both imagery and verbal cognitive systems, while verbal information is processed only in the verbal cognitive system. This signifies that a video clip is a beneficial means by which to support students' ability to consolidate the meaning of new words; moreover, the dialogue in a video clip is also able to provide students with opportunities to practice the new vocabulary they are encountering.

Fig. 1 shows the framework of the UEVL system, which is a standard client-server framework. The server is mainly a database that is used to store the design of the learning activity, the learning material, and the profiles and learning portfolios of the students. The client involves both a teacher module and a student module. The teacher module enables teachers to design a learning activity in which they can use the module to arrange the learning location, learning sequence, the material to be learned and hints that can assist students. The student module enables students to perform a learning activity in which they can use a mobile device with the module to engage in the learning activity. Here, the mobile device is equipped with a radio-frequency identification reader and a global positioning system receiver to sense the location of the students involved in the process. Accordingly, the UEVL system is able to provide students with appropriate hints and learning material according to their situation.

Fig. 1. The framework of the UEVL system.

3.2. System demonstration

The UEVL system was developed to assist students in experiencing the SVL process in ubiquitous learning contexts. When students use the system, it detects their locations through radio-frequency identification and global positioning system technologies. Once the students are in the designed learning location, the system displays guide information to notify them that they have an opportunity to learn, as shown in Fig. 2(a). Afterward, the system presents learning material to the students. The learning material is in the form of a video clip, as shown in Fig. 2(b), and its subtitles provide students with an opportunity to learn vocabulary. Accordingly, students can experience the encountering phase of the SVL process.

Fig. 2. The encountering phase of the SVL process.

Once students have experienced the encountering phase, they can use the NSSL technology (Sun et al., 2011) to experience both the getting and understanding phases of the SVL process. This NSSL technology was developed to find NSSL words that would increase students' awareness of vocabulary. An example is used to describe how to use the NSSL technology to achieve this, as shown in Fig. 3. First, students input a query sentence (i.e., the subtitle of the video clip), as shown in Fig. 3(a). Second, the system parses the query sentence into separate words. In the meantime, students choose a query word in order to get a clear image of its form and its meaning, as shown in Fig. 3(b). Third, the system presents both examples and definitions of the query word. At the same time, students must match examples with the definitions in order to increase their awareness of the query word, as shown in Fig. 3(c). Fourth, when students have finished the matching exercise, the system reveals the correct answers to the students. Students can thus obtain a clear image of the form of the query word and can further understand its meaning.

Fig. 3. The getting and understanding phases of the SVL process.

When students have experienced the getting and understanding phases, they can watch the video clip to consolidate the connection between both the form and the meaning of the query word, namely, to experience the consolidating phase. When they are watching the video clip, students can learn how to use the query word through the dialogue in the video clip. Finally, students repeat the dialogue aloud in order to experience the using phase. As a result, students can use the UEVL system to experience the SVL process in ubiquitous learning contexts.

4. Research design

4.1. Research questions

Our investigation into the applicability of the UEVL system was structured around the following research questions:

1. What are students' perspectives on the UEVL system?
2. Are the perspectives of active students on the UEVL system similar to that

of passive students?

