

Context-Aware Writing in Ubiquitous Learning Environments

Tzung-Shi Chen¹, Cheng-Sian Chang², Jeng-Shian Lin², and Hui-Ling Yu³

¹*Department of Computer Science and Information Engineering
National University of Tainan, Taiwan*

²*Department of Information and Learning Technology
National University of Tainan, Taiwan*

³*Tainan Municipal Dong-Guang Elementary School, Taiwan
chents@mail.nutn.edu.tw*

Abstract

With the popularization of the wireless network, and the progress of mobile computing technology, the efficiency of the hand-held device is better, and its applications are wider. Combining hand-held device and E-learning will be the main learning method in the future. This research employs wireless network, hand-held device, and RFID to build Context-Aware Writing System (C-Writing for short) in ubiquitous learning environments. After the learner using the C-Writing in the ubiquitous learning environment actually, we evaluate the result of learning by their works with/without C-Writing. We use the questionnaire to evaluate the learning situations; here the questionnaire contains the content of the users' attitudes, system acceptance, system quality, content quality, and interactive with environment. The result of research shows most of the students approve this system's benefit, and he/she is willing to use similar system in the future. Learners can efficient improve learning performance and attract attention of learners through this system.

Keywords: context-awareness, mobile learning, RFID, situated learning, ubiquitous learning.

1. Introduction

In recent years, with advances in information Technologies and high-speed network, e-learning has become a new learning approach for people. This method results in a pedagogic paradigm from a teacher-centered and lecture-centered model into a constructivist, interactive and learner-centered model. Though, learners are able to browse and download information anytime and anywhere through e-learning platform, but it can not apply in the outdoor learning activity.

M-learning is to play an important role in e-learning environment. Many researches of mobile learning (M-learning) and ubiquitous learning (U-learning) have been provided in order to improve learning approach in the past. These researches result showed that learners are able to accept this learning approach of context-aware and enhance learning performance [1, 2]. The characteristic of M-learning is not limited by time and location, which can provide more learning opportunity for learners.

This paper provide a Context-Aware Writing system which employs the wireless network, hand-held device, and RFID (Radio Frequency Identification) to build ubiquitous learning environments, called C-Writing for short. Learners can use handhold device to write in different situation where is beforehand built by us as shown in Fig. 1.

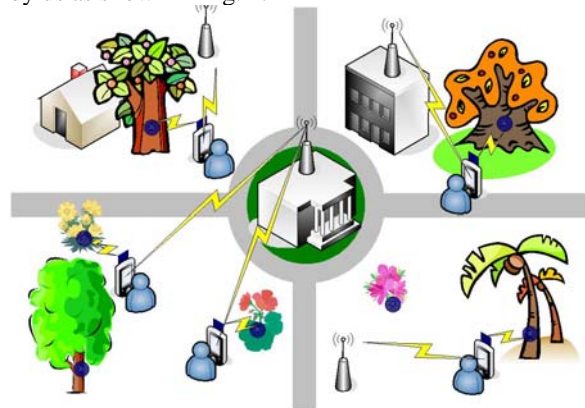


Figure 1. Environment for Context-aware Writing.

In this writing environment, learner not only can obtain related information (such as model essay, idiom, example sentence, photo, video, and so on) in different place where is chosen by one's own, but also can observe and perceive around environment or communicate with other peoples (such as learning

partner or teacher) to acquire inspiration of writing and proceeded with his writing. Therefore, learners are able to write still more vivid, original and connotative essay through stimulation of realistic environment.

2. Literature Review

Learning is not an automatic consequence of pouring information into a learner's head, which requires the learner own mental involvement and doing [3]. Knowledge is acquired through interaction between individual and environment. In order to reach an effective learning performance, we should be provide a actual situation for learners, let he/she are able to participate learning activity. Chen, Li and, Chen (2007) proposed a personalized context-aware ubiquitous English vocabulary learning system which can exploit appropriate context based on learner's location, leisure learning time, and individual abilities to adapt learning contents toward learners for promoting the learning interests and performance [4]. Moushir, El-Bishouty, Ogata, and, Yano (2007) provide a learning system that is called PERKAM which can suggests the best matched educational materials and peer helpers in accordance with the detected objects and the current location that utilized the RFID technology to detect the learner's environmental objects and location, and then allows the learners to share knowledge, interact, collaborate, and exchange individual experiences [1]. Though, the purpose of context aware ubiquitous learning is to turn e-learning and mobile learning into a further stage, which from learning at anytime anywhere to be at the right time and right place with right learning resources and right learning peers [5].

