

# 行政院國家科學委員會專題研究計畫第二年期中進度 報告

## 以情境感知遊戲互動之合作式語言學習模式發展與學習成效評 估研究

計畫主持人：陳志銘 副教授

計畫執行單位：國立政治大學圖書資訊與檔案學研究所

計畫編號：97-2511-S-004-002-MY3

計畫執行期間：97年8月1日~100年7月31日

### 摘要

隨著網際網路的快速發展，許多先進國家已經普遍建立無線通訊基礎建設，在日常生活也提供許多便利的無線通訊服務。由於這個發展趨勢，近幾年來基於無線網路的定位技術發展的非常快速，也在實際的應用上提供許多以位置為基礎的資訊服務。許多研究指出無線網路技術可以應用於發展許多具有提昇學習成效及自我學習的有效學習模式，因此近幾年來數位學習已經逐漸由網路學習發展為行動學習，或甚至是無所不在學習，利用結合無線網路發展語言教學及學習模式已經成為一個新的研究趨勢。因此本研究基於校園環境，建置一個能藉由無線網路偵測學習者位置，並擷取適合該學習情境英語學習內容之情境感知無所不在英語學習系統，系統被實際實作於個人數位助理 PDA 上，並且成功的應用於輔助英語教學，以及提昇學習者的英語學習成效。

**關鍵字：**情境感知學習、無線網路定位技術、無所不在學習、情境學習、英語學習

### Abstract

*With fast development of Internet techniques, the infrastructure of wireless communication has been successfully established in many modern countries and many convenient wireless facilities has already provided in our daily life. With such a tendency, the positioning techniques based on wireless techniques also develop very fast and bring out many location-based services in real-word applications. Actually, many researches have indicated that the wireless technology can be applied to enhance the learning performance of teaching, learning and self-study. Due to this reason, the web-based learning has gradually been evolved into mobile learning or even*

*ubiquitous learning in recent years. Certainly, performing language teaching and learning actions in cooperating with advanced wireless technology has been a novel trend. Therefore, the research proposes a context-aware ubiquitous English learning system in a campus environment, which can detect the learner location by wireless positioning techniques, then retrieve location specific learning content to individual learner through wireless network. Currently, the system has been successfully implemented on PDA and it was applied to assist English teaching and learning for learning performance promotion.*

**Keywords:** *context-aware learning, wireless positioning technique, ubiquitous learning, situated learning, English learning*

### 1. Introduction

With the fast development of e-learning technology, e-learning rapidly evolves into mobile learning or even ubiquitous learning in recent years. The progress of wireless technologies has brought up a new trend in a learning environment, from simply using computers and networks to teach and learn, to a new learning mode called ubiquitous learning [3]. A ubiquitous learning environment provides an interoperable pervasive and seamless learning architecture to connect, integrate, and share three major dimensions of learning resources: learning collaborators, learning contests and learning services [2][3][8]. In addition, many ubiquitous learning systems have been developed to support various pedagogic theories by providing various online learning coursewares and combining with mobile devices. Thus, the research presents a novel learning mode in a campus environment, which can apply wireless positioning technique to sense

learner location, and then recommend appropriate English course materials based on learner's surroundings, to help instructors and learners for English teaching and learning.

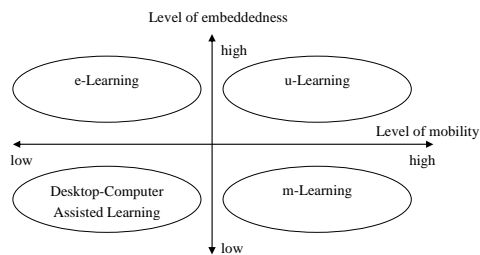
## 2. Research background

### 2.1. The development of ubiquitous learning

#### 2.1.1 The evolution of u-learning

Due to the advance of the wireless technology, the learning form is gradually promoted from e-learning, m-learning to u-learning. Taiwan government also proposes the plan of "Ubiquitous Taiwan" [7] to push novel ubiquitous services through wireless infrastructure in 2005. The ubiquitous learning services aims to achieve the right time and right place with right learning services except performing learning at anytime and anywhere. Ubiquitous learning is emphasized not only on mobility and location, but also on learners' social perspectives and personal accessibilities.