4.2. Research theoretical fundamentals: the technology acceptance model

Technology acceptance evaluation played an important role in the successful development of e-learning systems (Chatzoglou, Sarigiannidis, Vraimaki, & Diamantidis, 2009; Liu, Chen, Sun, Wible, Kuo, 2010; Sanchez-Franco, 2010). The technology acceptance model was developed by Davis and his colleagues (Davis, 1989; Davis et al., 1989), and it has become a popular means by which to evaluate user perspectives on the acceptance of technology (Davis, 1989; Davis et al., 1989). Davis proposed four main perceived constructs to develop the technology acceptance model that include perceived ease of use, perceived usefulness, attitude toward use, and behavioral intention. Perceived ease of use refers to a person's belief that using a technology will be free of effort (Davis, 1989). Perceived usefulness refers to a person's belief that using a technology will enhance his/her job performance (Davis, 1989). Attitude toward use refers to a person's general feeling regarding the favorableness or unfavorableness of some stimulus object (Fishbein & Azjen, 1975). Behavioral intention refers to a person's subjective probability that he/she will perform a specified behavior (Chatzoglou et al., 2009). In addition to the four constructs, Davis also argued that external variables (e.g., system characteristics) will affect intention to use and actual use (Davis et al., 1989). As a result, such external variables were hypothesized have a direct/indirect effect on perceived ease of use and perceived usefulness; perceived ease of use was hypothesized to influence perceived usefulness and attitude toward use; perceived usefulness was hypothesized to affect attitude toward use and behavioral intention, and attitude toward use was hypothesized to influence behavioral intention. Through the technology acceptance model, researchers can understand whether a given system meets user requirements and can further demonstrate a system's value. Consequently, the technology acceptance model was adopted as the fundamental theoretical construct by which to investigate students' perspectives on the UEVL system used in this study.

4.3. Research model and hypotheses

Fig. 4 shows the research model, which originates from technology acceptance model theory. In this study, system characteristics and material characteristics are used as the external variables. The model consists of seven hypotheses, which are described as follows:

Fig. 4. Research model.

The UEVL system's system characteristics were based on ubiquitous technology (i.e., RFID and GPS). Studies of ubiquitous learning (Liu, 2009; Liu et al., 2009; Tan et al., 2007) have revealed that ubiquitous learning systems provide students with opportunities to learn anytime and anywhere. That is to say, ubiquitous technology enables students to easily undertake learning. Furthermore, the UEVL system has several functions embedded by which to guide students to learn, such as guide information and guide maps. That is to say, these functions are able to play a tutoring role that guides successful learning. Consequently, we expected that the UEVL system's system characteristics would have a positive influence on perceived ease of use, and the first hypothesis was developed as follows:

H1. System characteristics are positively related to perceived ease of use.

The UEVL system's material characteristics were based on the video clip. Studies of dual coding theory (Clark & Paivio, 1991) have revealed that the effects of visual information on learning are more significant than those of verbal information because, as was mentioned earlier, visual information is processed in both the imagery and verbal cognitive systems, while verbal information is processed only in the verbal cognitive system. Furthermore, previous study has indicated that information presented in text and video formats can create an authentic, attractive, and multi-sensory language context for students and can further improve the vocabulary learning performance of students (Sun & Dong, 2004). Consequently, we expected that the UEVL system's material characteristics would have a positive influence on perceived usefulness, and the second hypothesis was developed as follows:

H2. Material characteristics are positively related to perceived usefulness.

Studies of the technology acceptance model (Davis, 1989; Davis et al., 1989) have revealed that when users believe that a technology is easy to use and is useful with regard to improving their job performance, they will tend to accept and use the technology. In the meantime, if users think that the technology is easy to use, they will find the technology to be useful. Finally, once users think that the technology is easy and useful, their attitude and intention will be affected by the technology (Chatzoglou et al., 2009; Liu et al., 2010; Sanchez-Franco, 2010; Sun & Cheng, 2009). Thus, perceived ease of use has been hypothesized to influence perceived usefulness and attitude toward use, and subsequently; perceived usefulness has been hypothesized to influence attitude toward use and behavioral intention, and attitude toward use has been hypothesized to influence behavioral intention. Consequently, the third to the seventh hypotheses are shown as follows:

H3. Perceived ease of use is positively related to perceived usefulness.

H4. Perceived ease of use is positively related to attitude toward use.

H5. Perceived usefulness is positively related to attitude toward use.

H6. Perceived usefulness is positively related to behavioral intention.

H7. Attitude toward use is positively related to behavioral intention.

4.4. Participants and grouping

The participants were students from a university class in Tainan City, Taiwan. A total of 40 students enrolled in the experiment. The demographic details show that the average age was 21.79 (SD = 0.85). A total of 20 students had a habit of actively learning English (at least once per month), and a total of 20 students did not have this habit. These participants were divided into two groups based on their learning patterns. One group was active students who had the habit of actively learning English. The second group was passive students who did not have the habit of actively learning English. Furthermore, these students' prior experience with computer usage ranged from 3 to 16 years, with a mean of 9.28 years (SD = 2.61). This result revealed that these participants were experienced in the use of computers.