The concept of learning like as a social system

within communities of practice, the best way to learn is with others in groups [6]. The individual learning is monotony and solitude [7]. Ubiquitous learning not only obtains learning material at right time and right place for learners, but also interacts with other people such as teachers, peers or, experts. Therefore, applying Collaborative learning into curriculum can addressed this request, and provided an opportunity of interactive between people. Nguyen, Guggisberg, and Burkhart provided a multimedia forum allows the learners to work collaboratively using heterogeneous devices, at anytime and from anywhere, that was called CoMobile [8]. Yatani, Onuma, Sugimoto, Kusunoki presented a Musex system that is based on an orienteering game, and embedded in mobile devices to support collaborative learning in museum. Therefore, this research attempt to build a system that combines context-aware with collaborative learning, which reaches effective learning for learners.

3. System Architecture

In this learning environment, learner not only can obtain related information in different place where is chosen by one's own, but also can observe and perceive around environment or communicate with other peoples to excite inspiration of writing, to encourage idea or creativity of learners, and to proceed with his writing.

The design of C-Writing system can allow learners to write, read, observe, and discuss. The three-tier architecture is used, which include a client, a server, and a database system as shown in Fig. 3. On the client side, system allows learners to assess learning content in any time and any where via PDA (Personal Digital Assistant).

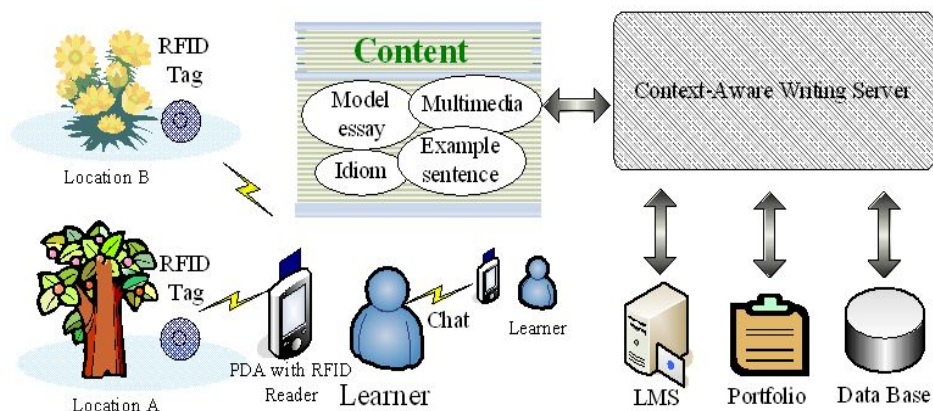


Figure 2. System Architecture.

On the server side has a context-aware writing server which can detect position of learner through RFID technology, and then provide appropriate learning content for learner. On the database side have a Learning Content Database (LCD) sub-system and a Portfolio sub-system which can store the data in a SQL 2000 database. The data in LCD sub-system include essay of model, multimedia, idiom and, example sentence. The portfolio sub-system stores learning portfolio and writing of learner. There are three components in the design of the C-Writing, described as follows:

1. **The component of context-aware device.** In the learning environment, we installed the RFID Tags in several different locations where is related to writing theme. The major platform for end learners is the *PDA*. The PDA have a function of RFID Reader, learner can tag RFID Tags to obtain learning content, to write the essay, and to communicative with other peoples as show in Figure 3(h).
2. **The component of learning content.** The PAD will connected context-aware writing server and provide suitable learning content for learner, when the learner hold PDA to a location related to writing theme and tag RFID Tag. The learning contents are classified into essay of model, idiom, example sentence, and multimedia. The part of the essay of model sifted from relevant books of composition (such as prototype composition of Primary school, book of pupil's composition, guidebook of pupil's composition, and so on) by expert and teacher as show in Figure 3(a). In the part of the idiom, we looks for idioms relevant to model essay which established by Ministry of Education as show in Figure 3(b). Afterward, the idiom explained by expert and teacher, and appends the example sentence as show in Figure 3(c). Learner can be very easy to understand the meaning of idiom and to use it. In the part of the multimedia, we pre-shoot multimedia of each situation put on the system as show in Figure 3(d). Finally, if so, the learning content can not satisfy requirement of learner, he/she can link other learning website to search different information and content via wireless network.
3. **The component of writing and discussion platform.** Learner can write essay through input of phonetic notation and handwriting recognition as show in Figure 3(f). Finally, this system provide a communicative tool for learner, he/she can discussion one's own idea and impression with other people.

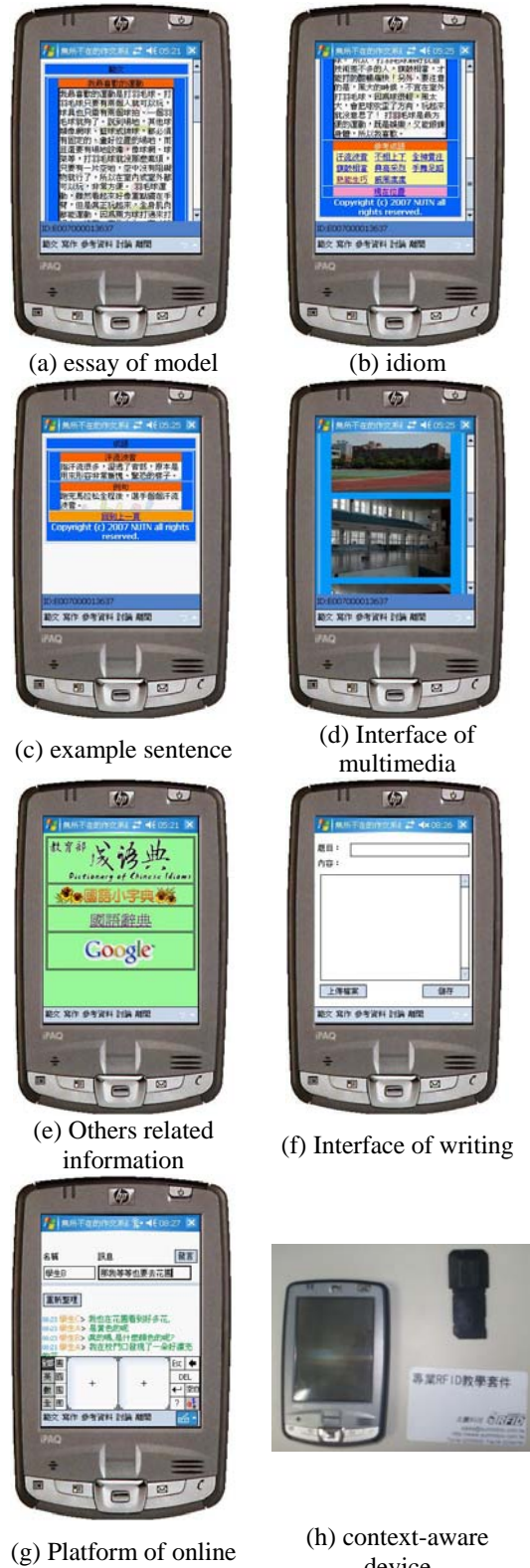


Figure 3. The implemented learning system.

4. Research Design

This study focuses on the impact of context-aware systems on writing in elementary education. The study was performed in Dong-Guang Elementary School, Tainan City, Taiwan with a sample of 30 3rd grade students. The data were gathered using a questionnaire survey, in which subjects were asked to indicate their attitudes toward the C-Writing system. The experiment of C-Writing system is divided into three steps.