To understand ubiquitous learning more clearly, Fig. 1 gives a comparison for u-learning, m-learning, e-learning and desktop-computer assisted learning in terms of dimensions of mobility and embeddedness. Clearly, this figure reveals that their mobility and embeddedness are different. The "mobility" shows about the level of easy-to-carry; the "embeddedness" means how large storages and memories that can be used. Undoubtedly, u-learning includes the highest mobility and embeddedness because it provides most convenience to make learners learn at anytime and anywhere than the other three learning modes.



**Figure 1. The comparisons of 4 electric learning environments [9]**

#### 2.1.2 Features of ubiquitous learning

In summary, the main characteristics of ubiquitous learning are described and listed as follows [4][5]:

**(1) Permanency:** Learners can never lose their work unless purposefully deleted. In addition, all the learning processes are recorded continuously in everyday.

**(2) Accessibility:** Learners can access their documents, data, or videos from anywhere. That information is provided based on their requests. Therefore, the learning involved is self-directed.

**(3) Immediacy:** Wherever learners are, they can get any information immediately. Therefore learners can solve problems quickly. Besides, the learner may record the questions and look for the answer later.

**(4) Interactivity:** Learners can interact with experts, teachers, or peers in the form of synchronies or asynchronous communication. Hence, the experts are more reachable and the knowledge is more available.

**(5) Situating of instructional activities:** Learning can be embedded in our daily life. The problems encountered as well as the knowledge required are all presented in the nature and authentic forms. It helps learners notice the features of problem situations that make particular relevant actions.

**(6) Adaptability:** Learners can get the right information at the right place with the right way. Moreover, ubiquitous learning can focus on the socio-cognitive process of social knowledge building and sharing.

**(7) Mobility:** The continuousness of computing capability while moving between two points.

**(8) Location aware:** The capability of detecting and identifying the location of person and devices.

**(9) Interoperability:** The capability of interoperable operating between various standards of resource exchange, service composition and integration.

**(10) Seamless:** The capability providing a never ending learning session under any connection with any devices.

**(11) Context aware:** The capability of detecting and identifying personal situated scenario.

**(12) Timely adaptation:** The capability of dynamically adjusting service depending on learners' needs.

Such features and constraints need to be formalized with requirements specification in order to satisfy the demands of a ubiquitous environment.

## 2.2. Situated learning

In the year since cognitive apprenticeship was first introduced, there has been extensive research toward developing learning environments that embody many of learning principles. Several well-known learning strategies have been developed further; in particular, the situated learning. For instance, Dewey created a situated learning environment in his experimental school by asking students to design and build a clubhouse [10], a task that emphasizes arithmetic and planning skills. Hence, the designed context-aware English curriculums mainly are based on the situated learning theory in the study.

### 2.2.1 Learning strategies based on situated learning

Chen [4] claimed that students should learn in a real situation or simulated one. Only in these circumstances learners can know what they learnt from real life. Brown et al. [1] proposed a similar concept: teaching activity can not be excluded from the learning situation. Learning activities

and situation should be deemed as a part of learning. To do so, students can acquire knowledge via interaction with these factors. They found situated learning means thinking about related situations when learning new things and applying acquired knowledge to real life. Moreover, learning situation should have variety to attain the learning goal.

Besides, Driscoll [6] proposed general suggestions in accordance with the teaching for situated learning: (a) Teachers can supply complicated circumstances to cope with the authentic activities. (b) Teacher can supply the opportunities of social negotiation as a necessary part of learning. (c) Teachers can help students learn to think reflex. (d) Teachers can lay stress on student-centered instruction.

Thus, this study devotes to offer a real participation in a campus environment as well as develop a context-aware system to direct learners who can self-examine and learn more English language skills in the daily life.

### 2.2.2 Learning strategies for language learning

Language learning strategies are operations performed by learners to acquire, store, and retrieve information for language learning [11]. Oxford [12] regarded learning strategies as specific actions taken by learners to enhance their progress in language learning, including direct and indirect strategies. The direct strategies include memory, cognitive and compensation strategies.

Briefly, memory strategies are the most important foundation while learning foreign languages. Oxford [11] proposed that memory strategies reflect some sample learning principles such as rearrange, creative thinking and review. In sum, learners must realize how to image or renew for combing the past experience. In our research, that's a reason why the course materials recommended by the proposed system would be important.

Oxford [12] divided memory strategies into three types including creating mental linkages, applying images and sounds, reviewing well. These three memory strategies are described in detail as follows.