4.5. Measurement

A structured questionnaire was developed based on a review of prior studies (Davis, 1989; Davis et al., 1989) as well as from feedback from 15 participants and three experts. The questionnaire included six constructs that included system characteristics, material characteristics, perceived ease of use, perceived usefulness, attitude toward use, and behavioral intention. Appendix A shows the final questionnaire that was distributed to students, who were asked to indicate their level of agreement with a number of statements on a seven-point Likert scale.

4.6. Experimental procedure

At the start of the experimental procedure, all the participants executed a learning activity through the UEVL system. In the activity, the participants used the system to learn English. Here, the activity was not only executed in indoor contexts, but also in outdoor contexts. When the activity was completed, the participants were asked to fill out the questionnaire that examined the proposed research model.

5. Results and discussion

In this study, the partial least squares approach was used to analyze the questionnaire data, due to the small sample size. The partial least squares approach is frequently used as an alternative to structural equation modeling. In contrast to the structural equation modeling, the partial least squares is capable of treating a small sample (minimum sample size=20) (Chin & Newsted, 1999). Therefore, partial least squares was thus adopted to conduct data analyses. In this paper, SmartPLS 2.0 was used to assess the measurement and structural models (Ringle, Wende, & Will, 2005).

5.1. Measurement model

The measurement model was assessed using item loadings, convergent validity, reliability of measure, and discriminant validity. An item was considered to be reliable if its loading was greater than 0.70 (Chin & Newsted, 1999). The convergent validity was assessed through using average variance extracted, which must exceed a standard minimum level of 0.5 (Hair, Black, Babin, Anderson, & Tatham, 2006). The reliability of the measures was examined through the use of composite reliability and Cronbach’s alpha. In general, the minimum value of composite reliability is 0.7, and the minimum value of Cronbach's alpha is 0.6 (Hair et al., 2006). The discriminant validity was assessed by using the square root of average variance extracted and latent variable correlations. The square root of average variance extracted of each construct should exceed the correlation shared between one construct and other constructs in the model (Fornell & Larcker, 1981). Tables 1, 2, and 3 show the results of the measurement model to be acceptable, since all the values met the standard levels.

Table 1.
The item loadings for the measurement model.

Table 2.
The convergent validity and reliability of measure for the measurement model.

Table 3.
The discriminant validity for the measurement model.

5.2. Structural model

The structural model was used to verify the hypotheses by using path coefficients and R^2 value (Chin & Newsted, 1999). The R^2 was used to assess the ability of the model to explain the variance in the dependent variables. The path coefficients were used to assess the statistical significance of the hypotheses. Fig. 5 shows the results of the structural model. The model explains 30% of the variation in perceived ease of use, 63% of the variation in perceived usefulness, 59% of the variation in attitude toward use, and 54% of the variation in behavioral intention. Seven path coefficients are also given in Fig. 5. First, the path coefficient between system characteristics and perceived ease of use was 0.55, $p < 0.05$, which indicates that system characteristics had a positive and significant influence on perceived ease of use. Second, the path coefficient between material characteristics and perceived usefulness was 0.27, $p < 0.05$, which indicates that material characteristics had a positive and significant influence on perceived usefulness. Third, the path coefficient between perceived ease of use and perceived usefulness was 0.59, $p < 0.05$, which indicates that perceived ease of use had a positive and significant influence on perceived usefulness. Fourth, the path coefficient between perceived ease of use and attitude toward use was 0.46, $p < 0.05$, which indicates that perceived ease of use had a positive and significant influence on attitude toward use. Fifth, the path coefficient between perceived usefulness and attitude toward use was 0.35, $p < 0.05$, which indicates that perceived usefulness had a positive and significant influence on attitude toward use. Sixth, the path coefficient between perceived usefulness and behavioral intention was 0.11, $p > 0.05$, which indicates that perceived usefulness did not have a positive and significant influence on behavioral intention. Seventh, the path coefficient between attitude toward use and behavioral intention was 0.64, $p < 0.05$, which indicates that attitude toward use had a positive and significant influence on behavioral intention. These results indicated that there was one hypothesis that refuted the prediction, namely H6, while the others confirmed the predictions; that is, H1, H2, H3, H4, H5, and H7. From the results, we observed that the applications of the ubiquitous technology and the video clip could promote students' intention to use the UEVL system. That is to say, an answer to the first research question was that the students' perspectives on the UEVL system were positive with regard to using it.