- (1) First step: the teacher taught student in the writing course using the traditional approach for eight weeks. The students were then asked to write an essay in the classroom, called “My campus”. This essay was adopted as pre-examination achievement.
- (2) Second step: to ensure that all students could write essays using the C-Writing system, students were taught how to use it and given practical guidance for two weeks. The students were then required to write their essays using the system, also called “my campus”, as displayed in Fig. 8. This essay was adopted in this study as post-examination achievement.
- (3) Third step: all participants were asked to answer a questionnaire after using the C-Writing system. Excluding the unreturned and incomplete questionnaire, the valid sample was 30. The questionnaire had 16 items based on the five-point Likert scale (from “1” which means “strongly disagree” to, “5” “strongly agree”). Descriptive statistics were then utilized to explain the learners’ attitudes toward the C-Writing system.



Figure 4. Student's practical operating circumstance.

4.1 Assessment of Student's Writing

Table 1. The items in assessment scale.

A1	The content of essay is coherent.
A2	The handwriting is neat and correct.
A3	The viewpoint of the essay is clearly represented.
A4	The punctuation and format of the article are correct.
A5	The idiom and example sentences are used flexibly and correctly.
A6	The style is relaxed and lively, and sentences are fluent.
A7	The rhetorical skill is good.
A8	The paragraphs are clearly demarcated, and have substantial content.
A9	The materials are original and show the author's own intention.
A10	Describe content in a deep way.

This research employ an assessment scale which designed by teacher of elementary school to confirm the context-aware system that is effective for ability of student's writing. The assessment scale includes ten assessment items as shown in Table 1. The perfect score of each item is 10 points, therefore, the total achievement which assessment scale is 100 marks. The pretest and posttest achievement graded by expert of writing. Afterwards, we use ANOVA analysis to compare the difference between pretest and posttest achievement of student learning performance.

4.2 Results

Most of students have experience (at home, school or library) of computer (100%, 30/30) and internet (100%, 30/30) and there are computer in the home (93.3%, 29/30), but only a few student have used PDA (23.3%, 7/30) and there are computer in home (30%, 9/30). This result revealed that most of students have basic computer operation ability and experience, but ability and experience of operation of PDA are insufficient.

4.2.1 Learner's attitudes toward the C-Writing system

Descriptive statistics (means [M] and standard deviations [SD]) of learner' attitudes toward the C-Writing system were shown in Table 2. The alpha reliability of 1 learner' attitudes toward the C-Writing system was to be highly accepted ($\alpha = 0.89$). In the part of user's attitudes, student consent that use PDA in outdoor learning is easy ($M = 4.27$, $SD = 0.78$) and feel happy through the system to writing ($M = 4.10$, $SD =$

1.18). In the part of System acceptance, students are very high for degree of the system acceptance ($M = 4.22$) and he/she hope that can use similar system in the future ($M = 4.17$, $SD = 0.95$). Student's perception for system quality ($M = 3.50$) and content quality ($M = 3.79$) is ordinary. Student consent that interactive with environment is effective while writing ($M = 4.22$), and they willing to discuss with other people ($M = 4.17$, $SD = 1.18$), to observe the surrounding environment ($M = 4.23$, $SD = 0.94$), and to combine the true environment to carry on the writing ($M = 4.27$, $SD = 0.95$).

4.2.2 Assessment of student's writing

Various independent variables (10 assessment items) were adopted to compare student achievements between pre-test and post-test. Table 3 presents the results of ANOVA. The means of "the content of essay

is coherent" ($F=15.91$, $P<0.001$), "The handwriting is neat and correct" ($F=10.54$, $P<0.01$), "the viewpoint of the essay is clearly represented" ($F=7.00$, $P<0.05$), "the idioms and example sentences are used flexibly and correctly" ($F=9.671$, $P<0.01$), "the style is relaxed and lively, and the sentences are fluent" ($F=6.33$, $P<0.05$), "the rhetoric skill is good" ($F=9.24$, $P<0.01$), "the paragraphs are clearly demarcated, and the content is substantial" ($F=11.74$, $P<0.01$), "The materials are original and show the author's own intention" ($F=13.94$, $P<0.001$), "describe content in a deep way" ($F=16.70$, $P<0.001$), and "total score" ($F=14.20$, $P<0.001$) for the posttest were higher than those of the pretest. ANOVA results reveal showed that this difference was significant. This result shows that the C-Writing system improved the writing ability and learning performance of the students.