**(a) Creating mental linkages:** There are there useful strategies, such as classifying, associating, and placing, to connect with learners' memory. Classifying means that learners can induce some learned words or sentences into groups, depends on that subjects (i.e. English about the weather), syntactical functions (i.e. A verb or a noun), and so on. Associating means that learners can associate old and new knowledge to memorize easily. For example, when they learn the word "billboard", then they can make a connection to the word "board" they have learned, so they can understand the word quickly. Placing new words into a context is also related to associating. It means that new-learned words can involve the situations where they are. For instance, learners can make up a sewing story

while they learn the new words like "seam", "button", and "needle".

**(b) Applying images and sounds:** There are four ways including using imagery, semantic mapping, using keywords and representing sounds to enhance memory. First of all, we can use imagery to remember a new language. It may be a draw, a picture or a series of places. For instance, we can offer a draw with those direction, such as under, above, between, in, out and some other familiar preposition when we learn. Secondly, a main point in using semantic mapping is that learners should set up a key concept and extend it in much imagery. The sketch is just like a tree map and learners are easy to realize. Thirdly, learners can use sounds or visions to learn new keywords. For example, learners memorize all of the similar sounds and they can remind words or phrases cleverly. Finally, learners absolutely remember all knowledge by representing sounds in memory, such as rhymes.

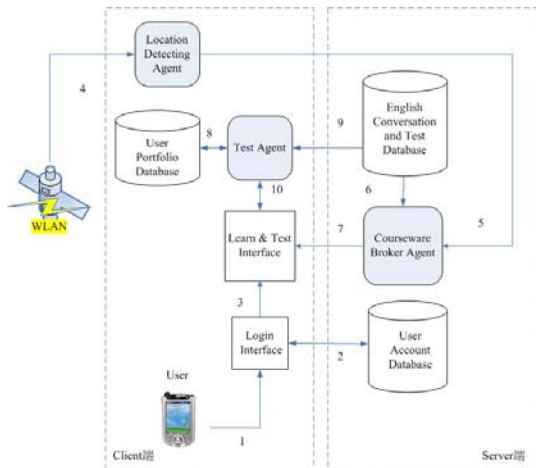
**(c) Reviewing well:** As for leaning, people know how important reviewing it is. Learners can depend on their individual conditions to review language materials. A useful structural reviewing can make learners improve learning effects rapidly. Anytime, they lean new words after they have reviewed. After a period of time, they will response automatically. In other words, no matter how learners know the new words, they will practice them frequently until they never forget them.

Specifically, memory strategies involve the skills helping learners to store and retrieve new information; cognitive strategies include the steps to directly analyze transformation of the target language; and compensation strategies refer to the techniques used to make up their missing knowledge in the process of comprehending and producing the target language.

## 3. System architecture and implemented system

### 3.1. System architecture

This study proposes a context-aware ubiquitous English learning system, and it depends on a learner's location, situated courseware and a learner's portfolios. Figure 2 shows the system architecture of the proposed context-aware ubiquitous English learning system.



**Figure 2. The proposed architecture of context-aware ubiquitous English learning system**

This learning system includes three intelligent agents and three databases. The client side contains the location detecting agent, the test agent and user portfolio database. The server side includes the courseware broker agent, user account database and English conversation and test database. Figure 2 shows the detailed system architecture. The client system can appropriately recommend English course materials to individual learners in order to enhance new vocabulary learning based on the situated learning theory supported by the proposed wireless positioning techniques. The server system aims at automatically recommending suitable courseware to individual learners. Moreover, to support the off-line learning mode, the data synchronized is in charge of keeping data consistency between the client data vases with the server databases after the wireless network recovers on-line connection. The detailed system components are explained in the following subsections.

**(1)Location detecting agent:** The agent evaluates learner location by neural network computing technique through signal strength features sensed from access points of indoor wireless network. After the learner's location is correctly detected, the courseware broker agent will choose appropriate course materials to individual learners in according with the location information.

**(2) Test agent:** The agent can automatically generate a suitable testing sheet according to the learned course materials for assessing the learning performances of learners. Learners can also figure out the learned course materials during learning processes by the agent.

**(3)User portfolio database:** The database aims at recording the detailed learning processes for personalized English course materials recommendation in the future. In addition, administrators or teachers can also realize learners' learning situations though it.