Fig. 5. The results of the structural model.

5.3. Analysis of active and passive students' perspectives

A deep analysis was used to investigate whether the perspectives of the active students on the UEVL system were similar to those of the passive students. The structural models for the active and passive students were conducted to investigate the issue. Fig. 6 and Fig. 7 show the structural models of active and passive students. Two phenomena could be observed from the structural models. The first phenomenon was that both the effect of system characteristics on perceived ease of use and the effect of material characteristics on perceived usefulness for the structural model of the active students (i.e., Fig. 6) were similar to that of the structural model for the passive students (i.e., Fig. 7). One finding could be obtained from the first phenomenon, namely, the applications of the ubiquitous technology and the video clip could influence students' use of the UEVL system, regardless of whether or not they had a habit of actively learning English.

Fig. 6. The structural model for the active students.

Fig. 7. The structural model for the passive students.

The second phenomenon was that the effect of perceived ease of use on attitude toward use, the effect of perceived usefulness on attitude toward use, and the effect of perceived usefulness on behavioral intention had an obvious difference with regard to the structural models of the active and passive students. In the structural model for the active students (i.e., Fig. 6), perceived ease of use had a small impact on attitude toward use (path coefficient = 0.17), and perceived usefulness had a large impact on attitude toward use (path coefficient = 0.74) and behavioral intention (path coefficient = 0.49). In the structural model for the passive students (i.e., Fig. 7), perceived ease of use had a large impact on attitude toward use (path coefficient = 0.83), and perceived usefulness did not affect attitude toward use (path coefficient = 0.17 and non-significant) and behavioral intention (path coefficient = 0.01 and non-significant). Another finding was obtained from the second phenomenon, namely, perceived usefulness significantly influenced the active students' attitude toward using the system, and perceived ease of use significantly influenced the passive students' attitude toward using the system. That is to say, an answer to the second research question was that the active students cared about whether the system could improve their English ability, and the passive students cared about whether the system could be easily used.

5.4. Discussion

The results obtained from the structural model for all students (i.e., Fig. 5) indicated that the applications of the ubiquitous technology and the video clip were useful in influencing students' intention to use the UEVL system. Evidence gathered from observing the students' behavior helps interpret the results. During the experiment, many students were surprised to learn that the UEVL system was able to sense their situation and provide them with an appropriate video clip in real-world contexts. It could be observed that students' curiosity was prompted by the UEVL system. In the meantime, it was obvious that students were excited to use the UEVL system and that they concentrated their attention on the video clip. The above student behavior explain the results and echo the studies of Lin (2009), Liu and Chu (2010), Sun and Dong (2004), and Kim and Gilman (2008). Lin (2009) indicated that ubiquitous technology is able to provide students with an environment for experiencing real feelings and emotions when they use such technology to learn language. Liu and Chu (2010) revealed that ubiquitous technology can not only provide students with opportunities to learn language, but also can enable them to engage in enjoyable experiences for the purpose of learning language. Sun and Dong (2004) pointed out that multimedia can be used to create an immersive learning context that attracts student attention toward vocabulary learning. Kim and Gilman (2008) indicated that multimedia is able to motivate students to concentrate on vocabulary learning. Consequently, it can be concluded that ubiquitous technology and the video clip applications are useful in vocabulary learning.