Table 2. Descriptive statistics of learner' attitudes toward the C-Writing system.

No.	Items	M	SD
	Users' attitudes	3.97	
	Use PDA in outdoor learning is easy.	4.27	0.78
	I have confidence in using the system for writing the better essay.	3.90	0.84
	I have confidence in using the system for ability to improve writing.	3.83	1.39
	I have confidence in using the system for enhance the interest of writing.	3.80	1.21
	I like use the system to writing.	3.90	0.99
	I feel happy through the system to writing.	4.10	1.18
	System acceptance	4.22	
	I intend to use the system as a writing tool in the future.	4.27	0.91
	I intend to use the similar system as a learning tool to learn other course.	4.17	0.95
	System quality	3.50	
	The function of system is enough.	3.77	1.17
	The system is very steady.	3.27	1.26
	The on-line quality of system is good.	3.47	1.28
	Content quality	3.79	
	The content in the system is abundant.	3.67	1.12
	The content in the system is clear and easy ready.	3.90	1.12
	Interactive with environment	4.19	
	I am willing to discuss with other people (such peer or teacher) while writing.	4.17	1.18
	I am able to observe the surrounding environment while writing.	4.23	0.94
	I can combine the true environment to carry on the writing.	4.17	0.95

Table 3. ANOVA results for assessment of student's writing

Variables	M		SD		F-value
	Pre-test	Post-test	Pre-test	Post-test	
A1	7.73	8.50	1.16	0.97	15.91***
A2	7.80	8.70	1.27	0.75	10.54**
A3	7.47	8.30	1.22	1.12	7.00*
A4	7.73	8.37	1.11	1.27	3.80
A5	7.56	8.60	1.33	1.16	9.67**
A6	7.60	8.30	1.04	1.02	6.33*
A7	7.37	8.27	1.10	1.11	9.24**
A8	7.50	8.47	0.90	1.20	11.74**
A9	7.63	8.63	1.00	1.03	13.94***
A10	7.73	8.73	0.94	0.91	16.70***
Total score	75.77	84.87	9.36	9.34	14.20***

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

4.3 Discussions

Regarding students' computer, handheld device and internet experience, that students of elementary schools have basic computer accomplishment. From Table 2, he/she are willing to use this system to writing essay. Essentially, when users have adequate experience regarding use of the computer, then they perceive use of the computers and the internet for assisting their job performance more positively [9]. Therefore, the students have highly positive attitudes toward the C-Writing for writing, when they have sufficient information equipment. In addition, they not exclude to learn other curriculums through similar learning system even if only few students have used PDA (the means of system acceptance are equal to 4.22). This result infers that nowadays students are attracted by new information technology whether they have used these devices or technology; they are able to adapt and use it rapidly. Students writing in various fields are improved through using C-Writing system, besides the ability of 'A4: the punctuation and format of the article are correct'. Results show that provide learning material, combine diverse situation, and communicate with peers for student appropriately, he/she can reflect the framework of writing, excite writing inspiration, and describe more vivid for writing.

Nowadays, computers are more likely a communication tool than just a data processing tool

[10]. From Table 2, students are willing to discuss with other people (such peer or teacher) while writing (the means are equal to 4.17). Student likes to share their viewpoint or idea through communication and discussion when he/she find novel things in the learning process, which is *knowledge-socialization*. Collaborative partnerships between academia and practice can help bridge the gap in terms of supporting opportunities to share perceptions, creating an environment for shared knowledge, and social opportunities, leading to further enabling preparation for potentially future staff [11].