**(4) English conversation and test database:** According to the learner's location, the database stores the

course materials based on the corresponding English context in a campus environment.

**(5) Courseware broker agent:** This agent is in charge of recommending a context courseware from the English conversation and test database to individual learner. The suitable English learning contents based on the learner's location and learner's preferences will be retrieved from the English conversation and test database.

**(6) User account database:** The user account database stores legal user accounts in order to confirm the learner's identity. After a learner logs in the system, the learn & test agent will provide a friendly learning interface for the learner with registered account to interact with the test agent and courseware broker agent.

### 3.2. The implemented system

The section briefly introduces the current implemented context-aware ubiquitous English learning system on PDA.

#### 3.2.1. Selecting and developing English materials

Detecting correct location information is the most important task in the proposed context-aware ubiquitous English learning system. Besides, the English vocabulary and sentences corresponded to the current location should be provided to the learner according to the situated learning approach in a campus environment. For example, when the learner locates at the library, the proposed system will direct learns to learn the sentences relating to how to borrow a book or how to make a copy, etc. Moreover, the system should recommend frequently used vocabularies and conversion sentences related to classroom learning if the learner performs the learning process in a classroom.

Therefore, this study selected some places in Nation Taiwan Normal University to design the corresponding course materials for the proposed system. Table 1 shows that there are seven selected places, and these places correspond to the learning items for supporting campus English learning. The learner can carry a PDA with wireless function and the proposed context-aware ubiquitous English learning system can broke correctly suitable course materials to individual learners based on their surroundings.

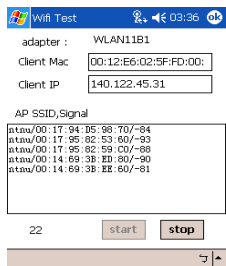
**Table1. The selected learning places in NTNU campus environment and the corresponding learning items**

Item Location label	Places in NTNU	Learning Items
A	Technological building	In class
B	Meddle square	Sports
C	Library	Borrow books
D	Computer center	Register a computer
E	Comprehensive building	In the cafeteria
F	English language training center	Meeting a friend
G	Parking place	Asking for diections

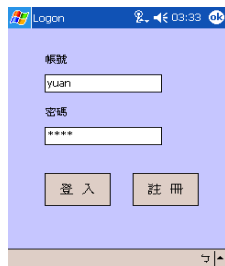
### 3.2.2 The implemented system prototype on PDA supported by a courseware management server

This section details the context-aware ubiquitous English learning system implemented by the Microsoft Visual Studio .Net 2003 on PDA. First, Figure 3(a) reveals the result of estimated location. In this case, the detected location is table tennis room. Figure 3(b) displays the designed login interface for checking legal user account. Figure 3(c) shows the menu of English learning. Figures 3(d) and 3(e) shows the recommended English vocabulary and learning dialogs recommended by the context analysis agent. Figure 3(f) exhibits the checking box for confirmed the learned course materials. Moreover, Figs. 3(g) and (h) show the learning contents of the test process and the test result, respectively.

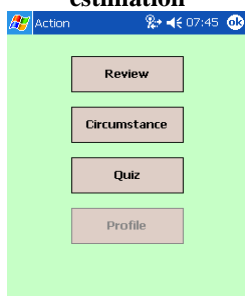
Additionally, the learning statuses of each learner will be sent to the courseware management server and stored in the user portfolio database. The courseware management server provides a friendly user interface for teachers to inspect the learners' learning portfolios in order to further understand the learning performances of individual learners.



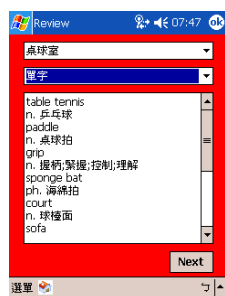
(a) The signals of location estimation



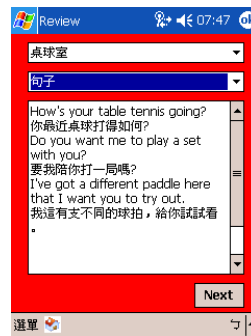
(b) The login interface



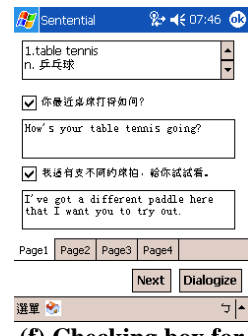
(c) The menu of learning



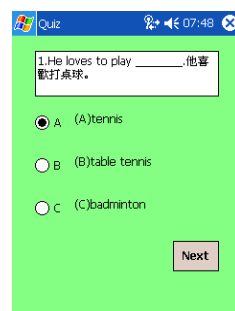
(d) The recommended vocabularies based on sensing learner location