The results obtained from the structural model for the active and passive students (i.e., Fig. 6 and Fig. 7) revealed that the active students cared about whether the system was useful in learning and that the passive students cared about whether the system was easy to use. One possible reason for these results is that the active students cared more about their learning than the passive students. In this work, the active students had a habit of actively learning, while the passive students did not have this habit. This implies that the active students had a strong learning motivation, while the passive students had a weak learning motivation, and thus the active students cared about whether the UEVL system was useful to them, while the passive students cared about whether the UEVL system was easy to use. Accordingly, the perceived usefulness of the UEVL system significantly influenced the active students' attitude toward use, while perceived ease of use of the UEVL system significantly influenced the passive students' attitude toward use. The results echoed the studies of Johannesen and Eide

(2000), as well as those of Lindblom-Ylänne and Pihlajamäki (2003). Their studies showed that active students benefit more from computer-supported learning systems than do passive students because active students focus their attention on the usefulness of such systems and further use such systems to improve their learning performance.

6. Conclusions

Our research applied ubiquitous technology, NSSL technology and video clips to develop a UEVL system, which assisted students in undertaking the SVL process in ubiquitous learning contexts. To explore students' perspectives of the UEVL system, the technology acceptance model was applied to construct the research model, and partial least squares was used to assess the model. The results revealed that the UEVL system was readily accepted by the students in the sample and that active students were more concerned about the perceived usefulness of the system, while passive students were more concerned about the perceived ease of use of the system.

Three practical implications drawn from this study may extend to instructional software designers and teachers. First, in our findings, ubiquitous technology and video clip applications were found to be useful in influencing students' intention to use the system. This implies that ubiquitous technology and video clips can be viewed as critical factors leading to student adoption of a system. Accordingly, instructional software designers may use ubiquitous technology and video clips to develop other instructional software designed to assist students in their learning processes. Second, the results indicate that active students care about the perceived usefulness of the system, while passive students care about the perceived ease of use of the system. This implies that active students and passive students have different requirements for instructional software, especially in the case of both the perceived usefulness and the perceived ease of use of such software. Accordingly, instructional software designers may design the instructional software according to the types of students in order to help students to learn efficiently and effectively. Third, in this work, ubiquitous technology and video clip applications were useful in prompting students' curiosity to use the UEVL system. This implies that applications including ubiquitous technology and video clips can be used as a method by which to motivate students to learn vocabulary. Accordingly, teachers may apply such technology and material to language learning in the areas of listening, speaking, reading, and writing.

Limitations of this study include the definitions of active and passive students, the type of the measurements, and the relatively small sample size. In this study, the definitions of active and passive students were arrived at using their learning habits as a criterion, which is a rough definition. We thus suggest that a more rigorous definition is used in further studies on this topic. Similarly, all of the measurements of this study are limited in the students' self-reported perceptions. In future work, we will introduce additional measurements to explore the effects of the UEVL system on vocabulary learning. Furthermore, increasing the sample size to obtain stronger evidence for the proposed UEVL system will be expected because the small sample size might limit the power of this study.

Appendix A. The final questionnaire

Construct	Item
system characteristics	(SC1) I think that the system can provide an English learning activity in the real environment.
	(SC2) I think that the system can provide a simulated English learning environment.
	(SC3) I think that I can use the system to interact with the environment to learn English.
material characteristics	(MC1) I think that the video materials can lead to a better understanding of the use of vocabulary.
	(MC2) I think that the video materials can help me immerse in a learning atmosphere.
	(MC3) I think that the video materials are useful for learning English.
perceived ease of use	(PEU1) I think that the system can provide clear guidance information.
	(PEU2) I think that the operation of the system does not require too much time.
	(PEU3) I feel that learning to use the system is easy.
perceived usefulness	(PU1) I think that the system can improve my English ability.
	(PU2) I think that the system can enhance my desire to use English.
	(PU3) I think that the system can improve my outcome with regard to learning English.
attitude toward use	(AT1) I like using the system to learn English.
	(AT2) I have a positive attitude toward using the system.
	(AT3) I feel that using the system to learn English is a good method.
behavioral intention	(BI1) If I have access to the system, I will use it to learn English.
	(BI2) If I own the system, I will be happy to use it.