Students in part of the idiom and example sentence can be used flexibly that is very good ($F = 9.67$, $P < 0.01$), the style is relaxed and lively and sentence is fluent ($F = 6.33$, $P < 0.01$), it is unique to draw materials; there is one's own intention ($F = 13.94$, $P < 0.001$), and observe it in a subtle way ($F = 16.70$, $P < 0.001$) have significant progress. This result is shown that student can absorb the information which provided by system to turn into self-knowledge that is *knowledge-internalization*, and apply it in writing and provide writing for peer to appreciate that is *knowledge-externalization*. In addition, the system provides suitable information for student at right time when they arrive a new situation that is *knowledge-combination*. Therefore, students carry on *knowledge conversion* and acquire higher learning performance (the means of total score from 75.77 to 84.87, $F = 14.20$, $P < 0.001$) in this experiment unconsciously by C-Writing system.

5. Conclusions

The purpose of learning is to help learners apply and implement knowledge to solve problems faced in real life. This study applies the capabilities of wireless network, RFID, and portable device to create a writing environment for learners. Learners are able to contact and observe real situation to acquire some information, knowledge, or ideas. The result of research shows most of the students approve this system's benefit, and he/she willing use similar system in the future. Learners can efficient improve learning performance and attract attention of learners through this system.

Acknowledgments

This work was supported in part by National Science Council under grants NSC-95-2524-S-156-001 and NSC-96-2221-E-024-009-MY2, Taiwan.

References

- [1] M. Moushir, El-Bishouty, H. Ogata, and Y. Yano,

- "PERKAM: Personalized Knowledge Awareness Map for Computer Supported Ubiquitous Learning," *Educational Technology & Society*, vol. 10, pp. 122-134, 2007.
- [2] K. Yatani, M. Onuma, M. Sugimoto, and F. Kusunoki, "Musex: A System for Supporting Children's Collaborative Learning in a Museum with PDAs," *Systems and Computers in Japan*, vol. 35, pp. 54-63, 2004.
- [3] M. L. Silberman, *Active Learning: 101 Strategies to Teach Any Subject*. Needham Heights, Massachusetts: Allyn & Bacon, 1996.
- [4] C.-M. Chen, Y.-L. Li, and M.-C. Chen, "Personalized Context-Aware Ubiquitous Learning System for Supporting Effectively English Vocabulary Learning," in *Seventh IEEE International Conference on Advanced Learning Technologies Niigata*, Japan, 2007.
- [5] M. Wang, L. Ci, P. Zhan, and Y. Xu, "Applying Wireless Sensor Networks to Context-Awareness in Ubiquitous Learning," in *Third International Conference on Natural Computation* Hainan University, Haida, China: IEEE, 2007.
- [6] M. A. Chatti, S. Srirama, D. Kensche, and Y. Cao, "Mobile Web Services for Collaborative Learning," in *Fourth IEEE International Workshop on Wireless, Mobile and Ubiquitous Technology in Education* Athens, Greece: IEEE, 2006.
- [7] G. Zhang, Q. Jin, and M. Lin, "A Framework of Social Interaction Support for Ubiquitous Learning," in *Proceedings of the 19th International Conference on Advanced Information Networking and Applications*, Taipei, Taiwan, 2005.
- [8] D. P. Nguyen, M. Guggisberg, and H. Burkhart, "CoMobile: Collaborative Learning with Mobile Devices," in *Proceedings of the Sixth International Conference on Advanced Learning Technologies* Kerkrade, Netherlands: IEEE, 2006.
- [9] S. S. Liaw, "Computers and the Internet as a job assisted tool: based on the three-tier use model approach," *Computers in Human Behavior*, vol. 23, pp. 399-414, 2007.
- [10] S. S. Liaw, G. D. Chen, and H. M. Huang, "Users' attitudes toward Web-based collaborative learning systems for knowledge management," in *Computers & Education*. In Press, Corrected Proof, 2006.
- [11] C. Souers, L. Kauffman, C. McManus, and V. Parker, "Collaborative learning: A focused partnership," in *Nurse Education in Practice*. In Press, Corrected Proof, 2007.