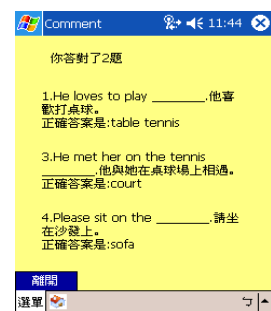
(e) The recommended dialogue sentences based on sensing learner location



(f) Checking box for confirmed the learned English course materials



(g) The corresponding test of the learned vocabulary



(h) The test result

Figure 3. The implemented context-aware ubiquitous English learning system on PDA

## 4. Conclusions

In this study, the indoor WLAN location estimation scheme is developed, and then employed to support personalized context-aware ubiquitous English learning. The implemented prototype of context-aware English learning system based on ubiquitous learning system can correctly associate the English course materials and their surroundings in a campus environment based on the sensing context awareness information of individual learner. In the future, the developed system will be added more functions including personalized learning, more friendly interaction interface, and artificial intelligence for developing intelligent context-aware ubiquitous English learning system. Moreover, the proposed system will be applied in real teaching and learning scenes for English learning. Besides, learners' learning performances will also be evaluated based on a planned experimental design to demonstrate the learning performance promotion for English learning.

## 5. References

- [1] Brown, J. S., Collins, A., & Duguid, P., "Situated cognition and the culture of learning," *Educational Researcher*, vol. 18, no. 1, pp. 32-42, 1989.
- [2] Chang, C.Y., & Sheu, J.P., "Design and Implementation of Ad Hoc Classroom and e-Schoolbag Systems for Ubiquitous Learning," *IEEE International Workshop on Wireless and Mobile Technologies in Education*, pp.8-14, Aug. 2002.
- [3] Cheng, Z., Shengguo, S., Kansan, M., Huang, T. & Aiguo, H., "A Personalized Ubiquitous Education Support Environment by Comparing Learning Instructional," *The 19<sup>th</sup> International Conference on Advanced Information Networking and Applications*, pp.567-573, March 2005.
- [4] Chen, Y.S., Kao, T.C., Sheu, J.P., and Chiang, C.Y., "A Mobile Scaffolding-Aid-Based Bird-Watching Learning System," *Proceedings of IEEE International Workshop on Wireless and Mobile Technologies in Education*, IEEE Computer Society Press, pp.15-22, 2002.
- [5] Curtis, M., Luchini, K., Bobrowsky, W., Quintana, C., and Soloway, E. "Handheld Use in K-12: A Descriptive Account," *Proceedings of IEEE International Workshop on Wireless and Mobile Technologies in Education*, IEEE Computer Society Press, pp.23-30, 2002.
- [6] Driscoll, M.P., *Psychology of learning for instruction*, Needham Heights, MA: Allyn & Bacon, 1999.
- [7] Institute for information industry, 2005-2006 e-Learning. Retrieved 20, 1, 2006 from Website: <http://www.elearn2.org.tw/iiiwiki/>
- [8] Haruo, N., Kiyoharu, P.H., Yasufumi, K. & Shiho, M., "Designing Ubiquitous and Universal Learning Situations: Integrating Textbooks and Mobile Devices," *The 19<sup>th</sup> Annual conference on Distance Teaching and Learning*, 2003.
- [9] H. Ogata, Y. Yano, "Supporting Knowledge Awareness for a Ubiquitous CSCL," *Proc. Of E-Learn 2003*, pp.2362-2369, 2003.
- [10] Naiman, N., Frohlich, M., Stern, H. H., & Todesco, A. , "The Good Language Learner," Toronto: Ontario Institute for Studies in Education, 1978.
- [11] Oxford, R. L., "Language learning strategies and beyond: A look at strategies in the context of the styles," In S.M. Sally (Ed.). *Shifting the instrumental focus to the learner*,(pp.116-145). VT: Northeast Conference, 1990(a)
- [12] Oxford, R. L., *Language Learning strategies: What every teacher should know*, Boston: Heinle & Heinle Publishers, 1990(b)