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Table 1. The item loadings for the measurement model.

Table 2. The convergent validity and reliability of measure for the measurement model.

Table 3. The discriminant validity for the measurement model.

Fig. 1. The framework of the UEVL system.

Fig. 2. The encountering phase of the SVL process.

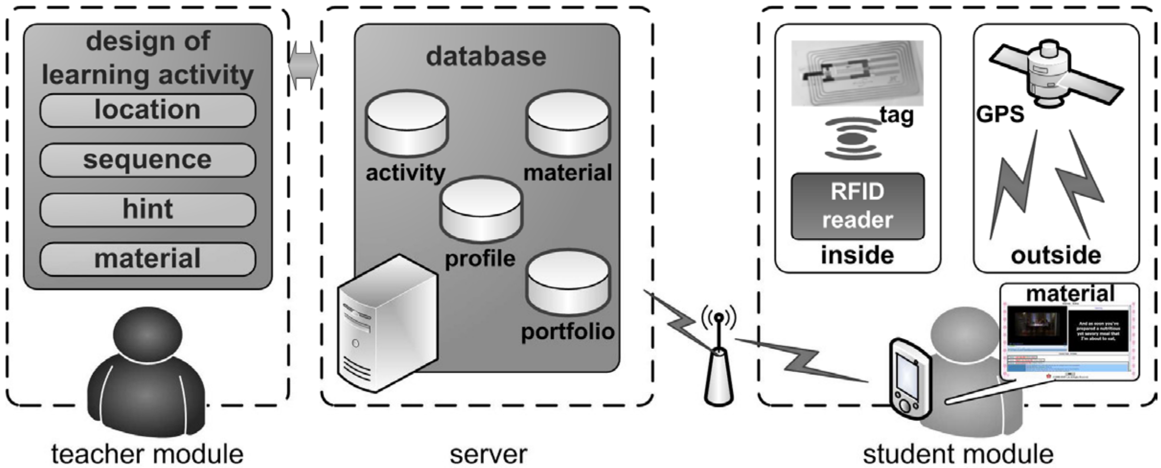
Fig. 3. The getting and understanding phases of the SVL process.

Fig. 4. Research model.

Fig. 5. The results of the structural model.

Fig. 6. The structural model for the active students.

Fig. 7. The structural model for the passive students.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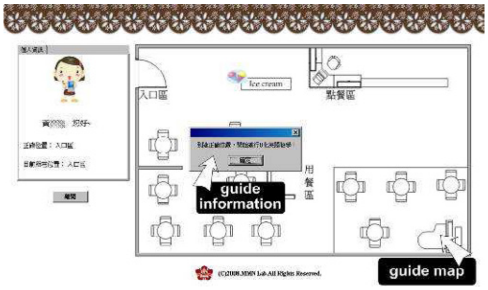
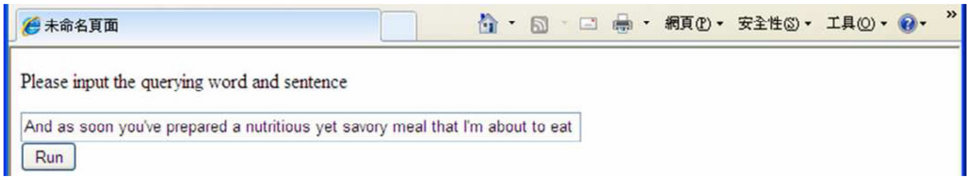
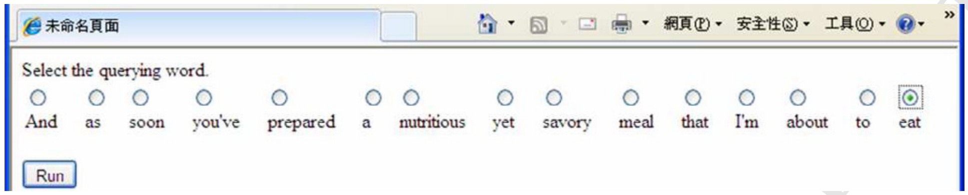


(a) the guide information (b) the learning material

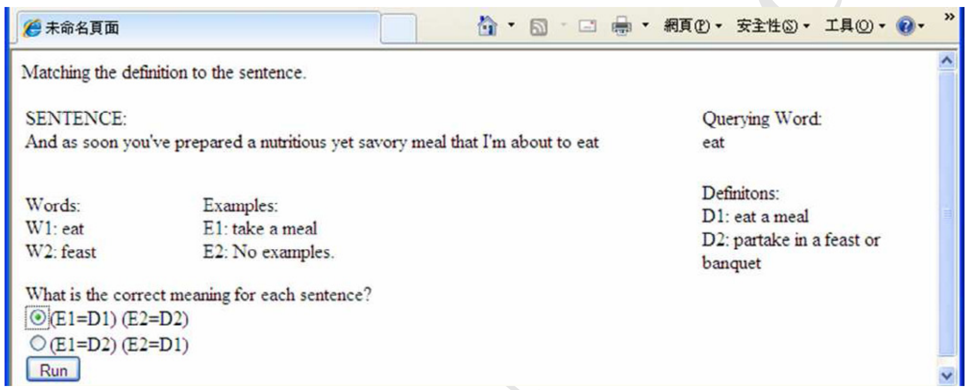
Fig. 2. The encountering phase of the SVL process.



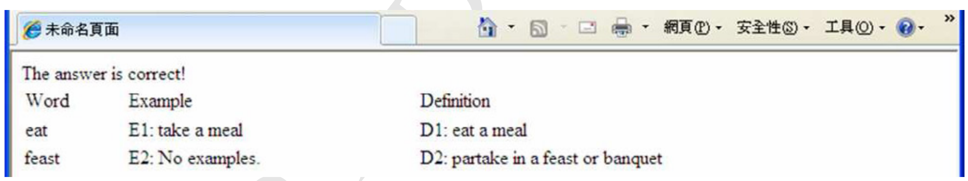
(a) students input a query sentence



(b) the query sentence is separated into words

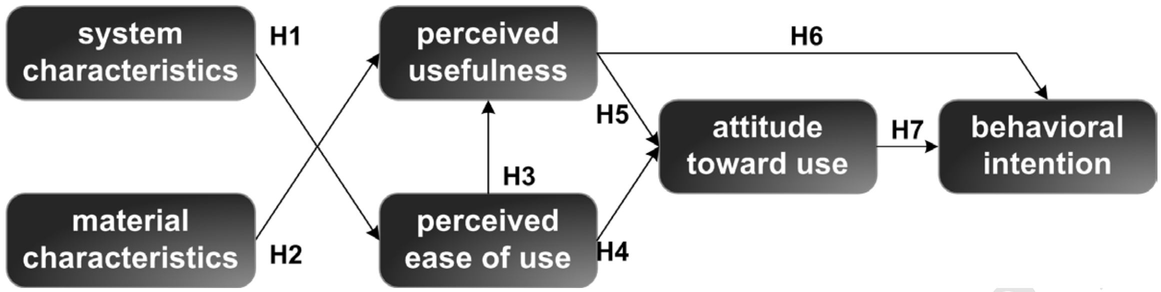


(c) students match the examples with the definitions



(d) the system shows the correct answers to students

Fig. 3. The getting and understanding phases of the SVL process.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H6
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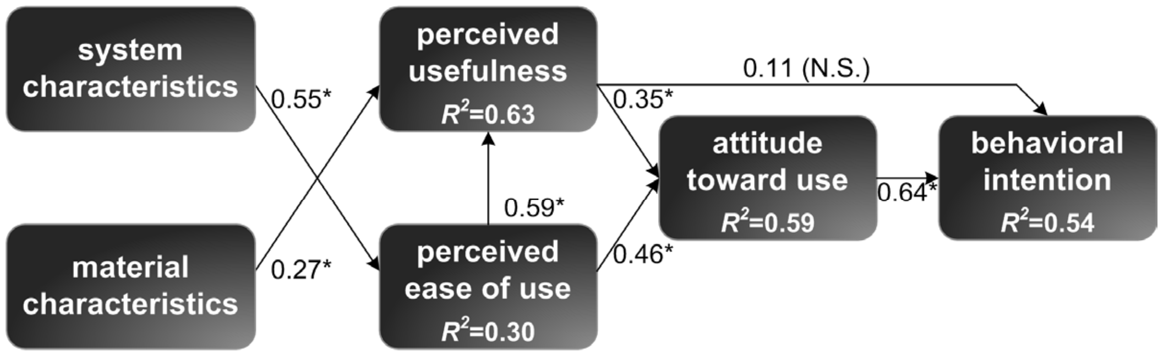
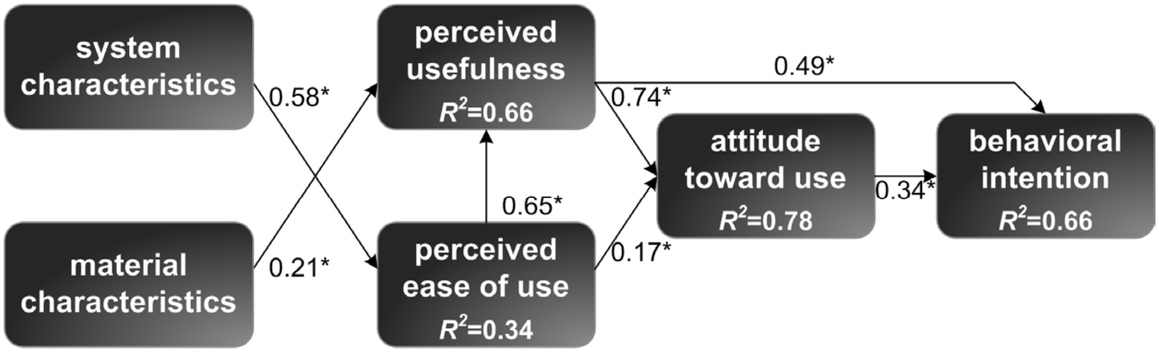
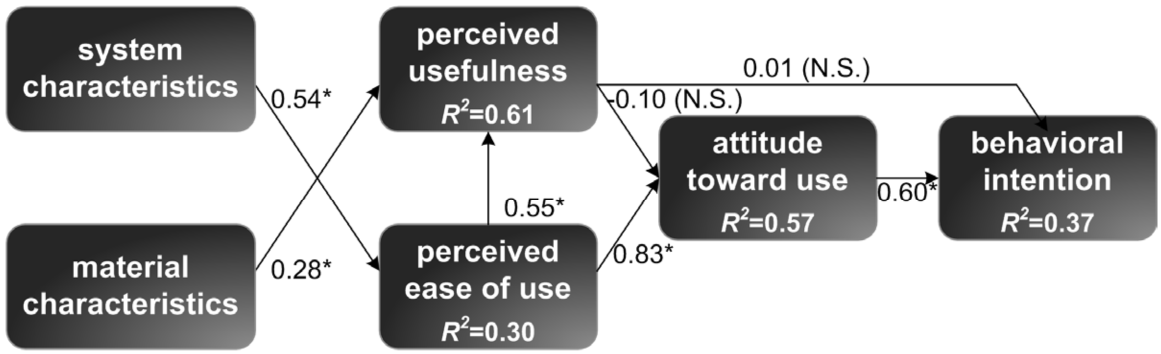


Note: Marked coefficients (*) are significant at p<0.05 (T>1.96). N.S.=non-significant



Note: Marked coefficients (*) are significant at p<0.05 (T>1.96).



Note: Marked coefficients (*) are significant at $p<0.05$ ($T>1.96$). N.S.=non-significant